PYC3704 - Past exam questions 2012-2013

PYC3704 (PYC304C)

Psychological Research

EXAM PREPARATION

This document is a compilation of past UNISA exam papers and their answers.

The answers are motivated by a combination of:

- **Page references to the UNISA Study Guide for PYC3704: Psychological Research**
- **Feedback in past UNISA Tutorial Letters**
- **Personal views and comments from the author, other tutors and students**

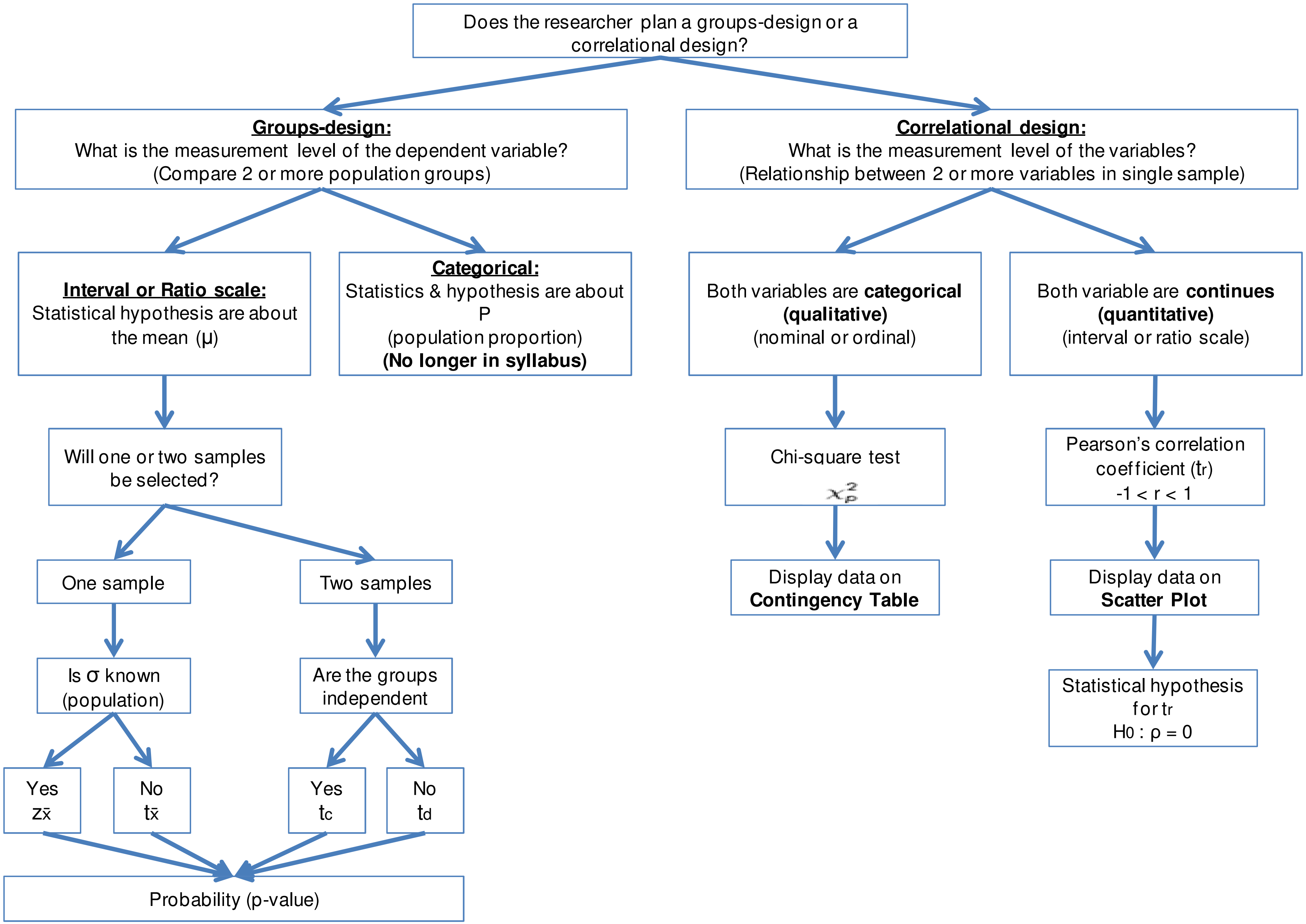
Past exams covered are:

May-Jun 2012   Oct-Nov 2012   May-Jun 2013   Oct-Nov 2013

Please note:

This document is an additional tool for exam preparation. The author takes no responsibility for incorrect answers. Students must ensure that they learn the prescribed material and understand the content.

PYC3704 Flow Chart



Symbols - Populations and Samples

Description	Symbol	
	Populations (Parameter)	Samples (Statistic)
Arithmetic mean	μ	$\bar{x}$
Standard deviation	σ	s $(s=\sqrt{s^2})$
Variance	σ^2	s^2
Standard error of mean (Also called Standard deviation of the sampling distribution of the mean)	$\sigma_{\bar{x}}$ $(= \sigma/\sqrt{n})$	$s_{\bar{x}}$ $(= s/\sqrt{n})$
Mean of sampling distribution of the mean (Mean of all means. This is equal to the mean under H_0) (Central value of sampling distribution)	$\mu_{\bar{x}}$	
Z score for means		$z_{\bar{x}}$
Difference between scores	$\bar{D}$	$\bar{d}$
Standard deviation of sample of difference scores		$s_{\bar{d}}$
Correlation between two measurements (Pearson's R)	ρ	r
Proportions	P	p
Level of significance Set by the researcher at the start of project Probability of making a Type I error Mistakenly rejecting the H_0 when it is true		α
Probability of making a Type II error Not rejecting H_0 when H_0 is false and H_1 is true		β
Squared correlation Can be used as indication of size of effect	r^2	

Standard Normal Distribution (z)

z	Mean to z	Larger portion	Smaller portion
0.00	0.0000	0.5000	0.5000
0.01	0.0040	0.5040	0.4960
0.02	0.0080	0.5080	0.4920
0.03	0.0120	0.5120	0.4880
0.04	0.0160	0.5160	0.4840
0.05	0.0199	0.5199	0.4801
0.06	0.0239	0.5239	0.4761
0.07	0.0279	0.5279	0.4721
0.08	0.0319	0.5319	0.4681
0.09	0.0359	0.5359	0.4641
0.10	0.0398	0.5398	0.4602
0.11	0.0438	0.5438	0.4562
0.12	0.0478	0.5478	0.4522
0.13	0.0517	0.5517	0.4483
0.14	0.0557	0.5557	0.4443
0.15	0.0596	0.5596	0.4404
0.16	0.0636	0.5636	0.4364
0.17	0.0675	0.5675	0.4325
0.18	0.0714	0.5714	0.4286
0.19	0.0753	0.5753	0.4247
0.20	0.0793	0.5793	0.4207
0.21	0.0832	0.5832	0.4168
0.22	0.0871	0.5871	0.4129
0.23	0.0910	0.5910	0.4090
0.24	0.0948	0.5948	0.4052
0.25	0.0987	0.5987	0.4013
0.26	0.1026	0.6026	0.3974
0.27	0.1064	0.6064	0.3936
0.28	0.1103	0.6103	0.3897
0.29	0.1141	0.6141	0.3859
0.30	0.1179	0.6179	0.3821
0.31	0.1217	0.6217	0.3783
0.32	0.1255	0.6255	0.3745
0.33	0.1293	0.6293	0.3707
0.34	0.1331	0.6331	0.3669
0.35	0.1368	0.6368	0.3632
0.36	0.1406	0.6406	0.3594
0.37	0.1443	0.6443	0.3557
0.38	0.1480	0.6480	0.3520
0.39	0.1517	0.6517	0.3483

z	Mean to z	Larger portion	Smaller portion
0.40	0.1554	0.6554	0.3446
0.41	0.1591	0.6591	0.3409
0.42	0.1628	0.6628	0.3372
0.43	0.1664	0.6664	0.3336
0.44	0.1700	0.6700	0.3300
0.45	0.1736	0.6736	0.3264
0.46	0.1772	0.6772	0.3228
0.47	0.1808	0.6808	0.3192
0.48	0.1844	0.6844	0.3156
0.49	0.1879	0.6879	0.3121
0.50	0.1915	0.6915	0.3085
0.51	0.1950	0.6950	0.3050
0.52	0.1985	0.6985	0.3015
0.53	0.2019	0.7019	0.2981
0.54	0.2054	0.7054	0.2946
0.55	0.2088	0.7088	0.2912
0.56	0.2123	0.7123	0.2877
0.57	0.2157	0.7157	0.2843
0.58	0.2190	0.7190	0.2810
0.59	0.2224	0.7224	0.2776
0.60	0.2257	0.7257	0.2743
0.61	0.2291	0.7291	0.2709
0.62	0.2324	0.7324	0.2676
0.63	0.2357	0.7357	0.2643
0.64	0.2389	0.7389	0.2611
0.65	0.2422	0.7422	0.2578
0.66	0.2454	0.7454	0.2546
0.67	0.2486	0.7486	0.2514
0.68	0.2517	0.7517	0.2483
0.69	0.2549	0.7549	0.2451
0.70	0.2580	0.7580	0.2420
0.71	0.2611	0.7611	0.2389
0.72	0.2642	0.7642	0.2358
0.73	0.2673	0.7673	0.2327
0.74	0.2704	0.7704	0.2296
0.75	0.2734	0.7734	0.2266
0.76	0.2764	0.7764	0.2236
0.77	0.2794	0.7794	0.2206
0.78	0.2823	0.7823	0.2177
0.79	0.2852	0.7852	0.2148

z	Mean to z	Larger portion	Smaller portion
0.80	0.2881	0.7881	0.2119
0.81	0.2910	0.7910	0.2090
0.82	0.2939	0.7939	0.2061
0.83	0.2967	0.7967	0.2033
0.84	0.2995	0.7995	0.2005
0.85	0.3023	0.8023	0.1977
0.86	0.3051	0.8051	0.1949
0.87	0.3078	0.8078	0.1922
0.88	0.3106	0.8106	0.1894
0.89	0.3133	0.8133	0.1867
0.90	0.3159	0.8159	0.1841
0.91	0.3186	0.8186	0.1814
0.92	0.3212	0.8212	0.1788
0.93	0.3238	0.8238	0.1762
0.94	0.3264	0.8264	0.1736
0.95	0.3289	0.8289	0.1711
0.96	0.3315	0.8315	0.1685
0.97	0.3340	0.8340	0.1660
0.98	0.3365	0.8365	0.1635
0.99	0.3389	0.8389	0.1611
1.00	0.3413	0.8413	0.1587
1.01	0.3438	0.8438	0.1562
1.02	0.3461	0.8461	0.1539
1.03	0.3485	0.8485	0.1515
1.04	0.3508	0.8508	0.1492
1.05	0.3531	0.8531	0.1469
1.06	0.3554	0.8554	0.1446
1.07	0.3577	0.8577	0.1423
1.08	0.3599	0.8599	0.1401
1.09	0.3621	0.8621	0.1379
1.10	0.3643	0.8643	0.1357
1.11	0.3665	0.8665	0.1335
1.12	0.3686	0.8686	0.1314
1.13	0.3708	0.8708	0.1292
1.14	0.3729	0.8729	0.1271
1.15	0.3749	0.8749	0.1251
1.16	0.3770	0.8770	0.1230
1.17	0.3790	0.8790	0.1210
1.18	0.3810	0.8810	0.1190
1.19	0.3830	0.8830	0.1170

z	Mean to z	Larger portion	Smaller portion
1.20	0.3849	0.8849	0.1151
1.21	0.3869	0.8869	0.1131
1.22	0.3888	0.8888	0.1112
1.23	0.3907	0.8907	0.1093
1.24	0.3925	0.8925	0.1075
1.25	0.3944	0.8944	0.1056
1.26	0.3962	0.8962	0.1038
1.27	0.3980	0.8980	0.1020
1.28	0.3997	0.8997	0.1003
1.29	0.4015	0.9015	0.0985
1.30	0.4032	0.9032	0.0968
1.31	0.4049	0.9049	0.0951
1.32	0.4066	0.9066	0.0934
1.33	0.4082	0.9082	0.0918
1.34	0.4099	0.9099	0.0901
1.35	0.4115	0.9115	0.0885
1.36	0.4131	0.9131	0.0869
1.37	0.4147	0.9147	0.0853
1.38	0.4162	0.9162	0.0838
1.39	0.4177	0.9177	0.0823
1.40	0.4192	0.9192	0.0808
1.41	0.4207	0.9207	0.0793
1.42	0.4222	0.9222	0.0778
1.43	0.4236	0.9236	0.0764
1.44	0.4251	0.9251	0.0749
1.45	0.4265	0.9265	0.0735
1.46	0.4279	0.9279	0.0721
1.47	0.4292	0.9292	0.0708
1.48	0.4306	0.9306	0.0694
1.49	0.4319	0.9319	0.0681
1.50	0.4332	0.9332	0.0668
1.51	0.4345	0.9345	0.0655
1.52	0.4357	0.9357	0.0643
1.53	0.4370	0.9370	0.0630
1.54	0.4382	0.9382	0.0618
1.55	0.4394	0.9394	0.0606
1.56	0.4406	0.9406	0.0594
1.57	0.4418	0.9418	0.0582
1.58	0.4429	0.9429	0.0571
1.59	0.4441	0.9441	0.0559

z	Mean to z	Larger portion	Smaller portion
1.60	0.4452	0.9452	0.0548
1.61	0.4463	0.9463	0.0537
1.62	0.4474	0.9474	0.0526
1.63	0.4484	0.9484	0.0516
1.64	0.4495	0.9495	0.0505
1.65	0.4505	0.9505	0.0495
1.66	0.4515	0.9515	0.0485
1.67	0.4525	0.9525	0.0475
1.68	0.4535	0.9535	0.0465
1.69	0.4545	0.9545	0.0455
1.70	0.4554	0.9554	0.0446
1.71	0.4564	0.9564	0.0436
1.72	0.4573	0.9573	0.0427
1.73	0.4582	0.9582	0.0418
1.74	0.4591	0.9591	0.0409
1.75	0.4599	0.9599	0.0401
1.76	0.4608	0.9608	0.0392
1.77	0.4616	0.9616	0.0384
1.78	0.4625	0.9625	0.0375
1.79	0.4633	0.9633	0.0367
1.80	0.4641	0.9641	0.0359
1.81	0.4649	0.9649	0.0351
1.82	0.4656	0.9656	0.0344
1.83	0.4664	0.9664	0.0336
1.84	0.4671	0.9671	0.0329
1.85	0.4678	0.9678	0.0322
1.86	0.4686	0.9686	0.0314
1.87	0.4693	0.9693	0.0307
1.88	0.4699	0.9699	0.0301
1.89	0.4706	0.9706	0.0294
1.90	0.4713	0.9713	0.0287
1.91	0.4719	0.9719	0.0281
1.92	0.4726	0.9726	0.0274
1.93	0.4732	0.9732	0.0268
1.94	0.4738	0.9738	0.0262
1.95	0.4744	0.9744	0.0256
1.96	0.4750	0.9750	0.0250
1.97	0.4756	0.9756	0.0244
1.98	0.4761	0.9761	0.0239
1.99	0.4767	0.9767	0.0233

z	Mean to z	Larger portion	Smaller portion
2.00	0.4772	0.9772	0.0228
2.01	0.4778	0.9778	0.0222
2.02	0.4783	0.9783	0.0217
2.03	0.4788	0.9788	0.0212
2.04	0.4793	0.9793	0.0207
2.05	0.4798	0.9798	0.0202
2.06	0.4803	0.9803	0.0197
2.07	0.4808	0.9808	0.0192
2.08	0.4812	0.9812	0.0188
2.09	0.4817	0.9817	0.0183
2.10	0.4821	0.9821	0.0179
2.11	0.4826	0.9826	0.0174
2.12	0.4830	0.9830	0.0170
2.13	0.4834	0.9834	0.0166
2.14	0.4838	0.9838	0.0162
2.15	0.4842	0.9842	0.0158
2.16	0.4846	0.9846	0.0154
2.17	0.4850	0.9850	0.0150
2.18	0.4854	0.9854	0.0146
2.19	0.4857	0.9857	0.0143
2.20	0.4861	0.9861	0.0139
2.21	0.4864	0.9864	0.0136
2.22	0.4868	0.9868	0.0132
2.23	0.4871	0.9871	0.0129
2.24	0.4875	0.9875	0.0125
2.25	0.4878	0.9878	0.0122
2.26	0.4881	0.9881	0.0119
2.27	0.4884	0.9884	0.0116
2.28	0.4887	0.9887	0.0113
2.29	0.4890	0.9890	0.0110
2.30	0.4893	0.9893	0.0107
2.31	0.4896	0.9896	0.0104
2.32	0.4898	0.9898	0.0102
2.33	0.4901	0.9901	0.0099
2.34	0.4904	0.9904	0.0096
2.35	0.4906	0.9906	0.0094
2.36	0.4909	0.9909	0.0091
2.37	0.4911	0.9911	0.0089
2.38	0.4913	0.9913	0.0087
2.39	0.4916	0.9916	0.0084
2.40	0.4918	0.9918	0.0082
2.41	0.4920	0.9920	0.0080
2.42	0.4922	0.9922	0.0078

z	Mean to z	Larger portion	Smaller portion
2.43	0.4925	0.9925	0.0075
2.44	0.4927	0.9927	0.0073
2.45	0.4929	0.9929	0.0071
2.46	0.4931	0.9931	0.0069
2.47	0.4932	0.9932	0.0068
2.48	0.4934	0.9934	0.0066
2.49	0.4936	0.9936	0.0064
2.50	0.4938	0.9938	0.0062
2.51	0.4940	0.9940	0.0060
2.52	0.4941	0.9941	0.0059
2.53	0.4943	0.9943	0.0057
2.54	0.4945	0.9945	0.0055
2.55	0.4946	0.9946	0.0054
2.56	0.4948	0.9948	0.0052
2.57	0.4949	0.9949	0.0051
2.58	0.4951	0.9951	0.0049
2.59	0.4952	0.9952	0.0048
2.60	0.4953	0.9953	0.0047
2.61	0.4955	0.9955	0.0045
2.62	0.4956	0.9956	0.0044
2.63	0.4957	0.9957	0.0043
2.64	0.4959	0.9959	0.0041
2.65	0.4960	0.9960	0.0040
2.66	0.4961	0.9961	0.0039
2.67	0.4962	0.9962	0.0038
2.68	0.4963	0.9963	0.0037
2.69	0.4964	0.9964	0.0036
2.70	0.4965	0.9965	0.0035
2.71	0.4966	0.9966	0.0034
2.72	0.4967	0.9967	0.0033
2.73	0.4968	0.9968	0.0032
2.74	0.4969	0.9969	0.0031
2.75	0.4970	0.9970	0.0030
2.76	0.4971	0.9971	0.0029
2.77	0.4972	0.9972	0.0028
2.78	0.4973	0.9973	0.0027
2.79	0.4974	0.9974	0.0026
2.80	0.4974	0.9974	0.0026
2.81	0.4975	0.9975	0.0025
2.82	0.4976	0.9976	0.0024
2.83	0.4977	0.9977	0.0023
2.84	0.4977	0.9977	0.0023
2.85	0.4978	0.9978	0.0022

z	Mean to z	Larger portion	Smaller portion
2.86	0.4979	0.9979	0.0021
2.87	0.4979	0.9979	0.0021
2.88	0.4980	0.9980	0.0020
2.89	0.4981	0.9981	0.0019
2.90	0.4981	0.9981	0.0019
2.91	0.4982	0.9982	0.0018
2.92	0.4982	0.9982	0.0018
2.93	0.4983	0.9983	0.0017
2.94	0.4984	0.9984	0.0016
2.95	0.4984	0.9984	0.0016
2.96	0.4985	0.9985	0.0015
2.97	0.4985	0.9985	0.0015
2.98	0.4986	0.9986	0.0014
2.99	0.4986	0.9986	0.0014
3.00	0.4987	0.9987	0.0013
3.01	0.4987	0.9987	0.0013
3.02	0.4987	0.9987	0.0013
3.03	0.4988	0.9988	0.0012
3.04	0.4988	0.9988	0.0012
3.05	0.4989	0.9989	0.0011
3.06	0.4989	0.9989	0.0011
3.07	0.4989	0.9989	0.0011
3.08	0.4990	0.9990	0.0010
3.09	0.4990	0.9990	0.0010
3.10	0.4990	0.9990	0.0010
3.11	0.4991	0.9991	0.0009
3.12	0.4991	0.9991	0.0009
3.13	0.4991	0.9991	0.0009
3.14	0.4992	0.9992	0.0008
3.15	0.4992	0.9992	0.0008
3.16	0.4992	0.9992	0.0008
3.17	0.4992	0.9992	0.0008
3.18	0.4993	0.9993	0.0007
3.19	0.4993	0.9993	0.0007
3.20	0.4993	0.9993	0.0007
3.21	0.4993	0.9993	0.0007
3.22	0.4994	0.9994	0.0006
3.23	0.4994	0.9994	0.0006
3.24	0.4994	0.9994	0.0006
3.25	0.4994	0.9994	0.0006
3.26	0.4994	0.9994	0.0006
3.27	0.4995	0.9995	0.0005
3.28	0.4995	0.9995	0.0005

z	Mean to z	Larger portion	Smaller portion
3.29	0.4995	0.9995	0.0005
3.30	0.4995	0.9995	0.0005
3.31	0.4995	0.9995	0.0005
3.32	0.4995	0.9995	0.0005
3.33	0.4996	0.9996	0.0004
3.34	0.4996	0.9996	0.0004
3.35	0.4996	0.9996	0.0004
3.36	0.4996	0.9996	0.0004
3.37	0.4996	0.9996	0.0004
3.38	0.4996	0.9996	0.0004
3.39	0.4997	0.9997	0.0003
3.40	0.4997	0.9997	0.0003
3.41	0.4997	0.9997	0.0003
3.42	0.4997	0.9997	0.0003
3.43	0.4997	0.9997	0.0003
3.44	0.4997	0.9997	0.0003
3.45	0.4997	0.9997	0.0003
3.46	0.4997	0.9997	0.0003
3.47	0.4997	0.9997	0.0003
3.48	0.4997	0.9997	0.0003
3.49	0.4998	0.9998	0.0002
3.50	0.4998	0.9998	0.0002
3.51	0.4998	0.9998	0.0002
3.52	0.4998	0.9998	0.0002
3.53	0.4998	0.9998	0.0002
3.54	0.4998	0.9998	0.0002
3.55	0.4998	0.9998	0.0002
3.56	0.4998	0.9998	0.0002
3.57	0.4998	0.9998	0.0002
3.58	0.4998	0.9998	0.0002
3.59	0.4998	0.9998	0.0002
3.60	0.4998	0.9998	0.0002
3.65	0.4999	0.9999	0.0001
3.70	0.4999	0.9999	0.0001
3.75	0.4999	0.9999	0.0001
3.80	0.4999	0.9999	0.0001
3.85	0.4999	0.9999	0.0001
3.90	0.5000	1.0000	0.0000
3.95	0.5000	1.0000	0.0000
4.00	0.5000	1.0000	0.0000

PYC3704 (PYC304C)

May/June 2012

#	Question	Ans	Page	Comments
1	The term 'inference' in psychological research refers to _______ 1. describing information in a precise way 2. making a prediction or generalization based on existing information 3. the procedures for making a construct visible so that a measurement can be made 4. the development of a hypothesis as a relationship among variables	2	P2	An inference is a conclusion that follows from existing information, by generalising from the specific information to the general type of phenomenon, where the conclusion is not absolutely certain. So in summary inferential statistics are techniques for making generalisations based on imperfect numeric data, where the conclusions have a high probability of being true, but you can never be completely certain.
2	In psychological research, a construct may be a(n) _______ 1. measurement based on the careful observation of aspects of humans or human behaviour 2. observation of an aspect of humans or human behaviour which was operationalised in some way 3. hypothetical aspect of humans or human behaviour which we wish to investigate 4. explanation of empirical observations based on the measurement of certain variables	3	P4	Constructs and their interrelations (how they affect each other, their patterns of interaction) are used in this way to **develop theoretical explanations** of why people behave in certain ways in certain contexts, or why mental phenomena appear to be as they are.

#	Question	Ans	Page	Comments
3	Which of the options below provides the best description of the main purpose of quantitative research in psychology? Its purpose is to ______ 1. develop theories that explain the relationships among observed aspects of human behaviour and mental processes 2. develop predictions about human behaviour of which we can be applied with absolute certainty 3. describe and classify aspects of humans and human behaviour 4. develop hypotheses about relationships that may exist among various constructs	4	P1-2	Psychology is a discipline that endeavours to collect information and develop theories about human behaviour and mental processes. The aim is to establish facts that are related to psychological phenomena, that are valid and can be justified on scientific grounds.
			P2	The act of simply observing phenomena and describing them or collecting facts about them is usually not sufficient. The next step in the scientific process is to go beyond the level of description by attempting to develop explanations for the things we observe: we want to know not only what the facts are, but also why they appear to be as they are. In other words, we want to develop theories, which explain why things are as they appear to be when we observe them.
			P3	Psychologists try to develop explanations for human experiences and behaviour. To do this, they often have to make use of abstract concepts (also called constructs) that serve as explanations for the behaviour they observe.
			P4	Psychologists are interested to find out which constructs are important (in the sense of being required or useful to explain human behaviour) and how they work together in a pattern, or what their interrelationships are. One of the objectives of psychology is not only to describe human behaviour, but also to find explanations for it. Constructs and how they interact fill the role of explanatory mechanisms in psychology. We try to find out which constructs offer an appropriate explanation of the behaviour or events we perceive, and what the pattern of their interactions with other constructs may be. In this sense, it can be said that constructs are the building blocks of theory.
			P6	The link between observing a construct and measuring it is so close that when we talk about 'observation' in quantitative research, we often imply the process of measurement. The taking of a measurement is regarded as an act of observation.
			P21-26 Q2	Research in psychology is primarily about testing theories of human behaviour.
			Q3	The main purpose of psychological research is to test theories empirically.

#	Question	Ans	Page	Comments
4	Operationalising a construct means to ______ 1. find an explanation for the construct to explain why it appears as it is 2. make an educated guess on how it relates to other constructs 3. determine the correct level at which it should be measured 4. devise a systematic procedure to make the construct observable, in such a way that we can measure it	4	P25	'**Operationalisation' is where you make the construct** (which is usually an abstract concept, so it is difficult to observe it clearly) **visible by finding some suitable way to measure it**. You need it to be able to test a hypothesis, but it is not in itself 'the process of forming an hypothesis'. The primary aim of operationalisation is to describe a construct clearly and unambiguously so that it can be measured and tested in a research study.
5	Empirical knowledge is knowledge that is based on ______ 1. careful reasoning 2. appropriate theories 3. the observation of events 4. published research	3	P2	All scientific knowledge begins with description of the phenomena being studied, based on careful observation. **Knowledge based on observation of physical events** is referred to as empirical knowledge (as distinct from knowledge based on contemplation, unexplained insights, mystical experiences or claims by authority figures).

#	Question	Ans	Page	Comments
	Use the following extract from a research proposal to answer Questions 6 to 8 “Generalised anxiety disorder (GAD) refers to a pattern of almost constant worry or tension, even when there is little or no apparent cause. Both genetic predisposition and stressors in the life of a particular patient is believed to contribute to this condition. The research will investigate whether the level of anxiety of persons diagnosed with GAD is actually reduced by psychotherapy. It is expected that patients receiving therapy will score lower on the Manifest Anxiety Scale than patients not receiving therapy "			
6	“Both genetic predisposition and stressors in the life of a particular patient is believed to contribute to this condition' is _______ 1. the research hypothesis 2. a theory about the causes of GAD 3. a postulated relation between two constructs 4. a description of the constructs in terms of which GAD can be observed	2	P4 P15 P18-19 P21-26	A theory is a well-established principle that has been developed to explain some aspect of the natural world. A theory arises from repeated observation and testing and incorporates facts, laws, predictions, and tested hypotheses that are widely accepted. In science, a theory is a framework for facts. It is some kind of description that tells you how the facts are connected, and why the facts are as they are (where the word 'facts' refers to things or events that were observed and described in a careful way). A theory is a network of relations among facts that were **proposed** to be true and explanations for observed phenomena in terms of constructs. Constructs and their interrelations (how they affect each other, their patterns of interaction) are used in this way to develop theoretical explanations of why people behave in certain ways in certain contexts, or why mental phenomena appear to be as they are. A hypothesis is a specific, testable prediction about what you expect to happen in your study. A hypothesis can be informally described as an educated guess. As we indicated above, research usually tries to establish relationships among constructs in order to develop a theory or to test an existing theory. Usually, the theory makes it possible for us to make some kind of prediction of how constructs should be interrelated. We formulate this relationship as an hypothesis, and we test the hypothesis (using statistical methods) to see if the prediction is true. If it is not true, there is something wrong with the theory, and we need to reconsider it.

#	Question	Ans	Page	Comments
7	"Whether the level of anxiety of persons diagnosed with GAD is actually reduced by psychotherapy" describes _______ 1. an observed relation between two variables 2. a theoretical prediction about the effect of psychotherapy 3. the operationalisation of the construct 'anxiety' 4. the hypothesis to be investigated	4	P4 P15 P18-19 P21-26	See comments above
8	The dependent variable is _______ and the independent variable is _______ 1. whether or not psychotherapy is received, the level of anxiety experienced by patients 2. the effectiveness of psychotherapy, the level of anxiety 3. the level of anxiety experienced by patients, whether or not psychotherapy is received 4. the anxiety score as measured on the Manifest Anxiety Scale, the presence of stressors in the life of the patient	3	P8-9 P24	The dependent variable is the one that is predicted or explained, and the independent variable is manipulated to see how it affects the dependent variable. The independent variable is that variable which affects the dependent variable; or, conversely, the dependent variable depends on the independent variable. When a researcher focuses on the interaction of only two variables at a time, the dependent variable is usually the one that the researcher is interested in, the variable that is the focus of the research. The independent variable is something that the researcher manipulates, to see how this affects the dependent variable (in other words, the dependent variable is dependent on the independent variable). Hidden variables are effects on the dependent variable that we may be unaware of, or that we choose to ignore. Very often the events or behaviour that we observed are the consequence of many interacting factors, and we have to analyse the situation carefully to try and identify as many things as possible that may interfere with our ability to find a clear relationship between a dependent variable and some specific independent variable. One of these hidden effects that researchers in psychology often have to contend with is that people change their behaviour when they realise that someone is paying extra attention to them (usually referred to as the 'Hawthorne effect').

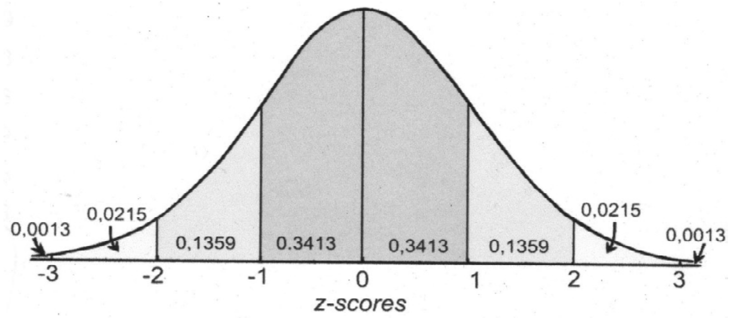
#	Question	Ans	Page	Comments
9	“The mental age of child number one is eight years'. In this statement 'mental age" is a(n) ______, whereas “eight years' is a(n) ______ 1. variable, specific value of that variable 2. construct, variable 3. independent variable, dependant variable 4. hidden variable, descriptive statistic	2	P7	A construct that has been measured in some way produces a variable. A variable refers to a number that can take on any one of a range of possible values. They can be discrete (when only whole numbers like 1, 2, 3 are allowed) or continuous (what mathematicians refer to as 'real numbers'). In some cases variables also take on values smaller than zero to produce negative numbers. So the (visible) variable reflects the intensity of the underlying (invisible) construct, in terms of how it was measured. We say that the variable is manifest (it is visible in the sense that we can observe it) and the construct is latent (it is invisible in the sense that we need some way to make it appear). So the latent construct is made manifest by the use of an appropriate measurement procedure. The dependent variable is the one that is predicted or explained, and the independent variable is manipulated to see how it affects the dependent variable.
10	A researcher would use a ______ to make a(n) ______ about the nature of the ______ 1. sample, inference, population 2. sample, hypothesis, population 3. variable, prediction, construct 4. population, inference, sample	1	P11	The entire collection of cases that you are interested in when you make your measurements for a particular construct is referred to as the **population**. The population depends on which people or objects or events you are interested in studying. Because populations can be very large, and we rarely have access to them, we would draw a **sample** of observations from the population and use that sample to **infer** certain things about the population's characteristics. The most appropriate sample is usually a simple random sample, where each individual has the same chance of being included. If our samples are not random, they may lack external validity: it may not be possible to generalise beyond the group from which we drew the sample.
11	A measurement that summarises an aspect of a population is called a ______ while a measurement that describes the same aspect of a sample is called ______ 1. construct, variable 2. parameter, statistic 3. statistic, parameter 4. variable, construct	2	P14 P23	**A statistic is a sample measurement characteristic**. A test statistic is the quantity you calculate (often by making use of sample statistics) to test a statistical hypothesis. When we refer to these test quantities, we always refer to the name in full - 'test statistic', and when we use the term 'statistic' on its own it refers to a descriptive statistic that describes an aspect of the sample data. **Parameters are values that summarise aspects of population dat**a While the word 'parameters' does refer to descriptive statistics, it does not refer to all descriptive statistics. It is used only for those descriptive statistics that relate to the population, not to those that describe aspects of the sample.

#	Question	Ans	Page	Comments
12	A ______ is a speculative statement about the relationship among ______, based on observations or expectations 1. theory, constructs 2. hypothesis, statistics 3. theory, variables 4. hypothesis, constructs	4	P1 P18-19	A **research hypothesis** is formed as a clear statement in terms of a relationship among the constructs (and the variables by which they are measured). It is a statement about a possible relationship among constructs that may explain some set of observations that one intends to investigate. **Constructs**: concepts that act as explanations for phenomena, events and behaviour and are abstracted from observations. **Theories**: a theory is a frame of reference for facts that attempts to account for why things are as they are; a claim about how constructs are related to produce phenomena, which has been validated by research.
13	A class of 10 boys and 11 girls, including Mary and her friend Elizabeth, chooses a class representative by writing their names on slips of paper, putting these into a box and asking their teacher to draw one name blindly. What is the probability that either Mary or Elizabeth will be selected? 1. 1/11 2. 1/21 3. 2/21 4. 2/11	3	P29	Number of possible outcomes = Total kids = 21 Number of favourable events = Either Mary or Elizabeth = 2 $p(E) = \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}}$ $= \frac{2}{21}$ = 2/21
14	A college student claims that she can identify three different types of cheese by taste. An experiment is set up to test her ability. She is blindfolded and given three pieces of cheese, each representing a different brand. What is the probability that she will correctly identify TWO particular pieces of cheese by chance? 1. 0.11 2. 0.16 3. 0.33 4. 0.67	2	P35-36	The multiplicative rule states that p(A and B) = p(A) x p(B) where A and B are both independent events. This rule is used to determine the product of two or more probabilities and is indicated by the word 'and' (i.e. the probability of A and B). To identify 2 cheeses require two favourable events and therefore two calculations under multiplicative rule. First she needs to identify 1 correct cheese from 3 different types, then she needs to identify the 2nd correct cheese from the remaining 2 types. $p(E) = \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}} \times \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}}$ $= \frac{1}{3} \times \frac{1}{2} = \frac{1}{6} =$ 0.167

#	Question	Ans	Page	Comments
15	Which statement best represents an application of the law of large numbers? If I flip a coin 1000 times, it will fall heads-up ______ 500 times 1. approximately 2. exactly 3. at least 4. either much more or much less than	1	P31-32	The principle is called the law of large numbers, and it states the following: If an experiment is done repeatedly, and if the outcomes are independent of one another, the observed proportion of favourable occurrences of an event will eventually approach its theoretical probability. What the law states is that a probability value should be seen as a theoretical limit on which the relative occurrence of an event (outcome) can be expected to converge over time in the long run. For example, in the above coin-flipping example, the probability of the coin coming up heads or tails on any flip is not influenced by the result of the previous flip. Each flip is independent of the other, and the theoretical probability of heads coming up remains the same, that is, p(heads) = 1/2 = 0.5. In terms of the law of large numbers, we can make the following prediction: If we flip the coin repeatedly, even though we do not know whether heads or tails will come up on any particular flip, the actual proportion of heads will eventually get close to 0.5. Thus, as the experiment gets repeated over and over, the relative frequency or proportion of heads will approximate the theoretical probability of 0.5
16	The expression "$0.05 < p \leq 0.10$" should be interpreted as a probability value ______ 1. smaller than 0.05 and larger or equal to 0.10 2. halfway between 0.05 and 0.10 3. larger than 0.05 and smaller or equal to 0.10 4. smaller than 0.05 and equal to 0.10	3	P33-34	Because probabilities fall in a range from 0.0 to 1.0 when expressed decimally, a probability can never be higher than 1 or lower than 0. The general rule is written symbolically as follows: $0 \leq p \leq 1$. Note that a probability can be 0, but to say that a probability is 0 is actually the same as saying that the event is impossible and can never happen. Likewise, to say that the probability of an event is 1 is to assert that it is an absolute certainty. In actual practice, probabilities fall within these two extremes. You will typically encounter reference to probabilities in expressions such as "$p > 0.05$". This statement is interpreted as "the probability value is higher than 0.05".
17	Suppose that over the years 10 000 students wrote the examinations in PYC 3704-C and that 6000 of them passed, of which 300 obtained exactly 50%. This means that for randomly selected students the probability of obtaining exactly 50% is ______ while the probability of obtaining 50% or more is ______ 1. 0.60, 0.03 2. 0.05, 0.60 3. 0.60, 0.03 4. 0.03, 0.60	4	P35-36	**Part 1:** $p(E) = \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}} = \frac{300}{10000} = \frac{3}{100} = 0.03$ **Part 2:** $p(E) = \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}} = \frac{6000}{10000} = \frac{6}{10} = 0.6$

#	Question	Ans	Page	Comments
18	During the interpretation of psychological measurements the normal distribution is often ______ 1. adapted to fit the observed frequency distribution of scores 2. used as a theoretical model for interpreting the observed distribution of scores 3. used to calculate the relative frequency of observed scores 4. used to derive the mean and standard deviation of a sample	2	P50-51	Many of the scores that we use are also clustered around the average, and tail off to the ends of the distribution. Because it can be used to describe the distribution of many naturally or 'normally' occurring continuous variables, this type of symmetrical probability distribution is called a normal distribution. It is also commonly referred to as the normal curve, because the distribution can be plotted by a bell-shaped curve. The definition of the standard normal distribution (see section 2.3.3 on p52-53) is that it has a mean (μ) of 0 and a standard deviation (σ) of 1.
19	The scale along the x-axis of the standard normal distribution indicates ______ 1. probabilities 2. the mean of the distribution 3. the number of standard deviations below and above the mean 4. the p-values	3	P52-53	Statisticians have derived a rather complicated-looking equation (or formula) which describes the normal curve, and have shown that it contains only two variables, the mean (m) and the standard deviation (s), with the rest of its terms being constants. The formula produces distributions that are all bell-shaped, but the actual shape of the curve - how high it is or how spread out it is - depends only on the mean and the standard deviation of the distribution concerned.
20	The mean and standard deviation of a set of test scores are 20 and 8 respectively. What is the z-score corresponding to a test score of 14? 1. 1.33 2. 0.75 3. -0.75 4. -1.33	3	P55	$Z = \frac{X - \mu}{\sigma} = \frac{14 - 20}{8} = \frac{-6}{8} = -0.75$ Where: X represents the variable (test score), μ is the population mean, σ the standard deviation of the population from which x was obtained.

#	Question	Ans	Page	Comments
21	Suppose the height of military recruits is distributed normally with a mean of 1750 mm and a standard deviation of 50 mm. Drawing repeated samples of 25 recruits each, we expect the standard deviation of the sample means to be about _______ mm 1. 2 2. 10 3. 50 4. 25	2	P61-62 P109	The standard error is an extremely valuable measure because we can use it to estimate how well a sample mean approximates its population mean in general, that is, how much error you can expect on average between the sample mean ($\bar{x}$) that you calculated from your sample and the population mean (μ) that you are trying to estimate. In other words, it is an indication of the size of the error that you make by using a sample of a particular size (n) to determine the population mean. This amount of error will decrease as the size of the sample increases. $\sigma_{\bar{x}} = \sigma/\sqrt{n} = 50/\sqrt{25} = 50/5 = 10$
22	Which of the following statements about population parameters is the most accurate? 1. They are essential for making statements about probability distributions 2. They are always unknown but appropriate values can be estimated prior to sampling 3. They are essential, but cannot be estimated from sample information 4. They are always required prior to sampling because they are needed to calculate the sample statistics	4	P23 P13 P65 Q10 P60	**Parameters are values that summarise aspects of population dat**a While the word 'parameters' does refer to descriptive statistics, it does not refer to all descriptive statistics. It is used only for those descriptive statistics that relate to the population, not to those that describe aspects of the sample. Population parameters are rarely known (**usually unknown**), since the only way to determine them would be to collect the relevant data from the entire population. Population parameters are usually unknown and have to be inferred from sample data. Since population parameters are unknown, they cannot be essential to make statements about probability. Option 1 is, therefore, incorrect. Option 3 is also incorrect because it incorrectly states that population parameters cannot be estimated from sampling information, but the whole process of statistical inference is actually concerned with inferring information about a population from sample data. We use the sample to represent the population, and do our calculations on the sample data, but ultimately we want to determine the situation in the population. To do this, we often have to estimate the (population) parameters by using the (sample) statistics. A researcher seldom knows the values of the population parameters, but the values of sample statistics can be calculated by means of clearly formulated mathematical procedures and these can be used as estimates of the parameters of the corresponding population. Normally, we'll not know what our true population parameter is, and we would have calculated the mean from only a single sample - but we can still apply the basic principle: that our sample mean will be a reliable estimate of our population mean.

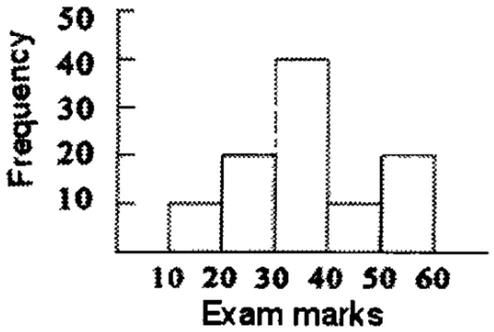
#	Question	Ans	Page	Comments
23	What is the principal advantage of z scores? They enable one to ______ 1. determine whether scores are normally distributed around the mean 2. transform a person's scores on tests with different means and the same standard deviations into comparable percentages 3. compare a person's scores on tests with different means and standard deviations 4. determine frequency distributions for tests with different means	3	P53 P55	This curve has a mean of μ = 0 and a standard deviation of σ = 1 and is known as the standard normal distribution, and is by convention indicated with the letter 'z' (so it is also referred to as the z-distribution). The measures on this distribution are referred to as standard scores or **z-scores**.  **FIGURE 2.7: The standard normal distribution** While its major use is in calculating probabilities, transforming a score from a normal distribution to its associated z-score has an additional benefit. **Transforming a set of measurements, each with a different mean and a different standard deviation, into a z-score can be used to compare an individual across different distributions**. After transformation, all the scores will fall on a common standard normal distribution with a mean of 0 and a standard deviation of 1, which makes it possible to compare them directly. **Theorem 1 The 68-95-99.7 Rule**: In every normal distribution with mean μ and standard deviation σ, approximately 68% of the data falls within one standard deviation of the mean. Approximately 95% of the data falls within two standard deviations of the mean. And finally, approximately 99.7% (almost everything) of the data falls within three standard deviations of the mean. According to the standard normal distribution tabel (z-tabel), if z=1 then the mean to z = 0.3413. Multiply by 2 to get both sides of the mean = 0.6826 or 68.26%

<table>
<tr><th>#</th><th>Question</th><th>Ans</th><th>Page</th><th>Comments</th></tr>
<tr><td>24</td><td>Consider the following Table

<table><tr><th>Subject</th><th>Student X</th><th>Mean of class</th><th>Std. dev. of class</th></tr><tr><td>A</td><td>50%</td><td>40%</td><td>5%</td></tr><tr><td>B</td><td>55%</td><td>50%</td><td>5%</td></tr><tr><td>C</td><td>60%</td><td>50%</td><td>10%</td></tr><tr><td>D</td><td>65%</td><td>65%</td><td>5%</td></tr></table>
In which subject did Student X do best, relative to his class?
1. A
2. C
3. D
4. B</td><td>1</td><td>Tut201 2012 Q21</td><td>The marks should first be converted to z-values, to make it possible to compare them across the different means and standard deviations:

$\mathbf{Z = \frac{X - \bar{X}}{S}}$ **or** $\mathbf{Z = (X - \bar{X}) / S}$

$Z_{SubjectA}$ = (50 - 40) / 5 = 10/5 = 2
$Z_{SubjectB}$ = (55 - 50) / 5 = 5/5 = 1
$Z_{SubjectC}$ = (60 - 50) / 5 = 10/10 = 1
$Z_{SubjectD}$ = (65 - 65) / 5 = 0/5 = 0

So it is clear that in the case of subject A, the student's marks are 2 standard deviations above the mean. In the other subjects the student's marks are 1 standard deviation or less above the mean.</td></tr>
<tr><td>25</td><td>Study the histogram below of the exam marks of a group of students in the same class. Note that the values on the horizontal axis are the class (category) limits


Assume we use this histogram as a basis for making probability predictions. What is the probability that a student's score will be between 40 and 60?

1. 0.20
2. 0.10
3. 0.70
4. 0.30</td><td>2</td><td>P29</td><td>Possible outcomes = 10 + 20 + 40 + 10 + 20 = 100

Favourable events = score > 40 and < 60
= Exam mark of 50 with frequency = 10
= 10

P(score > 40) = Number of favourable events / Number of possible outcomes
= 10 / 100
= 0.10

<u>OR</u>

Possible outcomes = 10 + 20 + 40 + 10 + 20 = 100

Favourable events = score > 40
= Exammark 50,freq 10 and exammark 60, freq 20
= 10 + 20 = 30

P(score > 40) = Number of favourable events / Number of possible outcomes
= (10 + 20) / 100
= 30 /100
= 0.30</td></tr>
</table>

#	Question	Ans	Page	Comments
	Use the scenario below to answer Questions 26 to 31 A researcher suspects that the addition of certain food supplements to the diet of elderly people will reduce the decline in cognitive functioning that comes about because of aging. She decides to test this using a neuropsychological test that measures the speeds with which objects are identified (the Neuropsychological Perceptual Speed or NPS test). It is known that the distribution of scores on this test is approximately normal and that a mean of $\mu = 80$ and $\sigma = 20$ was found in the population of persons older than 65. To investigate her hypothesis, she obtains a random sample of n=100 persons older than 65. Each member of this sample is given a daily dose of supplements over a period of six months. At the end of this time, each person is tested on the NPS test and a mean of $\dot{x} = 76$ is found. The researcher plans to test the hypothesis at $\alpha = 0.05$.			
26	The appropriate research hypothesis suggested by the scenario above is as follows 1. Cognitive functioning declines with age 2. The cognitive functioning of elderly persons is related to their perceptual speed 3. Cognitive functioning will be better for elderly persons who take the dietary supplement than for those who do not 4. The perceptual speed of elderly persons who take the dietary supplement will be greater than for those who do not	3	Tut201 2012 Q8	A psychological hypothesis formulates a testable empirical claim (something that can in principle be observed), and this usually involves postulating a relationship between two or more variables.
27	The appropriate alternative hypothesis to be tested is______ 1. $H_1: \mu < 80$ 2. $H_1: \mu < 84$ 3. $H_1: \bar{x} > 80$ 4. $H_1: \mu \neq 80$	1		$H_0: \mu = 80$ which is the score of the NPS on a normal population mean. For the speed of the NPS to improve, the NPS score must go down. See this as the time it took. The alternative hypothesis will therefore be to see if the NPS gets less than 80. So $H_1: \mu < 80$

#	Question	Ans	Page	Comments
28	The mean of the sampling distribution of the mean is _______ 1. 80 2. 76 3. 20 4. unknown	1	SG P60-61	The sampling distribution of means refers to the distribution of the means of all possible samples of a particular size randomly selected from the same population $\mu = \mu_{\bar{x}} = 80$
29	The standard error is _______ 1. 20 2. 2 3. 0.05 4. unknown	2	SG P60 SG P61	We can estimate the size of the error we would make if we used the sample mean as an estimate of the population mean. This is referred to as the **standard error**, and it is specified in the central limit theorem. **The standard error is denoted by $\sigma_{\dot{x}}$.** The σ indicates that we are describing a population, and the subscript ẋ informs us that we are dealing with a population of sample means. The standard error is given by dividing the population standard deviation by the square root of the sample size $\sigma_{\dot{x}} = \sigma / \sqrt{n}$ If σ = 20 and n = 100, then $\sigma_{\dot{x}} = 20 / \sqrt{100}$ $= 20 / 10$ $= 2$
30	With the information as given in the scenario, what would be the appropriate statistical test to test hypothesis? 1. A one sample t-test 2. A two sample t-test 3. A test of correlation r for relationship between variables 4. A one sample z-test	4	P100-106	The t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means when the population standard deviation σ is **unknown.** So we have to use the t-test ($t_{\bar{x}}$) when the **population standard deviation (σ)** is considered to be **unknown** - because the given standard deviation comes from the sample. $t_{\bar{x}} = \frac{(\bar{x} - \mu)}{s_{\bar{x}}}$ When the **population standard deviation (σ)** is **known** we use the z-test ($z_{\bar{x}}$) $z_{\bar{X}} = \frac{(\bar{x} - \mu)}{\sigma_{\bar{X}}} = \frac{(\bar{x} - \mu)}{\frac{\sigma}{\sqrt{n}}}$

#	Question	Ans	Page	Comments
31	The test statistic is calculated and, based on this, a computer program is used to determine that the one sided p-value =0.022. What conclusion can be drawn? 1. The null hypothesis can be rejected, so the supplement improves cognitive functioning 2. The null hypothesis cannot be rejected, so the supplement improves cognitive functioning 3. The alternative hypothesis can be rejected, so the supplement improves cognitive functioning 4. Insufficient information is given to make a conclusion without further calculations	1	P81	A test statistic is calculated to determine how far the observed measurements deviate from what we may expect by chance. Calculating the test statistic is the first step in a process of comparing the observed data with what may be expected by chance (i.e., if the null hypothesis were true). A computer program usually supplies a two-tailed p-value, but in this case the question states that the one-tailed p-value =0.022. This also means we are refering to a directional alternative hypothesis. We have already established that H_0: μ = 80 and H_1: μ < 80. The researcher plans to test the hypothesis at α = 0.05. We can therefore compare the p-value (0.022) with the alpha (0.05). The p-value is smaller than the alpha which means we have to reject the null hypothesis.
32	When applying a statistical test, the probability of a type I error is equal to ______ 1. 0.05 or 0.01 2. the level of significance 3. the calculated value of the test statistic 4. the p-value of the test statistic under the alternative hypothesis	2	SG 82-86 Tut202 2014 Q5	An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance represents the greatest risk of doing this that we are willing to take. We know that the extent of the type I error that a researcher is willing to make is controlled by the researcher by setting the level of significance (α) in advance. The probability of a type II error (β) is not controlled in advance by the researcher **except for the fact that we know that the lower (smaller) the probability of a type I error (α) the greater (larger) the probability of a type II error (β).** You could eliminate error of type I (rejecting H_0 when you should not) altogether by never rejecting the null hypothesis, irrespective of how small the p-value becomes, but that would make the probability of not rejecting H_0 when you should reject it (error of type II) an absolute certainty.

#	Question	Ans	Page	Comments
33	A statistical hypothesis is a formal statement about _______ 1. parameters 2. statistics 3. level of significance 4. p-values	1	P18 P71 P74	The next step in the research process is to turn the research hypothesis into a **statistical hypothesis: a formal hypothesis that can be tested by statistical techniques**. (on the basis of sample observations, whether the relationship proposed in the research hypothesis indeed exists.) This statistical hypothesis is a formal expression of the research hypothesis, which enables us to test it. Take note that a research hypothesis always translates into two mutually exclusive hypotheses (i.e. both cannot be true at the same time): a null and an alternative hypothesis. Also remember that, in Topic 1, we referred to quantities such as as parameters (population parameters). **These particular statistical hypotheses are, thus, statements about the value of a particular population parameter.**
34	The sampling distribution of a statistic (e g of the sample mean) can be calculated if we assume that the _______ hypothesis is true, but not if we assume that the _______ hypothesis is true 1. null, alternative 2. alternative, null 3. statistical, research 4. research, statistical	1	P58 P77-79	The sampling distribution of a statistic is the set of all possible values of the statistic when all possible samples of a fixed size are taken from the population. The sampling distribution refers to the variation of a statistic, for example, the sample mean ($\bar{x}$), from sample to sample. Note that here we are not concerned with the variation of individual elements in the sample, or individual elements in the population, but with the variation of a summary value (such as the mean) for a sample. So what we do instead is to calculate how far from the expected mean our observed mean is, and determine from this the probability that this difference is not 'real' but just a consequence of chance (random error). In other words, we determine the probability of getting this sample result, on a sample of this size, if H_0 were true. We use the expression 'under the null hypothesis' by which we mean , 'assuming that the hypothesis H_0 is true'. Similarly, the phrase 'under H_1' would mean, 'assuming that H_1 is true'.

#	Question	Ans	Page	Comments
35	When a statistical test yields a **large** p-value, which of the following statements is most correct? 1. The alternative hypothesis is probably true 2. The null hypothesis is probably false 3. The null hypothesis is probably true 4. The probability of an error of Type I is small	3	P81	Here is a summary of the important points regarding the p-value: • The p-value gives the probability of obtaining the sample result under H_0. • If the p-value is very small, the probability is very small that the sample result would occur under H_0, and one should consider rejecting H_0 in favour of H_1. • The smaller the p-value, the more likely that the null hypothesis is false and should be rejected in favour of the alternative hypothesis. So, if the p-value is very **large**, the probability is very big that the sample result would occur under H_0, and one should consider accepting H_0 in favour of H_1. **The null hypothesis is then probably true**
36	The hypothesis "H_1 $\mu < 50$" is a _______ hypothesis and requires a _______ statistical test 1. non-directional, one-tailed 2. directional, two-tailed 3. non-directional, two-tailed 4. directional, one-tailed	4	P75-76 P81	The alternative hypothesis can contain any of the symbols '>', '<' or '≠' respectively, the symbols for 'larger than', 'smaller than' or 'not equal to'. When a comparison is between a value that is greater (more) than another, we use the symbol '>' and when a comparison is between a value that is smaller (less than) than another, we use '<'. The statistical test that must be performed in either of these cases is a **directional or one-tailed statistical** test (we use these expressions interchangeably). When we do not specify what the direction of the difference should be, and both a larger and a smaller difference between means are considered as relevant, the symbol '≠' must be used. The statistical test to be performed will now be a **non-directional or two-tailed test**. The relationship between one-tailed and two-tailed p-values can be summarised as follows: • One-tailed p-value = (two-tailed p-value) / 2 • Two-tailed p-value = (one-tailed p-value) x 2 The important point to remember is that the p-value indicates more or less how likely the particular result we have observed in our data is if the null hypothesis were true; or, as we say, 'under the null hypothesis'.

#	Question	Ans	Page	Comments
37	When applying a z-test to compare a sample mean to a known population mean, the p-value represents the probability of ______ 1. rejecting the null hypothesis if it is false 2. obtaining the mean found in the sample of data under the alternative hypothesis 3. obtaining the mean found in the sample of data under the null hypothesis 4. failing to reject the null hypothesis when it is in fact true	3	Tut201 2014 Q10	The observed results are the values which you find in your sample(s) of data, for example the sample mean and sample standard deviation, or (if it is relevant), the correlation coefficient which you calculated. The p-value shows you the probability of seeing some relationship among these variables based on your calculations (such as a difference between means or a high correlation), if in fact this observed relationship is merely the consequence of chance (in other words, *if the null hypothesis was true*). You are in fact comparing the observed relationships in the data with what you would expect if the null hypothesis is true by calculating a relevant test statistic. This test statistic can then be used to find the p-value if we know the probability distribution of the test statistic. If this probability is small, it implies the null hypothesis is probably *not* true.
38	When applying a statistical test a decision is reached by comparing the ______ to the ______ 1. p-value, level of significance 2. test statistic, population parameter 3. test statistic, level of significance 4. p-value, test statistic	1	SG 82-86 Tut202 2014 Q5	An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance represents the greatest risk of doing this that we are willing to take. We know that the extent of the type I error that a researcher is willing to make is controlled by the researcher by setting the level of significance (α) in advance. The probability of a type II error (β) is not controlled in advance by the researcher **except for the fact that we know that the lower (smaller) the probability of a type I error (α) the greater (larger) the probability of a type II error (β).** You could eliminate error of type I (rejecting H_0 when you should not) altogether by never rejecting the null hypothesis, irrespective of how small the p-value becomes, but that would make the probability of not rejecting H_0 when you should reject it (error of type II) an absolute certainty.

#	Question	Ans	Page	Comments
39	The lower we set the level of significance, the greater the probability of - - 1. rejecting the null hypothesis 2. a type II error 3. a type I error 4. accepting the alternative hypothesis	2	SG 82-86 Tut202 2014 Q5	An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance represents the greatest risk of doing this that we are willing to take. We know that the extent of the type I error that a researcher is willing to make is controlled by the researcher by setting the level of significance (α) in advance. The probability of a type II error (β) is not controlled in advance by the researcher **except for the fact that we know that the lower (smaller) the probability of a type I error (α) the greater (larger) the probability of a type II error (β).** You could eliminate error of type I (rejecting H_0 when you should not) altogether by never rejecting the null hypothesis, irrespective of how small the p-value becomes, but that would make the probability of not rejecting H_0 when you should reject it (error of type II) an absolute certainty.
40	Which of the following assumptions do we make when applying a statistical test? We assume that the ______ 1. level of significance is small 2. null hypothesis is true 3. alternative hypothesis is true 4. the null hypothesis is false	2	P77 P82	The decision rule for H_0 is simply as follows: If the p-value of the sample result is smaller (less) than α (level of significance), the null hypothesis is rejected. If the p-value is not smaller than α, the null hypothesis (H_0) is not rejected.

#	Question	Ans	Page	Comments
41	The size of the level of significance depends on ______ 1. a choice made by the researcher 2. conventional rules 3. the calculation of a test statistic 4. the p-value under H_0	1	Tut201 2012 Q29 Tut202 2013 Q2	The level of significance (α) reflects the greatest risk that the researcher is willing to take of rejecting the null hypothesis in error. The researcher wants to establish that the observation which was made (as calculated from a sample of data) has a very small chance of being purely the result of chance variations in the data. He/she controls this by requiring that this calculated probability (the p-value) should be below a specific level (α) which is chosen in advance. Alternative 4 is false because the p-value refers to this *calculated* probability of finding a test statistic of a particular size if the null hypothesis is true (i.e. 'under the null hypothesis'), while the level of significance is the *maximum* value of this p-value which the researcher is willing to consider if the null hypothesis is to be rejected. The p-value must be less than this chosen level of significance, or else the statistical relationship between the variables is considered to be too small to be regarded as significant (the greater the p-value, the greater the probability that the effect which was observed in the sample data is purely the result of chance). Alternative 3 is false because an appropriate test statistic has to be calculated in order to find the p-value, but this test statistic is not called 'the level of significance.' While values for α such as 0.01 or 0.05 are often used by convention, the researcher can in fact use any value which he/she deems appropriate, so alternative 2 is not strictly correct.
42	When two population means are compared, the p-value expresses the probability of the difference between the sample means given that ______ 1. H_0 is false 2. H_1 is true 3. H_1 is false 4. H_0 is true	1	P81 P76-77	Here is a summary of the important points regarding the p-value: • The p-value gives the probability of obtaining the sample result under H_0. • If the p-value is very small, the probability is very small that the sample result would occur under H_0, and one should consider rejecting H_0 in favour of H_1. • The smaller the p-value, the more likely that the null hypothesis is false and should be rejected in favour of the alternative hypothesis. So, if the p-value is very **large**, the probability is very big that the sample result would occur under H_0, and one should consider accepting H_0 in favour of H_1. **The null hypothesis is then probably true** Generally, we would compare the two population means because H_0 seems to be false, but H_1 has not yet proven to be true.

#	Question	Ans	Page	Comments
43	What does it mean to say “the difference between the means of groups A and B is statistically significant? 1. It is unlikely that the alternative hypothesis will be true 2. The sample result is more probable under the alternative hypothesis 3. The null hypothesis explains the sample result 4. The alternative hypothesis should be rejected	2	Tut202 2014 Q8	The null hypothesis states that there is no difference in the means calculated from samples of data from each of of groups A and B. When we calculate the two means from sample data (which we regard as an observation) we may find a difference in the two calculated means, but at least part of this difference could be due to measurement errors. We calculate the p-value (based on a test statistic with a known probability distribution) to find out what the probability is that that these observed differences in the sample data are just a consequence of measurement error if the null hypothesis is assumed to be true. If this probability is low (lower than a pre-determined cut-off level, α), we conclude that the difference in the two means is statistically significant because the probability that the null hypothesis is true is very small. In other words, we conclude that the size of the difference between means found in the sample data would not be likely if the null hypothesis were true. Therefore: The sample result is more probable under the alternative hypothesis
44	When two means are compared, the p-value expresses the probability that a difference ______ 1. is statistically significant 2. which is found between the means is due to the alternative hypothesis 3. which is found between the means is due to chance or sampling error 4. will be found between the means	3	P76-77	In fact, we are not yet entitled to conclude that the alternative hypothesis is true. This is because of the problem of sampling error. This error exists partly because we are using a sample to make conclusions about a population, in addition to which we are using a test that is only accurate to a certain degree. It is because of this random error that we require the use of statistical tests to see whether the result is in fact adequate for us to make a decision about the hypothesis. (See section 1.4.4 on the problem of the error term in measurement.)
45	The power of a statistical test refers to the ______ 1. test's ability to give small p-values 2. test's ability to detect significant results 3. sample size 4. probability that an error of Type I will not be made when the test is used	2	P85-86	**The ability of a statistical test to detect a significant relationship between variables when such a relationship does in fact exist, is referred to as its power**. This is the inverse of a Type II error: it is the probability of rejecting H_0 when, in fact, it is false and H_1 is true. To put it succinctly, it is the probability of correctly rejecting a false null hypothesis The power of a test is calculated by subtracting the probability of a Type II error from one (i.e., power = $1 - \beta$). It can be thought of as a measure of the "accuracy" of the text. The power of a test is related to how sensitive the test should be (see section 3.3.4 on effect size below) as well as the sample size (n) that you are going to use. In practice, we usually control only the α-level when we use a particular statistical test. But, given a fixed α-level, there are ways of increasing the power of a test even if we do not actually calculate the value of $1 - \beta$.

#	Question	Ans	Page	Comments
46	The value that is conventionally indicated with the symbol α refers to the _______ 1. maximum probability of obtaining the observed results under H_0 2. probability of making an error of Type II if the rejection of H_0 is in fact true 3. ability of the statistical test to detect whether an effect exists 4. maximum probability of making an error of Type I if the rejection of H_0 is to be considered	4	P81-82	Small p-values would lead one to reject the null hypothesis, because it shows that the probability of H_0 being true is not very high. But how small must the p-value be? The practice in empirical research is to decide what size p-values would be considered small enough to justify rejecting the null hypothesis before the research is actually conducted. We do this by specifying a 'cut-off' p-value so that, if the calculated p-value of our sample result is smaller than this 'cut-off' p-value, the null hypothesis is rejected. This 'cut-off' p-value is called the significance level of the statistical test procedure. We will use the symbol 'α' to denote this significance level. The symbol 'α' is pronounced 'alpha' and is the Greek letter equivalent to the normal 'a' in our (Roman) alphabet. By convention, this value is often set at either 0.05 or 0.01. **The α-value specifies the maximum risk that we are willing to take of making an error if we reject the null hypothesis** (see section 3.3.3 for more details on this).
47	A researcher wants to test the hypothesis that the mean depression score on a depression scale for patients diagnosed with clinical depression is greater than 120. The statistical hypothesis to be tested is H_0 $\mu = 120$ H_1 $\mu > 120$ She uses a random sample of n=64 drawn from the population of diagnosed patients and finds that $\dot{x} = 127$ and s = 24 Which of the values below is the closest to the correct value of $s_{\bar{x}}$? 1. 0.37 2. 3.0 3. 0.61 4. $s_{\bar{x}}$ cannot be calculated from the information that was provided	2	P105	$s_{\bar{x}} = s / \sqrt{n}$ $= 24 / \sqrt{64}$ $= 24 / 8$ $= 3$

#	Question	Ans	Page	Comments
48	Suppose H_0 $\mu = 100$ is tested against H_1 $\mu \neq 100$ with α=0.05. If the t-statistic is found to be -3.20 and the two-tailed p-value is 0.04, what decision regarding the statistical hypothesis can be taken? 1. Do not reject H_1 2. Reject H_1 and accept H_0 3. Do not reject H_0 4. Reject H_0, and accept H_1	1		p = 0.04 α = 0.05 General rule: if $p < \alpha$, reject H_0 and accept H_1 Remember H_1 $\mu \neq 100$ (two-tailed), so α=0.05 is based on two-tailed hypothesis. The p-value of 0.04 is also two-tailed, so we can compared the p-value and α directly
49	Suppose the alternative hypothesis states that $\mu > 60$. The researcher should test H_0 against H_1 if the _______ 1. sample mean is larger than 60 2. sample mean is smaller than 60 3. sample mean differs from 60 4. p-value is smaller than the level of significance	1	P106	H_1: $\mu > 60$ μ = sample mean $\mu > 60$ is directional indicating larger than. So if the sample mean is greater than 60, a test should be performed.
50	The following list contains a number of situations where a researcher may consider using a variation of the t-test a) To compare two group means b) To determine whether a relationship exists between two categorical (nominal scale) variables c) To compare a group mean with a constant value d) To determine whether a relationship exists between two continuous quantitative variables Two of the statements above are true. Choose the correct set of true statements from the list below 1. (a) and (b) 2. (a) and (c) 3. (b) and (d) 4. (c) and (d)	2	P123 P115-123	One can use t-tests to compare two groups at a time until one has compared all three groups with one another. It would probably be wise to use a smaller level of significance since the probability of a Type I error increases as you do more statistical tests on the same data. T-test does not test for relationships. It compares groups

#	Question	Ans	Page	Comments
51	When applying a t-test for the difference between the means of two independent samples, the probability of obtaining the calculated t-statistic under the null hypothesis is compared to the ______ to reach a decision 1. level of significance 2. degrees of freedom 3. two-tailed probability 4. effect size	1	P86-87 P105 P116	With a t-test, the population standard deviation σ (and, therefore, the population variance $σ^2$) is unknown. You calculate the t-statistic using sample values to get a p-value which is then compared with the alpha level of significance
52	Samples can be considered independent when _______ 1. the sample comes from the assignment of subjects to a treatment or experimental group and this is varied to see how it affects certain measurements 2. care was taken that the samples are drawn under different experimental conditions 3. the samples are drawn from more than a single population of subjects 4. the composition of one sample is not systematically related to the composition of the other one	4	P112	**Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample.** The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly.

#	Question	Ans	Page	Comments
53	A social psychologist wants to test how long people will wait before responding to cries of help from an unknown person. The psychologist wants to confirm his suspicion that people will take less time to react when they hear a female voice than when they hear a male voice. He tests this on a sample of n=1 5 people who are told (one at a time) to sit in a waiting room to be called for an interview. While they wait, each participant hears a call for help from a male or female voice, which is actually a recording. The dependent variable is the number of seconds that each participant waits until they go to investigate or tried to find help. The following sample statistics are calculated from the results. Male voice $\dot{x}_1$= 11.9 seconds, $s_1 = 3.5$ Female voice $\dot{x}_2$ = 15.3 seconds, $s_2 = 4.1$ Given these sample statistics, what type of statistical test is required to confirm the relevant statistical hypothesis? 1. A one-tailed statistical test 2. A two-tailed statistical test 3. A test for independent samples 4. No statistical test is necessary	3	P113-116	The dependent variable is the one that is predicted or explained, and the independent variable is manipulated to see how it affects the dependent variable. We have to perform a t_c test In order to use the t-test (t_c) statistic, we need to make two assumptions regarding the data: • that the two populations being compared are normally distributed • with the same variance (or standard deviation). Note: Even the most elementary statistics program makes provision for performing t-tests. Such programs usually require that we indicate which variable should be used to identify the two groups and which is the dependent variable. In addition, we have to choose between **a t_c test for independent samples or a t_d test for dependent or correlated groups**

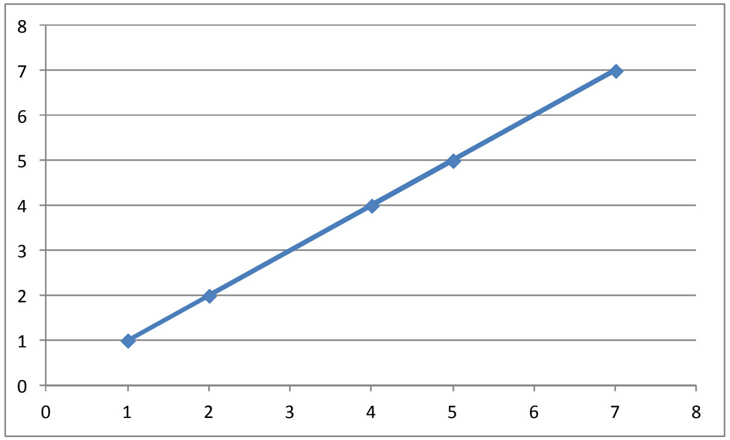
#	Question	Ans	Page	Comments
54	A researcher plans to use the t-test to compare two independent samples of data of only 15 individuals each. Consider the following assumptions that may be relevant here a) the sample standard deviations have to be equal b) the data from both samples has to come from populations that are normally distributed What minimum assumptions from the ones given above needs to be met before she may proceed? 1. At least one of (a) or (b) must be true 2. (a) and (b) must both be true 3. Neither (a) nor (b) is relevant but other assumptions exist that will have to be considered 4. The t-test should never be used with such a small sample at all	2	P115 P116	In order to use the t-test (t_c) statistic, we need to make two assumptions regarding the data: • that the two populations being compared are normally distributed • with the same variance (or standard deviation). (Remember that the square root of the variance is equal to the standard deviation.) We can also assume that the samples are independent - since the samples were selected randomly, we can safely consider them to be independent of each other. All of this makes the t_c-test an appropriate test. Note: Even the most elementary statistics program makes provision for performing t-tests. Such programs usually require that we indicate which variable should be used to identify the two groups and which is the dependent variable. In addition, we have to choose between **a t_c test for independent samples or a t_d test for dependent or correlated groups**
55	A researcher wants to test the following hypotheses H_0 $\mu_1 = \mu_2$ H_1 $\mu_1 > \mu_2$ On the basis of data provided, the output from a computer programme indicates that a t-value of $t = 1.72$ was found, with the p-value for a two-tailed test given as $p = 0.056$. What should the researcher do to evaluate this result at a level of significance of $\alpha = 0.05$? 1. Divide the p-value by 2 before comparing it with α 2. Multiply the p-value by 2 before comparing it with α 3. Divide α by 2 before comparing p to α 4. Compare the p-value as given with α	1	P78-81 P105	The relationship between one-tailed and two-tailed p-values can be summarised as follows: • One-tailed p-value = (two-tailed p-value) / 2 • Two-tailed p-value = (one-tailed p-value) x 2 The important point to remember is that the p-value indicates more or less how likely the particular result we have observed in our data is if the null hypothesis were true; or, as we say, 'under the null hypothesis'. H_1 $\mu_1 > \mu_2$ is a directional hypothesis and a one-tailed test should be performed. Computer programs often only provide the p-value for non-directional testing (i.e., for the two-tailed t-test). In this case, the non-directional p-value ($p = 0.056$) should be divided by two to get the one-tailed value of $p = 0.028$.

#	Question	Ans	Page	Comments
	Base your answers to Questions 56 - 58 on the following scenario A researcher suspects that a relationship exists between colour perception and visual memory (i.e. the capacity to recall visual information). She suspects that high ability to detect colours rapidly acts as an aid to the capacity of visual memory. A group of 100 research participants are divided into two groups, based on the capacity of their visual memory, as determined by an appropriate test. One group (Group 1) of n_1=44 displays high recollection of visual images, the other group (Group 2) of n_2=56 scores low on the test. Each participant from each of the groups are then tested on how many colours they can recall of objects they see very briefly displayed on a computer screen			
56	Which is the most appropriate research hypothesis for the researcher to test? 1. The mean of the number of colours recalled by the participants with a good visual memory will differ significantly from the mean number of colours recalled by those with a limited visual memory 2. The mean of the number of colours recalled by the participants with a good visual memory will be significantly less than the mean number of colours recalled by those with a limited visual memory 3. The mean of the number of colours recalled by the participants with a good visual memory will be significantly greater than the mean number of colours recalled by those with a limited visual memory 4. The mean of the differences between the number of colours recalled by the participants with a good visual memory and those with a limited visual memory will be significantly greater than zero	3		"She suspects that high ability to detect colours rapidly **acts as an aid to the capacity** of visual memory" The mean of the number of colours recalled by the participants with a good visual memory will be significantly greater than the mean number of colours recalled by those with a limited visual memory
57	Which is an appropriate way to formulate the alternative hypothesis for the analysis of the results? 1. H_1 $\mu_1 < \mu_2$ 2. H_1 $\dot{x}_1 > \dot{x}_2$ 3. H_1 $\mu_1 > \mu_2$ 4. H_1 $\mu_1 \neq \mu_2$	3		H_1 $\mu_1 > \mu_2$

#	Question	Ans	Page	Comments
58	Which is the appropriate test statistic to be calculated when analysing the results of this research? 1. The t-statistic for the difference between the means of two independent samples 2. The t-statistic for the difference between the means of two dependent samples 3. The t-statistic for the mean difference score of a single sample 4. The test statistic based on the correlation coefficient r for the relationship between two variables (visual memory and recall of colours)	4	P129-130	Correlation: measuring the association between variables **Correlation is a measurement of the extent to which a measurement on one variable is related to a measurement on another variable for the same sample of individual cases.** This can be visualised by way of a graphical representation called a scatter plot. A scatter plot is a graph that represents the measurements of two variables on two perpendicular axes, usually called the x-axis (horizontal axis or abscissa) and the y-axis (vertical axis or ordinate).
	Base your answers to Questions 59 and 60 on the following scenario. To test the efficacy of a workshop aimed at improving people's interpersonal skills, a researcher applies a scale which rates the interpersonal skills of 20 participants before and after they participate in the workshop. Scores on his rating scale among the general population have a mean of 5 and a standard deviation of 1.5			
59	Which of the following is the most appropriate way to express the null hypothesis for an analysis of the results? (Interpret μ as a population mean and $\dot{D}$ as the population mean of the differences scores) H_0: $\mu = 5$ H_0: $\mu_1 = \mu_2$ H_0: $\dot{D} = 0$ H_0: $\mu_1 \neq \mu_2$	2		" To test the efficacy of a workshop aimed at improving people's interpersonal skills, a researcher applies a scale" There is no direction indicated (greater, more, smaller, etc.) " participants before and after they participate in the workshop" So two group means are compared. H_0 is always "=" Therefore: H_0: $\mu_1 = \mu_2$

#	Question	Ans	Page	Comments
60	Which is the appropriate test statistic to calculate? 1. The z-statistic for the mean of a sample 2. The t-statistic for the difference between the means of two dependent samples 3. The t-statistic for the difference between the means of two independent samples 4. The t-statistic for the mean of a single sample	2	P112	" participants before and after they participate in the workshop" So the same group is used which make it dependant. Samples are considered as comprising **independent groups** if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample. The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of **dependent groups** refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design.
61	When studying correlations in research, one investigates the relation between _______ 1. the mean of a single sample of subjects and a population mean 2. two dependent groups of subjects, with respect to a single variable 3. two variables measured on the same group of subjects 4. two independent groups of subjects, with respect to a single variable	3	P129-130	Correlation: measuring the association between variables The notion of the relationship between two continuous variables and how the size of the relationship can be expressed in terms of a correlation between them (the index of association is the Pearson product-moment correlation coefficient). This coefficient can also be used as a test statistic. **Correlation is a measurement of the extent to which a measurement on one variable is related to a measurement on another variable for the same sample of individual cases.** This can be visualised by way of a graphical representation called a scatter plot.
62	A scatter plot is a graphical representation of _______ 1. the relationship between two variables measured on a nominal scale within a single group 2. the frequency distribution of a sample of measurements 3. relationship between two groups of subjects with regard to a single variable measured on an interval or ratio scale 4. the relationship between two variables measured on a ratio or interval scale within a single group	4	SG P130-132 Tut202 2014 Q18	A graph showing the position of each of a number of sampling units on each of two variables A *scatter plot* is a graph showing the relationship between two numerical variables. In such a graph the data of the one variable are plotted on the horizontal axis (usually referred to as the X axis), and the data of the other variable on the vertical (or Y) axis. It is **not** a comparison of sample and population, nor has it to do with spread of data or the independence of variables

#	Question	Ans	Page	Comments
63	A positive correlation between variables X and Y implies that persons scoring low on X will generally score ______ on Y 1. high 2. low 3. either high or low 4. in an indeterminate way	2	P133	If a correlation exists, the way in which one variable varies will be related to variation on the other one. A negative correlation implies that as one variable changes, the other changes *in the opposite direction*. A *high* value on X will imply a *low* value on Y, while a *low* value on X will be matched by a *high* value on Y. Conversely, if the correlation is positive, the variable values will generally vary is the same direction (both high or both low). When positive relationships occur, this implies that as one variable gets larger, so does the other. When negative relationships occur, this implies that as one variable gets larger, the other gets smaller.
64	Which of the following can take on a value of -0.5? 1. A probability 2. A level of significance 3. A correlation coefficient 4. A variance	3	P132-133	Correlation coefficients that measure the linear relationship between two variables, such as the Pearson product-moment correlation coefficient, can have a continuous value that ranges from -1 to 1 (a positive value is usually written without the sign, so '1' is presumed to mean '+1'). We use 'r' as the symbol that represents a correlation coefficient (as in the case of the Pearson product-moment correlation coefficient), and the following applies: • r = +1 implies a perfect positive linear relationship (the dots in a scatter plot will run from lower left to upper right in a perfectly straight line) • r = 0 implies no linear relationship at all (the dots may be scattered all over the place) • r = -1 implies a perfect negative linear relationship (the dots will run from upper left to lower right in a straight line)

#	Question	Ans	Page	Comments
65	What is the most likely value of the correlation coefficient between the following values of variables X and Y? <table><tr><td>X</td><td>2</td><td>7</td><td>4</td><td>5</td><td>1</td></tr><tr><td>Y</td><td>2</td><td>7</td><td>4</td><td>5</td><td>1</td></tr></table> 1. -1 2. 0 3. +1 4. 100	3	P132-133	 A perfect positive linear relationship exists (the dots in the scatter plot run from lower left to upper right in a perfectly straight line) We use 'r' as the symbol that represents a correlation coefficient (as in the case of the Pearson product-moment correlation coefficient), and the following applies: • r = +1 implies a perfect positive linear relationship (the dots in a scatter plot will run from lower left to upper right in a perfectly straight line) • r = 0 implies no linear relationship at all (the dots may be scattered all over the place) • r = -1 implies a perfect negative linear relationship (the dots will run from upper left to lower right in a straight line)

<table>
<tr><th>#</th><th>Question</th><th>Ans</th><th>Page</th><th>Comments</th></tr>
<tr><td>66</td><td>A researcher hypothesizes that a relationship should exist between spatial ability and general aptitude for mathematics. She collects the results of a sample of n = 100 school children for a mathematics test and measure the spatial ability of each with a test that represents a person's ability to rotate objects mentally on a 10-point scale.

Which of the following is the most appropriate way to express the null hypothesis for this research?

1. $r = 0$
2. $\mu = 0$
3. $\dot{x} = 0$
4. $p = 0$</td><td>4</td><td>SG P137

Tut202 2014 Q13</td><td>The symbol ‘ρ’ (the Greek letter ‘rho’) is used to represent the population parameter being tested when you calculate the Pearson’s correlation coefficient ‘r.’ That is, you calculate r for the sample, then have to decide whether this is likely to represent a significant linear correlation between two variables for the whole population (with this population correlation symbolised by ρ), by looking at the p-value associated with this calculated sample statistic r.

In a similar way ‘μ’ represents the population parameter (statistic) for a mean, and ‘σ’ the population parameter for a standard deviation.</td></tr>
<tr><td>67</td><td>A number of psychiatric patients are classified into one of four categories as: schizophrenic, severely depressed, bipolar disorder and others. Which of the following is suitable for representing this information versus the gender of these patients?

1. A contingency table
2. A scatter plot
3. A histogram
4. A spreadsheet</td><td>1</td><td>P142</td><td>After setting up the hypotheses to be tested for, the next step is to create a contingency table, which is a table indicating the number of individual objects falling in each cell of cross-tabulated data. In other words, it is a two-dimensional table in which each observation is classified in terms of two categories simultaneously.

<table><tr><th></th><th>Schizophrenic</th><th>Severely depressed</th><th>Bipolar disorder</th><th>Others</th></tr><tr><td>Male</td><td></td><td></td><td></td><td></td></tr><tr><td>Female</td><td></td><td></td><td></td><td></td></tr></table></td></tr>
</table>

<table>
<tr><th>#</th><th>Question</th><th>Ans</th><th>Page</th><th>Comments</th></tr>
<tr><td>68</td><td>What is the expected frequency of observations in cell AY if no interactions exist between the variables in the rows and columns of the following contingency table?

<table><tr><th></th><th>X</th><th>Y</th></tr><tr><td>A</td><td>6</td><td>4</td></tr><tr><td>B</td><td>4</td><td>6</td></tr></table>
1. 4
2. 5
3. 20
4. It cannot be calculated from the information provided</td><td>2</td><td>P143-144</td><td>It is important to note that the relation between the variables is described by the cell and not by the row or column frequencies. These cell frequencies represent the way the information is distributed relative to the two variables. These cell frequencies are often referred to as the observed or empirical cell frequencies.

To find the expected frequency for a particular cell, the row total for that row is multiplied by the column total for that column and this result is then divided by the overall total. These expected frequencies show what the results would have been like if the distribution of frequencies through the cells were homogeneous, in proportion to the respective row and column totals. If the observed frequencies correspond precisely with the expected frequencies, we know that the null hypothesis cannot be rejected. But the observed frequencies will seldom be precisely equal to the expected frequencies - even if H_0 is not rejected - because of sampling error.

It is the differences between these expected and observed frequencies that interest us, that is, we want to know how far the actual (observed) results are removed from the expected situation, if there is no interaction effect.

<table><tr><th></th><th>X</th><th>Y</th><th>Total</th></tr><tr><td>A</td><td>6</td><td>4</td><td>10</td></tr><tr><td>B</td><td>4</td><td>6</td><td>10</td></tr><tr><td>Total</td><td>10</td><td>10</td><td>20</td></tr></table>
Row total ($O_{.1}$) = 10
Column total ($O_{1.}$) = 10
Sample total (size) ($O_{..}$) = 20

E_{11} = (Row total x Column total) / Sample total
$E_{11} = (O_{.1} \times O_{1.}) / O_{..} = (10 \times 10) / 20 = 100 / 20 = 5$</td></tr>
</table>

#	Question	Ans	Page	Comments
69	A researcher wants to establish whether a relationship exists between people's religious affiliation and whether they are in favour of or against the death penalty (yes or no). Which of the following would be the most appropriate test to use? 1. The t-test for two independent samples 2. The Chi-square (x^2) test statistic 3. Pearson's correlation test statistic 4. The t-test for two dependent samples	2	SG P140 Tut202 2014 Q22	The chi-square test is usually used when you have a cross tabulation of frequency counts of events which are nominal scale measurements. This table is referred to as a contingency table. It is used to compare an observed frequency distribution (frequency counts based on a sample of observation) with the frequency distribution which we would expect to find if the null hypothesis of no relationship between two cross-tabulated variables were true.
70	Which of the following is the appropriate formula for the Chi square test? 1. $t_c = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ 2. $t_{\bar{x}} = \frac{(\bar{x} - \mu)}{s_{\bar{x}}}$ 3. $r = \frac{\text{cov}(X,Y)}{\sqrt{\text{var}(X)\,\text{var}(Y)}}$ 4. $\chi_p^2 = \sum_{ij} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$	4	P144	The Pearson chi-square test statistic is a calculation of the difference between the observed and expected frequencies. The formula is: $\chi_p^2 = \Sigma_{ij} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$ This means the expected value for each cell in the contingency table is subtracted from the observed value for that cell, squared, and divided by the expected value for that cell. Then all of these terms are added together to yield χ_p^2

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#	Question	Ans	Page	Comments
1	The entire collection of cases that you are interested in when you do research is referred to as the ______ 1. population 2. range 3. sample 4. data	1	P11	The entire collection of cases that you are interested in when you make your measurements for a particular construct is referred to as the population. The population depends on which people or objects or events you are interested in studying.
2	Mean, range, variance and standard deviation are examples of______ 1. variables 2. descriptive statistics 3. test statistics 4. inferential statistics	2	P10-11	A distinction exists between inferential statistics and descriptive statistics. **Descriptive statistics** refers to a set of quantities used to summarise aspects of numerical data. Examples that you may be familiar with are means, range, variance and standard deviation (see Appendix C for a quick introduction). These summary quantities are sometimes referred to as parameters (when they refer to the whole collection or population of data; see section 1.4.3 below). **Inferential statistics** refers to the use of statistical techniques to make generalisations about the relationships among (two or more) variables. Here the patterns that may exist in the data are carefully investigated.

<table>
<tr><th>#</th><th>Question</th><th>Ans</th><th>Page</th><th>Comments</th></tr>
<tr><td>3</td><td>Quantities that summarises aspects of a population are called (a) _______, while (b) _______ do the same for samples

1. (a) statistics (b) parameters
2. (a) parameters (b) statistics
3. (a) constructs (b) variables
4. (a) variables (b) parameters</td><td>2</td><td>P11

P161</td><td>These summary quantities are sometimes referred to as parameters (when they refer to the whole collection or population of data

You should take careful note of the following important distinctions between samples and populations. Summary values for populations are called 'parameters' and are usually denoted by Greek letters, while summary values for samples are called 'statistics' and are denoted by Roman letters.
<table>
<tr><th rowspan="2">Summary value</th><th colspan="2">Symbol</th></tr>
<tr><th>Populations (Parameter)</th><th>Samples (Statistic)</th></tr>
<tr><td>Arithmetic mean</td><td>μ</td><td>$\bar{x}$</td></tr>
<tr><td>Standard deviation</td><td>σ</td><td>s</td></tr>
<tr><td>Variance</td><td>σ^2</td><td>s^2 ($s=\sqrt{s^2}$)</td></tr>
<tr><td>Standard error of mean
(Also called Standard deviation of the sampling distribution of the mean)</td><td>$\sigma_{\bar{x}}$ ($= \sigma/\sqrt{n}$)</td><td>$s_{\bar{x}}$ ($= s/\sqrt{n}$)</td></tr>
<tr><td>Mean of sampling distribution of the mean
(Mean of all means. This is equal to the mean under H_0)</td><td>$\mu_{\bar{x}}$</td><td></td></tr>
<tr><td>Z score for means</td><td></td><td>$z_{\bar{x}}$</td></tr>
<tr><td>Correlation between two measurements
(Pearson's R)</td><td>ρ</td><td>r</td></tr>
<tr><td>Proportions</td><td>P</td><td>p</td></tr>
</table></td></tr>
<tr><td>4</td><td>The process of selecting a subset of a population for a survey is known as _______

1. survey research
2. triangulation
3. sampling
4. operationalisation</td><td>3</td><td>P11-12

P12</td><td>Because populations can be very large, and we rarely have access to them, we would draw a sample of observations from the population and use that sample to infer certain things about the population's characteristics. The most appropriate sample is usually a simple random sample, where each individual has the same chance of being included.

One of the most effective methods of sampling is random sampling, which involves selecting a subset in such a way that each member of the population has an equal probability of being included in the sample. From a statistical point of view, a more satisfactory definition of random sampling is that it is a method of drawing a sample from a population in such a way that every possible sample of a particular size has the same probability of being selected.</td></tr>
</table>

#	Question	Ans	Page	Comments
5	An inference is ______ 1. an explanation of why certain things are as they are observed to be 2. an educated guess about how certain phenomena may be interrelated 3. a generalisation from a specific situation to the phenomenon in general, which have a high probability of being true 4. a conclusion which follows logically from certain premises and which must be true if the premises are true	3	P2	An inference is a conclusion that follows from existing information, by generalising from the specific information to the general type of phenomenon, where the conclusion is not absolutely certain. So in summary inferential statistics are techniques for making generalisations based on imperfect numeric data, where the conclusions have a high probability of being true, but you can never be completely certain.
6	"Empirically" means "based on ______" 1. theory 2. statistical arguments 3. observations 4. facts	3	P2	All scientific knowledge begins with description of the phenomena being studied, based on careful observation. **Knowledge based on observation of physical events is referred to as empirical knowledge** (as distinct from knowledge based on contemplation, unexplained insights, mystical experiences or claims by authority figures).
7	Which of the following best describes "latent"? 1. observable 2. manifest 3. hidden 4. independent	3	P7 P23	So the (visible) variable reflects the intensity of the underlying (invisible) construct, in terms of how it was measured. We say that the variable is manifest (it is visible in the sense that we can observe it) and the construct is **latent (it is invisible in the sense that we need some way to make it appear).** So the latent construct is made manifest by the use of an appropriate measurement procedure. To say that a construct is 'latent' is another way of saying it is hidden from direct observation

#	Question	Ans	Page	Comments
8	A psychologist has a theory that visual perceptual ability influences the marks that learners will get in a mathematics test. In this example, 'visual perceptual ability' is the ______ variable 1. dependent 2. independent 3. manifest 4. hidden	2	P8-9 P24	The dependent variable is the one that is predicted or explained, and the independent variable is manipulated to see how it affects the dependent variable. The independent variable is that variable which affects the dependent variable; or, conversely, the dependent variable depends on the independent variable. When a researcher focuses on the interaction of only two variables at a time, the dependent variable is usually the one that the researcher is interested in, the variable that is the focus of the research. The independent variable is something that the researcher manipulates, to see how this affects the dependent variable (in other words, the dependent variable is dependent on the independent variable).
9	An operationally defined variable is ______ 1. abstract 2. latent 3. independent 4. observable	4	P24-26	Operational definitions of psychological constructs should define constructs in terms of observable behaviour. "Operational" refers to practical procedures by which constructs are made visible. "Operationalisation" is where you make the construct (which is usually an abstract concept, so it is difficult to observe it clearly) visible by finding some suitable way to measure it.

#	Question	Ans	Page	Comments
10	A psychologist is interested in studying the interaction between small groups of four to five people in each group. He suspects that the interactions between such groups can be described in similar terms to the interactions between individual persons. In order to be able to do a scientific study of this (a) ______ question, he would have to provide a(an) (b) ______ definition of the (c) ______ called "interaction" 1. (a) research (b) operational (c) construct 2. (a) scientific (b) experimental (c) concept 3. (a) experimental (b) research (c) statistic 4. (a) hypothetical (b) empirical (c) parameter	1	P15-16	We normally start with a **research question**. This could be an implication of a theory - something that seems to be implied by the theory or some kind of practical problem, which is stated in general terms. Using our existing knowledge about plausible answers, we reformulate the research question in terms of a conjecture or supposition, which has the goal of helping the researcher select what he or she has to observe in order to answer the research question. This is the research hypothesis (although there could be more than one), which expresses the problem in terms of very specific relationships among constructs that we expect to find (if our guess is true). It is important that this possible relationship should be clear and unambiguous. An hypothesis that is stated clearly and specifies exactly what is to be observed and what should be true if it is valid, is often called an **operational hypothesis**. However, this is just another name for a research hypothesis where the relationship between the measurements (representing the construct as variables) is written out in clear and explicit detail. **You can think of the research hypothesis as a description of relationships that should hold among the constructs (two or more).** The operational hypothesis is then the way the research hypothesis is expressed in the form of the relationships among the variables produced when the constructs are measured. But the operational hypothesis is usually taken as equivalent to the research hypothesis, so the distinction is rarely made in practice.
11	The variable manipulated by a researcher in an experiment is called the ______ variable 1. hypothetical 2. independent 3. dependent 4. empirical	2	P8-9 P24	The dependent variable is the one that is predicted or explained, and the independent variable is manipulated to see how it affects the dependent variable. The independent variable is that variable which affects the dependent variable; or, conversely, the dependent variable depends on the independent variable. When a researcher focuses on the interaction of only two variables at a time, the dependent variable is usually the one that the researcher is interested in, the variable that is the focus of the research. **The independent variable is something that the researcher manipulates**, to see how this affects the dependent variable (in other words, the dependent variable is dependent on the independent variable).

12	Which one of the definitions below is FALSE? 1. The term construct is used to refer to a concept which is of importance in psychological research 2. Measurement is a process whereby numbers are allocated to a construct according to a rule 3. When a psychological variable is measured, the result is referred to as a statistic 4. When a construct is measured, the resulting quantity is referred to as a variable	3	P3 P4 P4 P5 P7	Psychologists try to develop explanations for human experiences and behaviour. To do this, they often have to make use of abstract concepts (also called constructs) that serve as explanations for the behaviour they observe. Concepts such as these are sometimes referred to as 'constructs'. They are in a sense 'made up' concepts that we use to explain things (like behavioural patterns) that we can observe, but cannot see in themselves (at least, not directly). Psychologists are interested to find out which constructs are important (in the sense of being required or useful to explain human behaviour) and how they work together in a pattern, or what their interrelationships are. One of the objectives of psychology is not only to describe human behaviour, but also to find explanations for it. Constructs and how they interact fill the role of explanatory mechanisms in psychology. We try to find out which constructs offer an appropriate explanation of the behaviour or events we perceive, and what the pattern of their interactions with other constructs may be. In this sense, it can be said that constructs are the building blocks of theory. Constructs and their interrelations (how they affect each other, their patterns of interaction) are used in this way to **develop theoretical explanations** of why people behave in certain ways in certain contexts, or why mental phenomena appear to be as they are. **'Measurement' refers to a process whereby numbers are allocated to something according to a rule.** So what we need to do is to find specific standard procedures by which a specific construct can be observed, in such a way that a numeric value can be allocated. **A construct that has been measured in some way produces a variable**. A variable refers to a number that can take on any one of a range of possible values. They can be discrete (when only whole numbers like 1, 2, 3 are allowed) or continuous (what mathematicians refer to as 'real numbers'). In some cases variables also take on values smaller than zero to produce negative numbers.

13	Summary statistics that are used to summarize information about a population are called ______ 1. parameters 2. inferential statistics 3. samples 4. descriptive statistics	1	P14 P23	**A statistic is a sample measurement characteristic**. A test statistic is the quantity you calculate (often by making use of sample statistics) to test a statistical hypothesis. When we refer to these test quantities, we always refer to the name in full - 'test statistic', and when we use the term 'statistic' on its own it refers to a descriptive statistic that describes an aspect of the sample data. **Parameters are values that summarise aspects of population dat**a While the word 'parameters' does refer to descriptive statistics, it does not refer to all descriptive statistics. It is used only for those descriptive statistics that relate to the population, not to those that describe aspects of the sample.
14	A frequency distribution of the ages in months of a class of Grade 1 children indicates for each age in months what the corresponding ______ is 1. variable 2. number of children of that age 3. z-score 4. probability	2	P47 P140	The expression 'frequency' implies the count of observations in each of a number of categories. A *frequency distribution* of ages will represent the number of students falling in each of a number of age categories, which can be represented graphically in a histogram. The chi-square test is usually used when you have a cross tabulation of frequency counts of events which are nominal scale measurements. This table is referred to as a contingency table. It is used to compare an observed frequency distribution (frequency counts based on a sample of observation) with the frequency distribution which we would expect to find if the null hypothesis of no relationship between two cross-tabulated variables were true.

<table>
<tr>
<td>15</td>
<td>A researcher investigating short term memory reads a list of ten three digit numbers to a group of 100 research participants. Each participant is then asked to write down as many of the numbers as they can recall. The frequency table below shows the count of persons who can correctly recall a specific number of three-digit numbers from the list

<table>
<tr><td>Number of items remembered</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>Frequency</td><td>0</td><td>4</td><td>11</td><td>13</td><td>22</td><td>18</td><td>17</td><td>9</td><td>6</td><td>0</td></tr>
</table>

Using this table as a basis, estimate the probability that a specific person will remember nine or more three-digit numbers.

1. 0.06
2. 0
3. 94%
4. 0.15</td>
<td>1</td>
<td>P53</td>
<td>Frequency of 9 or more number remembered are:
9 numbers = 6
10 numbers = 0

Number of participants (N) = 100

Formula is :
$$\mu = \frac{\sum x_i}{N}$$
So:
μ = ∑xi / N
= (6+0) / 100
= 6 / 100
= 0.06</td>
</tr>
<tr>
<td>16</td>
<td>Two class representatives, one boy and one girl, must be selected from a class of 10 boys and 8 girls, which includes Mary and her friend John. The teacher writes the names of all the children on slips of paper. She first puts the girls' names into a box and then draws one of their names blindly. Then she empties the box and puts the names of all the boys inside, and one name is again drawn blindly.

What is the probability that Mary and John will both be selected?

1. 2/80
2. 0.0125
3. 0.225
4. 2/18</td>
<td>2</td>
<td>P34-35</td>
<td>The multiplicative rule states that p(A and B) = p(A) x p(B) where A and B are both independent events. This rule is used to determine the product of two or more probabilities and is indicated by the word 'and' (i.e. the probability of A and B).

Total number of kids = 18 (10 boys and 8 girls)
John selected = 1 out of 10
Mary selected = 1 out of 8

P(Mary and John) = P(Mary) x P(John) = 1/8 x 1/10 = 1/80 = 0.0125

The additive rule is p(A or B) = p(A) + p(B). This rule is used when two or more events are mutually exclusive. The additive rule is used to determine the sum of two or more probabilities, and is signalled by the use of the word 'or' (i.e. the probability of A or B).</td>
</tr>
</table>

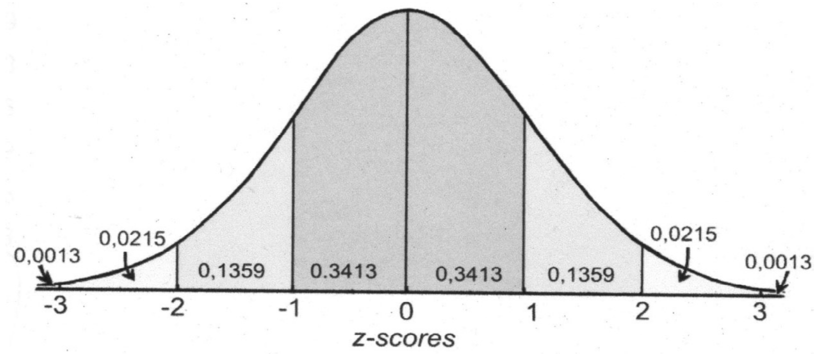
	Base your answers to Questions 17 and 18 on the following information: Suppose the weights of the population of military recruits are distributed normally with a mean of 64 kg and a standard deviation of 8 kg. Different samples of these recruits, each with a sample size of 16, are drawn repeatedly			
17	We expect the standard deviation of the sample means to be about ______ kg 1. 2 2. 3 3. 4 4. 8	1	P60-61	**Central limit theorem.** If a simple random sample of size n is selected from a population with mean μ and standard deviation σ, the sampling distribution of means obtained from all possible samples is approximately normal with mean μ and standard deviation $\sigma/\sqrt{n}$. The central limit theorem gives a precise description of the distribution that you will obtain if you selected every possible sample, calculated every sample mean, and constructed the distribution of the sample mean. The importance of the theorem lies in the fact that we can use it to describe a sampling distribution without actually having to sample a population of raw scores 'infinitely', and because of this we can calculate the extent to which any sample mean approximates the mean of the population from which it was drawn. Just as the normal distribution is defined by its mean and standard deviation, so the distribution of sample means is described by the same two quantities. The central value of the sampling distribution equals the population mean (i.e. the mean of the distribution of all possible means is the same as the mean of the population from which the samples were drawn, or $\mu_{\bar{x}} = \mu$) **while the standard deviation of the sample means is estimated by a value we call the standard error of the mean**. Like a standard deviation, the standard error of the mean tells us by what average amount the sample means deviate from the mean of the sampling distribution. It is an estimate of the size of the error we shall make if we use the mean of the distribution of sample means as an estimate of the true population mean, that is, if we use $\mu_{\bar{x}}$ to estimate μ. The standard error is denoted by $\sigma_{\bar{x}}$. The σ indicates that we are describing a population, and the subscript $\bar{x}$ informs us that we are dealing with a population of sample means. The standard error is given by dividing the population standard deviation by the square root of the sample size: $\sigma_{\bar{x}} = \sigma / \sqrt{n}$ where: μ = 64 (mean) σ = 8 (standard deviation) n = 16 (sample size) So: $\sigma_{\bar{x}} = \sigma / \sqrt{n} = 8 / \sqrt{16} = 8/4 = 2$

18	We expect the mean of the sample means to be about _______ kg 1. 52 2. 72 3. 64 4. 62	3	P61	$\mu_{\bar{x}} = \mu = 64$ Just as the normal distribution is defined by its mean and standard deviation, so the distribution of sample means is described by the same two quantities. The central value of the sampling distribution equals the population mean (i.e. **the mean of the distribution of all possible means is the same as the mean of the population from which the samples were drawn, or $\mu_{\bar{x}} = \mu$** while the standard deviation of the sample means is estimated by a value we call the standard error of the mean. Like a standard deviation, the standard error of the mean tells us by what average amount the sample means deviate from the mean of the sampling distribution. It is an estimate of the size of the error we shall make if we use the mean of the distribution of sample means as an estimate of the true population mean, that is, if we use $\mu_{\bar{x}}$ to estimate μ.

Base your answers to Questions 19 and 20 on the information in the table below:

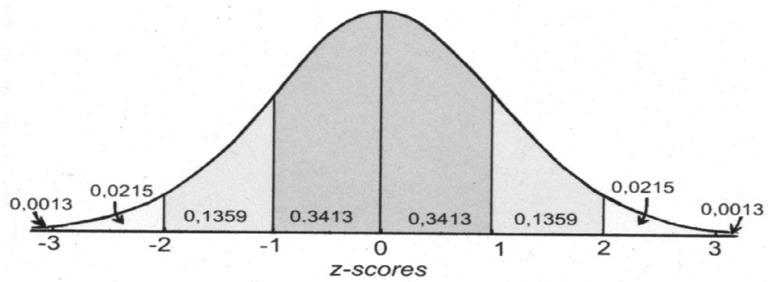
Subject	Student X	Mean of class	Std. dev. of class
A	50%	46%	2%
B	55%	50%	4%
C	60%	50%	6%
D	66%	65%	3%

19	In which subject did Student X do best, relative to his class? 1. A 2. C 3. D 4. B	1	P55	Calculate the z-score for each class. The subject with the highest z-score is where student X did the best in. Formula is: $Z = \frac{x - \mu}{\sigma}$ Where x = Student X score μ = Mean of class σ = Std dev of class Subject A: Z = (x- μ) / σ = (50%-46%) / 2% = 4% / 2% = 2 Subject B: Z = (x- μ) / σ = (55%-50%) / 4% = 5% / 4% = 1.25 Subject C: Z = (x- μ) / σ = (60%-50%) / 6% = 10% / 6% = 1.67 Subject D: Z = (x- μ) / σ = (66%-65%) / 3% = 1% / 3% = 0.33 Student X did best in Subject A

20	What is the probability of getting a score of 66% or more in subject D? 1. 0.33 2. 0.13 3. 0.63 4. 0.37	4	App D	Subject D: $Z = (x - \mu) / \sigma = (66\%-65\%) / 3\% = 1\% / 3\% = 0.33$ So Z=0.33 P(score ≥ 66%) = P(X ≥ 66%) So P(Z ≥ 0.33) = 0.3707 (Refer to standard normal distribution table where z=0.33. Since we are looking for ≥ 0.33, refer to the smaller portion column)
21	A z-score is conventionally used to refer to a variable from which probability distribution? 1. Any normal distribution 2. The binomial distribution 3. The even distribution 4. The standardized normal distribution	4	P52-53	There is one form of the normal distribution that is of special importance. This curve has a mean of μ = 0 and a standard deviation of σ = 1 and is known as the **standard normal distribution**, and is by convention indicated with the letter 'z' (so it is also referred to as the z-distribution). **The measures on this distribution are referred to as standard scores or z-scores**.  **FIGURE 2.7: The standard normal distribution**

22	The total area under the standard normal curve equals ______ 1. its mean 2. its standard deviation 3. the z-score 4. one	4	P53-54	Figure 2.7 above shows the approximate proportions of scores distributed under the area covered by the curve. • **The total area under the curve gives the probability of the interval -∞ and +∞, and is equal to +1** (i.e., the probability of any value of z falling between minus and plus infinity is equal to 1). • Because the distribution is symmetrical, 0.5 of the area lies to the left of the mean and the same proportion to the right of the mean. • Approximately 0.341 of the area lies between the mean and 1 standard deviation in each direction. • Roughly two-thirds, or 0.682 (0.341 x 2) of the area of the curve lies within one standard deviation of the mean. • Approximately 0.477 (i.e. 0.3413 + 0.1359) of the area lies between the mean and 2 standard deviations in each direction. • Approximately 0.954 (i.e. 0.477 x 2) of the area lies within 2 standard deviations from the mean. • Approximately 0.998 (i.e. 0.954 + (0.0215 x 2)) of the area lies within three standard deviations from the mean.
23	The mean and standard deviation of a set of test scores are 20 and 8 respectively. If the z-score which corresponds to a test score of 14 is calculated, in which of the intervals listed below would it fall? 1. Smaller than -1.0 2. Between -1.0 and 0 3. Between 0 and 1.0 4. Larger than 1.0	2	P55	$Z = \frac{X - \mu}{\sigma} = \frac{14 - 20}{8} = \frac{-6}{8} = -0.75$ Where: X represents the variable (test score), μ is the population mean, σ the standard deviation of the population from which x was obtained.

24	Why is the central limit theorem of importance in inferential statistics? It ______ 1. informs us how sampling error will increase as the population increases 2. tells us that sampling error will begin to approximate a normal distribution as samples grow larger 3. shows that the sampling distributions of certain sampling statistics will approach a normal distribution as the sample sizes increase 4. can be used to convert any measurement into an equivalent z-score	3	P60-61	**Central limit theorem.** If a simple random sample of size n is selected from a population with mean μ and standard deviation σ, the sampling distribution of means obtained from all possible samples is approximately normal with mean μ and standard deviation $\sigma/\sqrt{n}$ The central limit theorem gives a precise description of the distribution that you will obtain if you selected every possible sample, calculated every sample mean, and constructed the distribution of the sample mean. The importance of the theorem lies in the fact that we can use it to describe a sampling distribution without actually having to sample a population of raw scores 'infinitely', and because of this we can calculate the extent to which any sample mean approximates the mean of the population from which it was drawn. **Some interesting facts about this theorem should be noted:** • This theorem gives the sample distribution of the sample means for any population, irrespective of the shape, mean or standard deviation of the original population. • **The distribution of sample means will become more normal as sample size (n) increases**, so that with larger and larger samples the shape of the distribution of sample means will become increasingly normal in form. In fact the distribution of sample means approximates a normal distribution very rapidly: by the time the sample size reaches n=30, the distribution is very close to perfectly normal.
25	The asymptotic property of the normal curve refers to the fact that ______ 1. the curve is bell-shaped 2. the endpoints of the curve get continuously closer to the x-axis without ever touching it 3. the curve has a standardised variance 4. the curve is symmetrical	2	P52	Normal curves share a number of key properties, such as the following: • They are bell-shaped. The most observations occur at the midpoint of the curve. • They are symmetrical. The left side is a mirror image of the right side. • They are continuous. Theoretically, the values which the variables can assume are infinite and are measured on a truly continuous scale so that the curve is smooth. • **Their curves are asymptotic**, which means that the two tails never touch the horizontal axis, moving ever closer to infinity, because there is always some probability that more extreme values will occur.

26	The standard error is a measurement of ______ 1. how well a sample mean approximates a population mean 2. the extent to which a variable varies around its mean 3. the extent to which one variable changes as another one changes 4. the size of the error being made when you fail to reject a null hypothesis which is actually false	1	P60 P61	We can estimate the size of the error we would make if we used the sample mean as an estimate of the population mean. This is referred to as the **standard error**, and it is specified in the central limit theorem. **The standard error is denoted by $\sigma_{\dot{x}}$.** The σ indicates that we are describing a population, and the subscript ẋ informs us that we are dealing with a population of sample means. The standard error is given by dividing the population standard deviation by the square root of the sample size $\sigma_{\dot{x}} = \sigma / \sqrt{n}$ Like a standard deviation, the standard error of the mean tells us by what average amount the sample means deviate from the mean of the sampling distribution. **It is an estimate of the size of the error we shall make if we use the mean of the distribution of sample means as an estimate of the true population mean, that is, if we use $\mu_{\dot{x}}$ to estimate μ.**
27	Statistical hypotheses are statements about ______ 1. population parameters 2. sample statistics 3. characteristics of statistical distributions 4. all of the above	1	P74	Take note that a research hypothesis always translates into two mutually exclusive hypotheses (i.e. both cannot be true at the same time): a null and an alternative hypothesis. Also remember at this stage that, in Topic 1, we referred to quantities such as as parameters (population parameters). **These particular statistical hypotheses are, thus, statements about the value of a particular population parameter.**
28	Suppose we have stated H_0 $\mu = 10$, and H_1 $\mu < 10$, and find that the sample mean corresponds to a z-score of -3. This means that the corresponding p-value ______ 1. need not be found to reach a decision 2. is 0.0026 3. is 0.0013 4. can only be calculated if the sample standard deviation is known	3	App D	**Z < -3** **H_1 $\mu < 10$**  Since we are dealing with the z-scores on the bell curve, the probability of Z < -3 = probability of Z > 3 - both ends of the tails. However, since H_1 $\mu < 10$ indicates a one-tailed directional test, we only get the p-value for one tail. The p-value is read from appendix D as p(Z < -3) = p(Z > 3) = **0.0013**. We read the smaller p in appendix D because we are looking for p(Z < -3) or p(Z > 3). It is a one-tailed probability so do **NOT** multiply by 2 to get 0.0026 for a two-tailed test.

29	The hypothesis "H1: μ > 50" is a (a) ______ hypothesis and requires a (b) ______ statistical test 1. (a) non-directional (b) one-tailed 2. (a) directional (b) two-tailed 3. (a) non-directional (b) two-tailed 4. (a) directional (b) one-tailed	4	P75-76 P81	H1: μ > 50 The ">" indicates a directional hypothesis which requires a one-tailed test The alternative hypothesis can contain any of the symbols '>', '<' or '≠' respectively, the symbols for 'larger than', 'smaller than' or 'not equal to'. When a comparison is between a value that is greater (more) than another, we use the symbol '>' and when a comparison is between a value that is smaller (less than) than another, we use '<'. The statistical test that must be performed in either of these cases is a **directional or one-tailed statistical** test (we use these expressions interchangeably). When we do not specify what the direction of the difference should be, and both a larger and a smaller difference between means are considered as relevant, the symbol '≠' must be used. The statistical test to be performed will now be a **non-directional or two-tailed test**. The relationship between one-tailed and two-tailed p-values can be summarised as follows: • One-tailed p-value = (two-tailed p-value) / 2 • Two-tailed p-value = (one-tailed p-value) x 2 The important point to remember is that the p-value indicates more or less how likely the particular result we have observed in our data is if the null hypothesis were true; or, as we say, 'under the null hypothesis'.
30	The level of significance of a statistical test ______ 1. refers the p-value which is calculated from the test statistic 2. indicates the maximum risk that a researcher is willing to take of making an error of Type I 3. is the probability of obtaining the sample statistic under the null hypothesis 4. is used to indicate the probability of making an error by not rejecting the null hypothesis	2	SG P82-84	The a-value specifies the maximum risk that we are willing to take of making an error if we reject the null hypothesis. We know that the extent of the type I error that a researcher is willing to make is controlled by the researcher by setting the level of significance (α) in advance. The probability of a type II error (β) is not controlled in advance by the researcher except for the fact that we know that the lower (smaller) the probability of a type I error (α) the greater (larger) the probability of a type II error (β). You could eliminate error of type I (rejecting H_0 when you should not) altogether by never rejecting the null hypothesis, irrespective of how small the p-value becomes, but that would make the probability of not rejecting H_0 when you should reject it (error of type II) an absolute certainty.

31	When applying a statistical test, if the p-value is larger than the level of significance we ______ the alternative hypothesis 1. do not accept 2. fail to reject 3. accept 4. cannot make a conclusion about	1	SG 82-86 Tut202 2014 Q5	An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance represents the greatest risk of doing this that we are willing to take. We know that the extent of the type I error that a researcher is willing to make is controlled by the researcher by setting the level of significance (α) in advance. The probability of a type II error (β) is not controlled in advance by the researcher except for the fact that we know that the lower (smaller) the probability of a type I error (α) the greater (larger) the probability of a type II error (β). You could eliminate error of type I (rejecting H_0 when you should not) altogether by never rejecting the null hypothesis, irrespective of how small the p-value becomes, but that would make the probability of not rejecting H_0 when you should reject it (error of type II) an absolute certainty. **The decision rule for H_0 is simply as follows:** **If the p-value of the sample result is smaller (less) than α (level of significance), the null hypothesis is rejected. If the p-value is not smaller than α, the null hypothesis (H_0) is not rejected.** **Similarly, the decision rule for H_1 is simply as follows:** **If the p-value of the sample result is larger than α, the alternative hypothesis is accepted. If the p-value is not larger than α, the alternative hypothesis is not accepted.**
32	A type II error occurs when ______ 1. the null hypothesis is rejected when it should not be rejected 2. the null hypothesis is not rejected when it should be rejected 3. the null hypothesis is wrongly not rejected 4. the alternative hypothesis not accepted when it should be accepted	2	SG 82-86 Tut202 2014 Q5	An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance represents the greatest risk of doing this that we are willing to take. We know that the extent of the type I error that a researcher is willing to make is controlled by the researcher by setting the level of significance (α) in advance. The probability of a type II error (β) is not controlled in advance by the researcher **except for the fact that we know that the lower (smaller) the probability of a type I error (α) the greater (larger) the probability of a type II error (β).** You could eliminate error of type I (rejecting H_0 when you should not) altogether by never rejecting the null hypothesis, irrespective of how small the p-value becomes, but that would make the probability of not rejecting H_0 when you should reject it (error of type II) an absolute certainty.

	Base your answers to Questions 33 to 37 on the following scenario: Rose is interested in the problem of depth perception. She wonders whether artists who practise visual arts, and who are known to have made a study of the problem of perspective, would be better at judging depth than people in general. She decides to investigate this using a test for depth perception which was standardized on the general population with a mean of 5, where a greater number implies better depth perception on a scale of 1 to 9. She randomly draws 100 students who had graduated from a class on perspective at a school for fine arts and tests each of them on the depth perception test. She finds that the mean depth perception score of her sample is 6.2 and the sample standard deviation is 1.7			
33	How would you describe the population investigated in this research? 1. The general population 2. Artists who studied perspective 3. Artists who had studied perspective at a specific school for fine arts 4. Artists who had completed the test for depth perception	3		She randomly draws 100 students who had **graduated from a class on perspective at a school for fine arts**
34	Which of the following best describes the research or theoretical hypothesis to be tested? 1. Depth perception is related to artistic ability 2. Visual artists have a superior ability for depth perception to people In general 3. Students from the school of visual arts have better depth perception than the general population 4. The relationship between depth perception and artistic ability is statistically significant	2		She wonders whether **artists who practise visual arts**, and who are known to have made a study of the problem of perspective, **would be better at judging depth than people in general**
35	Which of the following are appropriate null and alternative hypotheses? 1. H_0: $\mu = 5$ H_1: $\mu < 5$ 2. H_0: $\mu = 5$ H_1: $\mu \neq 5$ 3. H_0: $\mu = 5$ H_1: $\mu > 5$ 4. H_0: $\mu \neq 5$ H_1: $\mu > 5$	3		H_0 always has "=" sign so option 4 is incorrect. The hypothesis Rose made was " She wonders whether artists who practise visual arts, and who are known to have made a study of the problem of perspective, **would be better** at judging depth than people in general" Therefore, H_1 must be better (larger / greater than) than the mean (5) H_1: $\mu > 5$ So the correct hypotheses are H_0: $\mu = 5$ H_1: $\mu > 5$

36	Which is the correct value of the standard deviation of the sampling distribution of the mean of the depth perception scores? 1. 17 2. 2.0 3. 0.017 4. 0.17	4		The given standard deviation was extracted from the sample of 100 so we use $s_{\bar{x}}$ and not $\sigma_{\bar{x}}$. The formula for standard deviation of the sampling distribution is the standard error which is $s_{\bar{x}} = s/\sqrt{n}$ $= 1.7/\sqrt{100}$ $= 1.7/10$ $= 0.17$
37	Which is the appropriate test statistic to calculate? 1. The t-statistic for the difference between the means of two independent groups 2. The t-statistic for the mean of a single group 3. The z-statistic for the mean of a single group 4. The t-statistic for the difference between the means of two dependent groups	2	P102-106	The t-statistic for the mean of a single sample. This is because the standard deviation is unknown. What is given was extracted from a sample of 100. In this question the population standard deviation (σ) is considered to be unknown because the given standard deviation comes from the sample. So we have to use the t-test ($t_{\bar{x}}$) The important point is that - as in the case of the z-distribution - the t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means when the population standard deviation σ is **unknown**. $t_{\bar{x}} = \frac{(\bar{x} - \mu)}{s_{\bar{x}}}$
38	When two population means are compared, the p-value is calculated to represent the probability of observing a specific difference between the sample means given that _______ 1. H_0 is true 2. H_1 is true 3. H_0 is false 4. H_1 is false	1	P81	Here is a summary of the important points regarding the p-value: • The p-value gives the probability of obtaining the sample result under H_0. • If the p-value is very small, the probability is very small that the sample result would occur under H_0, and one should consider rejecting H_0 in favour of H_1. • The smaller the p-value, the more likely that the null hypothesis is false and should be rejected in favour of the alternative hypothesis. So, if the p-value is very **large**, the probability is very big that the sample result would occur under H_0, and one should consider accepting H_0 in favour of H_1. **The null hypothesis is then probably true** **The important point to remember is that the p-value indicates more or less how likely the particular result we have observed in our data is if the null hypothesis were true; or, as we say, 'under the null hypothesis'.**

39	A psychologically unimportant result may turn out to be statistically significant if the researcher ______ 1. sets a low level of significance 2. uses a large sample 3. reduces the probability of a type I error 4. changes the effect size	2	SG P84-85 P33 P86 P88	By setting a low level of significance, we reduce the probability of a type I error. This by implication makes the probability of accepting the alternative hypothesis smaller. By setting a low level of significance we unfortunately increase the probability of *not* rejecting a null hypothesis when it should be rejected because it is false The main reason why such a seemingly slight difference could be so statistically significant stems from the large sample size - the larger the sample size, the closer the observed frequency can be expected to be to the true probability. **Effect size:** A major determinant of the sensitivity or power of a statistical test is sample size (which is why we can increase sample size to enhance power). When the sample is large, even smaller effects will have statistical significance. The reason is that the larger the sample, the less error variance can be expected (variance purely due to randomness). This is due to a principle called the law of large numbers, which states that on average the result obtained from a large number of trials should be close to the expected value, and will tend to become closer as more trials are performed (this law is described in section 2.1.2). This implies that when sample sizes are large, even sample effects that seem insignificant can produce small p-values, leading to the rejection of H_0. Effect size, power and sample size are interrelated; you can determine one if you have information regarding the other two. For example, if you set your desired effect size and know the power of the test, you can use this to determine what an optimal sample size would be to use the test effectively.

40	The mean score of a sample of research participants is compared with a population mean of 20 for a particular questionnaire which measures anxiety level. The following hypothesis is set up to be tested H_0: μ = 20 H_1: μ ≠ 20 A researcher draws a random sample of 25 persons and calculates the mean score and the standard deviation of this sample. This is used to calculate a t-test statistic to test the hypothesis at a significance level of α = 0.01. If a p-value of p = 0.036 is found, which of the following statements about the mean which was calculated from this sample is most likely to be true? 1. It is close to 20 2. It differs significantly from 20 3. It is definitely not equal to 20 4. There is not sufficient information given to estimate it	1		p-value = 0.036 α = 0.01 p-value(0.036) > α(0.01) Since the p-value(0.036) is greater than the level of significance (0.01), we do not reject the null hypothesis . Therefore: H_0: μ = 20 (or very close to 20) The steps we would apply are firstly the decision rule based on the p-value. We decide that we will not reject Ho. So we have already been given that Ho: = 20. If we look at the options provided: if we choose option 2 we would be saying that we will consider the alternate hypothesis, we have already decided not to do that. So it can't be option 2. The same concept applies to option 3. And option 4 is not correct because we have been provided with the all the information required to firstly apply the decision rule and the we have the Significance level and the p-value.
41	When two means are compared, the p-value expresses the probability that a difference between the means _______ 1. Will be significant 2. is due to the alternative hypothesis 3. will be found between the means 4. is due to chance or sampling error	4	Tut202 2014 Q8	The null hypothesis states that there is no difference in the means calculated from samples of data from each of of groups A and B. When we calculate the two means from sample data (which we regard as an observation) we may find a difference in the two calculated means, but at least part of this difference could be due to measurement errors. **We calculate the p-value (based on a test statistic with a known probability distribution) to find out what the probability is that that these observed differences in the sample data are just a consequence of measurement error if the null hypothesis is assumed to be true.** If this probability is low (lower than a pre-determined cut-off level, α), we conclude that the difference in the two means is statistically significant because the probability that the null hypothesis is true is very small. In other words, we conclude that the size of the difference between means found in the sample data would not be likely if the null hypothesis were true. Therefore: The sample result is more probable under the alternative hypothesis

42	Which symbol is conventionally used to indicate the value of the maximum probability that an error would be made if the null hypothesis is rejected which a particular researcher is willing to allow? 1. α 2. ß 3. p 4. σ	1	P83 P85 P29 P79	α = level of significance β = the error of failing to reject a null hypothesis that is really false p = probability σ = standard deviation **α indicates the risk that a researcher is prepared to take of making a Type I error (rejecting H_0 when the researcher should not do so),** β is used to indicate the opposite risk - the risk he (or she) is taking of making a Type II error (not rejecting H_0 when in fact he should).
43	Cohen's d refers to the ______ 1. difference score when two means from dependent samples are compared 2. effect size 3. power of a test 4. amount of variance shared by two variables when they are correlated	2	P87	One way that statisticians have suggested to deal with this problem is by the notion of effect size. Different procedures exist to determine the effect size of a result. In the case of a comparison between means, one way of calculating this is by the use of Cohen's d. We do this by expressing the mean difference that we observed relative to the standard deviation: $\textit{Effect size} = d = \frac{\textit{mean difference}}{\textit{standard deviation}}$
44	Effect size is calculated to determine ______ 1. whether an effect is statistically significant or not 2. the ability of a statistical test to detect a significant relationship between variables when such a relationship does In fact exist 3. the level of confidence one can reach that the test is valid 4. whether a significant effect is meaningful from a practical point of view	4	P87	The effect size is to assess whether a significant effect is meaningful from a practical point of view. The implication is that we have to be careful how we interpret significant results. A p-value of smaller than our chosen level of significance (α) simply implies that, relative to this sample, it is improbable that the effect we see in our observations is purely due to chance. It does not imply that the effect is big or important. This is something that we have to decide by looking at what the data means. One way that statisticians have suggested to deal with this problem is by the notion of effect size. Different procedures exist to determine the effect size of a result. In the case of a comparison between means, one way of calculating this is by the use of Cohen's d. We do this by expressing the mean difference that we observed relative to the standard deviation: $\textit{Effect size} = d = \frac{\textit{mean difference}}{\textit{standard deviation}}$

45	A random sample of n=100 people are tested to see how many items they can recall from a list with pictures of 12 items. The distribution of the results is found to be more or less normal with a mean of ẋ = 7 and a standard deviation of s = 2.0. What is the probability that a specific person, chosen at random from the general population, will remember 10 or more items from the list? 1. Less than 0.05 2. Between 0.05 and 0.1 3. Between 0.1 and 0.5 4. Greater than 0.5	2	P55-56	Probability (p-value) = ?? Mean ($\bar{x}$) = 7 Std Dev (s) = 2.0 Sample (n) = 100 Raw score (X) = 10 First calculate the z-score using $z = \frac{x - \bar{x}}{s}$ We do not use z-transformation formula $z = \frac{x - \mu}{\sigma}$ In practice, we are rarely able to calculate the mean of a population of scores and the standard deviation of the population s, because we seldom have population scores available. In such cases we can draw a representative sample from the population and use the sample statistics $\bar{x}$ and s to calculate z, as follows: $z = \frac{x - \bar{x}}{s}$ z = (10 - 7) / 2 z = 3 / 2 z = 1.5 Now you have standardised the normal distribution so the mean is 0 and the std dev is 1. When you look up the z-score (1.5) in the standard normal distribution tables (Appendix D) you will see the larger and smaller portion values. Larger portion is 0.9332 (93%) and smaller is 0.0668 (7%) So now you finally have enough information to answers the question. What is the probability that a specific person, chosen at random from the general population will remember 10 or more items from the list? So 10 or more will be the smaller portion of the graph (to the right of the z-score) so there is a 0.0668 (0.07 or 7%) chance (probability) they will get 10 or more items. The probability of 0.07 is between 0.05 and 0.1.

46	Under which condition would a researcher use a t-statistic to test a hypothesis about an unknown population mean μ? The value of the (a) ______is (b) ______ 1. (a) population standard deviation σ, (b) unknown 2. (a) standard error $s_{\bar{x}}$, (b) unknown 3. (a) population standard deviation σ, (b) known 4. (a) standard error $s_{\bar{x}}$, (b) known	1	P100-106	The t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means when the population standard deviation σ is **unknown.** So we have to use the t-test ($t_{\bar{x}}$) when the **population standard deviation (σ)** is considered to be **unknown** - because the given standard deviation comes from the sample. $t_{\bar{x}} = \frac{(\bar{x} - \mu)}{s_{\bar{x}}}$ When the **population standard deviation (σ)** is **known** we use the z-test ($z_{\bar{x}}$) $z_{\bar{x}} = \frac{(\bar{x} - \mu)}{\sigma_{\bar{x}}} = \frac{(\bar{x} - \mu)}{\frac{\sigma}{\sqrt{n}}}$
	Base your answers to Questions 47 to 49 on the following scenario Suppose that the memory span of adults is normally distributed with a mean of 7 items and a standard deviation of 2 items. A researcher is investigating the impairment of memory among persons who has been diagnosed as suffering from Korsakoff's syndrome (a neurological disorder linked to chronic alcohol abuse). He intends to test his prediction on a sample of 50 persons who were diagnosed as suffering from this syndrome			

47	Which of the following is an appropriate null hypothesis for testing the above prediction?
	
	1. The mean memory span of the population of persons suffering from Korsakoff's syndrome is smaller than 7
	2. The mean memory span of the population of persons suffering from Korsakoff's syndrome is equal to 7
	3. The mean memory span of the population of persons suffering from Korsakoff's syndrome is not equal to 7
	4. The mean memory span of the sample of persons suffering from Korsakoff's syndrome is equal to 7
		2	P73-75	The null hypothesis **will always contain equal signs**. In this case $H_0 : \mu = 7$.
				
				H_0 is defined as the hypothesis of no effect.
				
				• The null hypothesis (H_0) represents the status quo or the current belief in a situation. The null hypothesis **will always contain equal signs**.
				• The alternative hypothesis (H_1) is the opposite of the null hypothesis and represents a research claim or specific inference you would like to prove. This means that the alternative hypothesis takes the sign of the test depending on the situation.
				  ○ If we are testing the ***difference***, H_1 is indicated with ≠.
				  ○ Otherwise we can use signs like less than (<) or greater than (>) depending on the problem statement.
				• If you reject H_0, you have statistical proof that the alternative is correct.
				• If you do not reject H_0, you have failed to prove that the alternative hypothesis is correct. Failure to prove the alternative hypothesis does not necessarily mean that the null hypothesis is true.
				• The null hypothesis (H_0) always refers to a specific value of a parameter (such as μ, not a statistic (such as $\bar{x}$). This value is *always* known or will come from the given scenario.

48	Which of the following is an appropriate alternative hypothesis for testing the above prediction? 1. The mean memory span of the population of persons suffering from Korsakoff's syndrome is smaller than 7 2. The mean memory span of the population of persons suffering from Korsakoff's syndrome is equal to 7 3. The mean memory span of the population of persons suffering from Korsakoff's syndrome is not equal to 7 4. The mean memory span of the sample of persons suffering from Korsakoff's syndrome smaller than 7	1		A researcher is investigating the **impairment** of memory among persons who has been diagnosed as suffering from Korsakoff's syndrome. "Impairment" indicates less than or smaller than, so $H_1 : \mu < 7$ Therefore: The mean memory span of the population of persons suffering from Korsakoff's syndrome is smaller than 7
49	Testing the above prediction on a sample will require a ______ statistical test 1. non-directional 2. two-tailed 3. directional 4. non-parametric	3	P75	Directional because $H_1 : \mu < 7$. It is also one-tailed because it only focus on smaller than 7 and not larger than 7 as well. Two-tailed is when $H_1 : \mu \neq 7$. Now the focus will be on smaller than and larger than 7 results

50	A pharmaceutical company claims that a new sleeping pill which they are marketing will put people to sleep in less than 15 minutes. A researcher wants to test if the average time before people fall asleep after using this pill matches this claim. She uses the following hypothesis H_0: μ = 15 H_1: μ < 15 Suppose she tests this on a random sample of n = 40 research participants who suffer from insomnia. She finds that the mean time before members of the sample falls asleep after using the pill is 14.3 minutes with a standard deviation of 3.2. A subsequent t-test produces a two-tailed p-value of 0.0345 and the level of significance was set at 0.05. What is the value of the one-tailed or directional p-value? 1. 0.03450 2. 0.01725 3. 0.06900 4. Insufficient Information is given to determine thus value	2	P81	The relationship between one-tailed and two-tailed p-values can be summarised as follows: • One-tailed p-value = (two-tailed p-value) / 2 • Two-tailed p-value = (one-tailed p-value) x 2 The important point to remember is that the p-value indicates more or less how likely the particular result we have observed in our data is if the null hypothesis were true; or, as we say, 'under the null hypothesis'. Therefore: One tailed p-value = two tailed p-value divide by two So one-tailed p-value = 0.03450 / 2 = -0.01725
51	A researcher wants to compare the mean of the non-verbal reasoning scores of a sample of n=25 students with that of the general population. According to the literature, the non-verbal reasoning test which she uses was standardized to a population mean of u = 100 and a population standard deviation of σ =10. What is the value of the standard deviation of the sampling distribution of the mean which will be required to calculate the $z_{\dot{x}}$ test statistic? 1. 2.5 2. 0.4 3. 10 4. 2	4	P61-62	The standard error is an extremely valuable measure because we can use it to estimate how well a sample mean approximates its population mean in general, that is, how much error you can expect on average between the sample mean ($\bar{x}$) that you calculated from your sample and the population mean (μ) that you are trying to estimate. In other words, it is an indication of the size of the error that you make by using a sample of a particular size (n) to determine the population mean. This amount of error will decrease as the size of the sample increases. $\sigma_{\bar{x}} = \sigma/\sqrt{n} = 10/\sqrt{25} = 10/5 = 2$

52	What does it mean to say "the difference between the means of groups A and B is statistically significant? 1. The null hypothesis adequately explains the results 2. The alternative hypothesis is true 3. The alternative hypothesis should be rejected 4. The null hypothesis cannot be rejected	2	Tut202 2014 Q8	The null hypothesis states that there is no difference in the means calculated from samples of data from each of of groups A and B. When we calculate the two means from sample data (which we regard as an observation) we may find a difference in the two calculated means, but at least part of this difference could be due to measurement errors. We calculate the p-value (based on a test statistic with a known probability distribution) to find out what the probability is that that these observed differences in the sample data are just a consequence of measurement error if the null hypothesis is assumed to be true. If this probability is low (lower than a pre-determined cut-off level, α), we conclude that the difference in the two means is statistically significant because the probability that the null hypothesis is true is very small. In other words, we conclude that the size of the difference between means found in the sample data would not be likely if the null hypothesis were true. Therefore: The sample result is more probable under the alternative hypothesis
	Base your answers to Questions 53 and 54 on the following scenario A market researcher is asked to conduct a study to examine people's reaction to a movie trailer. He draws a random sample of 20 males and 20 females who saw the trailer. He asks them to indicate how likely it is that they will go and see the movie on a 7-point scale, where 1 indicates 'not at all' and 7 indicates 'definitely'. He wants to compare to establish whether males and females differ in their intention to see the movie based on an exposure to the trailer. Suppose the researcher finds that the mean and standard deviations for each group in the sample is as follows Males $\dot{x}_M = 5.7$ $S_M = 2.1$ Females $\dot{x}_F = 4.19$ $S_F = 1.6$			

53	Which are the appropriate statistical hypotheses for testing the researcher's hypothesis? 1. H_0: $\dot{x}_M = \dot{x}_F$ H_1: $\dot{x}_M \neq \dot{x}_F$ 2. H_0: $\mu_M = \mu_F$ H_1: $\mu_M > \mu_F$ 3. H_0: $\mu_M = \mu_F$ H_1: $\mu_M \neq \mu_F$ 4. H_0: $\mu = 0$ H_1: $\mu \neq 0$	3	P11-18 P21-26 P161	He wants to compare to establish whether males and females **differ** in their intention to see the movie based on an exposure to the trailer. The word "differ" does not indicate a direction and therefore the alternative hypothesis must have a "≠" sign. Hypotheses are tested on population parameters only, therefore only "μ","σ" and "p" can be used. A hypothesis is not stated for samples or statistics ("x̄" or "s"). An hypothesis is a statement of relationships among variables, not about the nature of variables

Summary value	Symbol	
	Populations (Parameter)	**Samples (Statistic)**
Arithmetic mean	μ	$\bar{x}$
Standard deviation	σ	s
Variance	σ^2	s^2 $(s=\sqrt{s^2})$
Standard error of mean (Also called Standard deviation of the sampling distribution of the mean)	$\sigma_{\bar{x}}$ $(= \sigma/\sqrt{n})$	$s_{\bar{x}}$ $(= s/\sqrt{n})$
Mean of sampling distribution of the mean (Mean of all means. This is equal to the mean under H_0)	$\mu_{\bar{x}}$	
Z score for means		$z_{\bar{x}}$
Correlation between two measurements (Pearson's R)	ρ	r
Proportions	P	p

54	Which is the appropriate test statistic to calculate? 1. The z-statistic for the difference between the means of two samples 2. The t-statistic for the difference between the means of two independent samples 3. The t-statistic for the mean of a single sample 4. The t-statistic for the difference between the means of two dependent samples	2	P110	Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample. The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design.
55	A researcher is asked by a motivational speaker to establish whether a workshop on assertiveness training is effective. The researcher decides to use a particular questionnaire which tests an individual's level of assertiveness. He presents the questionnaire to each of a sample of 50 participants in the workshop before it begins and once again after it has ended. When analysing these results the researcher should use a statistical test for the ______ 1. comparison of means for a single group 2. comparison of means for two dependent groups 3. comparison of means for two independent groups 4. correlation of two variables	2	P120 P110	This t-test statistic (t_d) is used for the comparison of means from two matched or dependent samples. The concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent group's research design is often referred to as a matched-pairs design. Another example of such a design would be a repeated measures design, where the same research participant is observed under more than one treatment or experimental condition. For example, to test the effectiveness of a psychotherapy technique, people can be tested before the treatment begins, and again afterwards. The two sets of measurement (indicated by two variables) can be regarded as two samples of data, which is to be compared to see whether some kind of change has taken place. Dependent samples are also sometimes referred to as correlated samples **NOTE:** Make sure that you do not confuse the notion of dependent versus independent samples with the distinction between dependent and independent variables (Topic 1, section 1.3.2). While the latter refers to the relationships among variables - how one may affect the other - in the case of samples it is a relationship among the groups from which the data were collected (i.e., where the variables were measured) that is of concern.

56	The probability under the null hypothesis of obtaining a t-value of 2.0 or higher in the case of a two-tailed test is _______ that for a one-tailed test 1. the same as 2. twice 3. half 4. impossible to calculate from	2	SG P81 Tut201 2014 Q12	A one-tailed p-value (used in the case of a directional hypothesis) is **half** the size of a two-tailed probability. Conversely, a two-tailed p-value (used in the case of a *non-directional* hypothesis) is **twice** the size of a one-tailed p-value. The relationship between one-tailed and two-tailed p-values can be summarised as follows: • One-tailed p-value = (two-tailed p-value) / 2 • Two-tailed p-value = (one-tailed p-value) x 2
57	When calculating the t-test for two independent samples, which of the following assumptions must be made if the sample sizes are relatively small? a) the value of σ is known for both populations b) the two population means differ c) the two populations have the same variance d) the two samples come from normally distributed data 1. (a) and (d) 2. (b) and (c) 3. (a) and (c) 4. (c) and (d)	4	P113 P116	In order to use the t-test (t_c) statistic, we need to make two assumptions regarding the data: • that the two populations being compared are normally distributed • with the same variance (or standard deviation). Note: Even the most elementary statistics program makes provision for performing t-tests. Such programs usually require that we indicate which variable should be used to identify the two groups and which is the dependent variable. In addition, we have to choose between **a t_c test for independent samples or a t_d test for dependent or correlated groups**

58	A sample of 70 people is tested on a test for assertiveness before and after a workshop in which they are given assertiveness training. Which of the following is the most appropriate formula for comparing the mean assertiveness score before the training with the one thereafter? 1. $t_{\bar{X}} = \frac{(\bar{X} - \mu_{\bar{X}})}{s_{\bar{X}}}$ 2. $\chi_p^2 = \sum_{ij} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$ 3. $t_c = \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ 4. $t_{\bar{d}} = \frac{\bar{d}}{\frac{s_{\bar{d}}}{\sqrt{n}}}$	4	P119-120	"70 people is tested on a test for assertiveness **before and after** a workshop." We therefore know that we are dealing with two matched or dependant samples. We have to use the t_d test $t_{\bar{d}} = \frac{\bar{d}}{\frac{s_{\bar{d}}}{\sqrt{n}}}$

Base your answers to Questions 59 and 60 on the following scenario:

A researcher compares a sample of children from a special school for gifted children with a group of children randomly drawn from other schools on a test which measures the creativity of the children on a 9-point scale She finds the following

Group 1 ('gifted' children)	$n_1 = 40$,	$\bar{x}_1 = 5.5$,	$s_1 = 1.2$
Group 2 (other children)	$n_1 = 62$,	$\bar{x}_2 = 4.9$,	$s_2 = 0.8$
All children pooled	$n = 102$,	$\bar{x} = 5.1$,	$s = 1.0$

She calculates a t-test statistic of t=3.37 and finds that p=0.0006, which she finds to be significant on the level of $\alpha = 0.01$

59	Even though the result described in the scenario is statistically significant, the researcher is unsure whether the difference between the means is large enough to be of practical importance. Which of the following strategies are the most appropriate to get a better idea of the usefulness of the result? 1. Calculating the effect size 2. Calculating the correlation coefficient 3. Calculating the power of the test 4. The low p-value is sufficient to show that the result is important In practical terms	1	P86	**<u>Effect size:</u>** A major determinant of the sensitivity or power of a statistical test is sample size (which is why we can increase sample size to enhance power). When the sample is large, even smaller effects will have statistical significance. The reason is that the larger the sample, the less error variance can be expected (variance purely due to randomness). This is due to a principle called the law of large numbers, which states that on average the result obtained from a large number of trials should be close to the expected value, and will tend to become closer as more trials are performed (this law is described in section 2.1.2). This implies that when sample sizes are large, even sample effects that seem insignificant can produce small p-values, leading to the rejection of H_0. $\text{Effect size} = d = \frac{\text{mean difference}}{\text{standard deviation}}$
60	If the researcher calculates the value implied In the previous question, what would the absolute value (ignoring the sign) of the result be? 1. Between 0.0 and 0.3 2. Between 0.3 and 0.5 3. Between 0.5 and 0.8 4. Greater than 0.8	3	P116	$\bar{x}_1 = 5.5$ $\bar{x}_2 = 4.9$ $s_p = s = 1.0$ $d = \frac{\text{estimated mean difference}}{\text{estimated standard deviation}} = \frac{\bar{x}_1 - \bar{x}_2}{s_p}$ $d = (\bar{x}_1 - \bar{x}_2) / s_p = (5.5 - 4.9) / 1.0 = 0.6 / 1 = 0.6$ d = 0.6 which lies between 0.5 and 0.8
61	A scatter plot is a graphical representation of the relation between ______ 1. two variables measured on a nominal scale within a single group 2. two variables measured on a ratio or interval scale within a single group 3. two groups of subjects measured on an interval or ratio scale on a single variable 4. two groups of subjects measured on an interval or ratio scale on two variables	2	SG P130-132 Tut202 2014 Q18	A graph showing the position of each of a number of sampling units on each of two variables A *scatter plot* is a graph showing the relationship between two numerical variables. In such a graph the data of the one variable are plotted on the horizontal axis (usually referred to as the X axis), and the data of the other variable on the vertical (or Y) axis. It is not a comparison of sample and population, nor has it to do with spread of data or the independence of variables

62	A researcher obtains a correlation coefficient of 0.40 between IQ scores and examination marks in a random sample of 10 PYC3704 students, and again a correlation coefficient of 0.40 between the same two variables on another random sample of 100 PYC3704 students. Which of these two correlation coefficients is the more likely to differ significantly from zero under the null hypothesis? 1. That obtained on the smaller sample 2. Both are equally likely to be significant 3. That obtained on the larger sample 4. There is no relationship between the size of the correlation coefficient and significance	3	P130-140 P139	**Pearson product-moment correlation coefficient** - the notion of the relationship between two continuous variables and how the size of the relationship can be expressed in terms of a correlation between them. This coefficient can also be used as a test statistic. **Correlation** is a measurement of the extent to which a measurement on one variable is related to a measurement on another variable for the same sample of individual cases. One should, however, be careful as to how one interprets a significant result. To clarify this, consider the relationship between the calculated significance (the p-value) and the sample size (n). For a smaller sample n, the test must be much more conservative. You must, therefore, put up a bigger hurdle to be crossed before you conclude that the result is not the consequence of chance. You, therefore, require a larger value of r before you can conclude that the result is not a chance event due to sampling or measurement error, but an actual representation of the state of affairs in the population. The consequence of this is that, for a large sample, a relatively modest correlation can turn out to be significant. For example, for a sample of n = 40 (as in the HIV/AIDS research project in Appendix A), the value of r must be at least r = 0.26 for a = 0.05 (a 5% level). If we increase the sample size to 100, a smaller result of r = 0.16 would be significant at the same level of a = 0.05. This shows that, for a large value of n, a very modest r can be significant. The implication of this is that significance does not indicate that a relationship is large. It merely tells you that some relationship exists (perhaps a modest one), and that it is large enough not to be regarded as purely due to the effect of chance, given the size of the sample.

63	Which of the combinations of the options below can be substituted in the following sentence to describe the situation when a significant negative correlation is found between two variables X and Y? A person who scores ______ on variable X is likely to have a ______ score on variable Y (a) low, low (b) low, high (c) high, low (d) high, high 1. (a) and (d) 2. (b) and (c) 3. (a) and (c) 4. (c) and (d)	2	P133	The question reads: "when a significant **negative** correlation is found" When **positive relationships** occur, this implies that as one variable gets larger, so does the other. When **negative relationships** occur, this implies that as one variable gets larger, the other gets smaller.
64	A researcher wants to establish whether the type of employment category that is filled by employees of a particular company (manager, middle manager, clerical worker, or technical worker) is at all related to their gender (male or female). Which would be the most appropriate test to use? 1. The t-test for two independent samples 2. Pearson's correlation test statistic 3. The t-test for two dependent samples 4. The Chi-square (x^2) test statistic	4	SG P140 Tut202 2014 Q22	The chi-square test is usually used when you have a cross tabulation of frequency counts of events which are nominal scale measurements. This table is referred to as a contingency table. It is used to compare an observed frequency distribution (frequency counts based on a sample of observation) with the frequency distribution which we would expect to find if the null hypothesis of no relationship between two cross-tabulated variables were true. The variables involved are qualitative in nature.
	Base your answers to Questions 65 and 66 on the following scenario- A group of hospitalized patients who have been diagnosed as suffering from schizophrenia are treated with certain drugs over a period of time. These drugs were prescribed to improve their mental alertness. A researcher studies a random sample of 30 these patients who have been on these drugs for varying amounts of time, hoping to establish a relationship between the number of days of drug treatment and patients' scores on a Mental Alertness Test			

<table>
<tr><td>65</td><td>Which is an appropriate null hypothesis for this research?

1. $\rho = 0$
2. $\mu_1 = 0$
3. $r = 0$
4. $\mu_1 = \mu_2$</td><td>1</td><td>P161</td><td>ρ = Correlation between two measurements for population parameters
r = Correlation between two measurements for sample statistics
μ = population mean

This is correlation/relationship between patients at various stages/days of drug treatment and patient's scores on a mental alertness test. In this case, we cannot select r=0 because the hypothesis is tested on population parameters.

<table>
<tr><th rowspan="2">Summary value</th><th colspan="2">Symbol</th></tr>
<tr><th>Populations (Parameter)</th><th>Samples (Statistic)</th></tr>
<tr><td>Arithmetic mean</td><td>μ</td><td>$\bar{x}$</td></tr>
<tr><td>Standard deviation</td><td>σ</td><td>s</td></tr>
<tr><td>Variance</td><td>σ^2</td><td>s^2 $(s=\sqrt{s^2})$</td></tr>
<tr><td>Standard error of mean
(Also called Standard deviation of the sampling distribution of the mean)</td><td>$\sigma_{\bar{x}}$ $(= \sigma/\sqrt{n})$</td><td>$s_{\bar{x}}$ $(= s/\sqrt{n})$</td></tr>
<tr><td>Mean of sampling distribution of the mean
(Mean of all means. This is equal to the mean under H_0)</td><td>$\mu_{\bar{x}}$</td><td></td></tr>
<tr><td>Z score for means</td><td></td><td>$z_{\bar{x}}$</td></tr>
<tr><td>Correlation between two measurements (Pearson's R)</td><td>ρ</td><td>r</td></tr>
<tr><td>Proportions</td><td>P</td><td>p</td></tr>
</table>
</td></tr>
<tr><td>66</td><td>Which is an appropriate alternative hypothesis for this research?

1. $\rho \neq 0$
2. $\mu_1 \neq \mu_2$
3. $p > 0$
4. $r > 0$</td><td>1</td><td>P161</td><td>The question does not stated better than or more than or any other directional alternative. It is merely comparing for or trying to establish a difference. It is therefore non-directional (≠) and needs a two-tailed test.

Since the hypothesis is tested on population parameters as established in the previous question, option 1 must be correct.</td></tr>
</table>

<table>
<tr>
<td>67</td>
<td>What is the expected frequency in cell AX of the following Contingency table?

<table><tr><td></td><td>X</td><td>Y</td></tr><tr><td>A</td><td>7</td><td>3</td></tr><tr><td>B</td><td>3</td><td>7</td></tr></table>
1. 3
2. 5
3. 7
4. 20</td>
<td>2</td>
<td>P143-144</td>
<td>It is important to note that the relation between the variables is described by the cell and not by the row or column frequencies. These cell frequencies represent the way the information is distributed relative to the two variables. These cell frequencies are often referred to as the observed or empirical cell frequencies.

To find the expected frequency for a particular cell, the row total for that row is multiplied by the column total for that column and this result is then divided by the overall total. These expected frequencies show what the results would have been like if the distribution of frequencies through the cells were homogeneous, in proportion to the respective row and column totals. If the observed frequencies correspond precisely with the expected frequencies, we know that the null hypothesis cannot be rejected. But the observed frequencies will seldom be precisely equal to the expected frequencies - even if H_0 is not rejected - because of sampling error.

It is the differences between these expected and observed frequencies that interest us, that is, we want to know how far the actual (observed) results are removed from the expected situation, if there is no interaction effect.

<table><tr><td></td><td>X</td><td>Y</td><td>Total</td></tr><tr><td>A</td><td>7</td><td>3</td><td>10</td></tr><tr><td>B</td><td>3</td><td>7</td><td>10</td></tr><tr><td>Total</td><td>10</td><td>10</td><td>20</td></tr></table>
Row total ($O_{.1}$) = 10
Column total ($O_{1.}$) = 10
Sample total (size) ($O_{..}$) = 20

E_{11} = (Row total x Column total) / Sample total
$E_{11} = (O_{.1} \times O_{1.}) / O_{..} = (10 \times 10) / 20 = 100 / 20 = 5$</td>
</tr>
</table>

68	If there is no relationship at all between two variables, what would be the most likely value of Pearson's correlation coefficient r, out of the following? 1. -1.0 2. 0.5 3. 0.0 4. 1.0	3	P132-133	Correlation coefficients that measure the linear relationship between two variables, such as the Pearson product-moment correlation coefficient, can have a continuous value that ranges from -1 to 1 (a positive value is usually written without the sign, so '1' is presumed to mean '+1'). We use 'r' as the symbol that represents a correlation coefficient (as in the case of the Pearson product-moment correlation coefficient), and the following applies: • r = 1 implies a perfect positive linear relationship (the dots in a scatter plot will run from lower left to upper right in a perfectly straight line) • **r = 0 implies no linear relationship at all** (the dots may be scattered all over the place) • r = -1 implies a perfect negative linear relationship (the dots will run from upper left to lower right in a straight line) When positive relationships occur, this implies that as one variable gets larger, so does the other. When negative relationships occur, this implies that as one variable gets larger, the other gets smaller. The relationship is called **linear** because Pearson's correlation coefficient measures the extent to which the relationship approximates a straight line.
69	A contingency table represents _______ 1. the distribution of the frequencies for a variable 2. the data used to plot the relationship between two variables 3. frequency counts for each of a number of possible outcomes of an experiment 4. the frequency counts when two nominal-scale variables are cross-classified	4	App B P142-144 Tut202 2014 Q20	**Contingency tables are used to represent frequency counts of data that have been classified in terms of 2 *nominal* variables** (for example, gender and occupational category). It is possible to fit ordinal, interval or ratio scale measurements into such a table, but they would first have to be transformed into a classification system; that is, the data have to be treated as if they represent nominal scale measurements. A contingency table is a two dimensional table used to represent the cross classification, or cross tabulation, of the responses relating to two nominal or categorical variables. It is basically a way to display and record the relationship between the two variables. The frequency counts of one variable are presented in the rows of the table and the frequency counts of the other variable in the columns, as shown in table 6.4 on page 142 and table 6.5 on p. 144 of the PYC3704 Guide

<table>
<tr>
<td>70</td>
<td>Which of the values given below is the closest to the probable value of the Pearson's product moment correlation coefficient for the variables X and Y?

<table>
<tr><td>Variable X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Variable Y</td><td>16</td><td>14</td><td>12</td><td>10</td><td>8</td><td>6</td><td>4</td><td>2</td></tr>
</table>

1. -1.0
2. 0.5
3. 0
4. 1.0</td>
<td>1</td>
<td>P132-133</td>
<td>Correlation coefficients that measure the linear relationship between two variables, such as the Pearson product-moment correlation coefficient, can have a continuous value that ranges from -1 to 1 (a positive value is usually written without the sign, so '1' is presumed to mean '+1'). We use 'r' as the symbol that represents a correlation coefficient (as in the case of the Pearson product-moment correlation coefficient), and the following applies:
• r = 1 implies a perfect positive linear relationship (the dots in a scatter plot will run from lower left to upper right in a perfectly straight line)
• r = 0 implies no linear relationship at all (the dots may be scattered all over the place)
• r = -1 implies a perfect negative linear relationship (the dots will run from upper left to lower right in a straight line)

When positive relationships occur, this implies that as one variable gets larger, so does the other <u>or</u> as one variable gets smaller, so does the other. Variable Y does the same as Variable X.

When negative relationships occur, this implies that as one variable gets larger, the other gets smaller <u>or</u> as one variable gets smaller, the other gets larger. Variable Y does the opposite to Variable X.

The relationship is called linear because Pearson’s correlation coefficient measures the extent to which the relationship approximates a straight line.</td>
</tr>
</table>

May/June 2013

#	Question	Ans	Page	Comments
1	The end goal of Psychological research is usually to _______ human behaviour 1. collect data on 2. diagnose psychological problems in 3. develop hypotheses about 4. test theories of	4	SG P3-4 Tut201 2012 Q7	Psychological research is mainly concerned with testing theories of human behaviour.
2	A researcher believes that there is a difference in the reasoning strategies used to solve puzzles between students who study physical sciences such as physics and chemistry and students who study social sciences such as psychology or sociology. She sets up a series of puzzles to be solved by students from different colleges or faculties at a university. This kind of research is referred to as ________ research 1. statistical 2. theoretical 3. empirical 4. inferential	4	P2 P10-11	An inference is a conclusion that follows from existing information, by generalising from the specific information to the general type of phenomenon, where the conclusion is not absolutely certain. So in summary inferential statistics are techniques for making generalisations based on imperfect numeric data, where the conclusions have a high probability of being true, but you can never be completely certain. A distinction exists between inferential statistics and descriptive statistics. **Descriptive statistics** refers to a set of quantities used to summarise aspects of numerical data. Examples that you may be familiar with are means, range, variance and standard deviation (see Appendix C for a quick introduction). These summary quantities are sometimes referred to as parameters (when they refer to the whole collection or population of data; see section 1.4.3 below). **Inferential statistics** refers to the use of statistical techniques to make generalisations about the relationships among (two or more) variables. Here the patterns that may exist in the data are carefully investigated. You are INFERRING from your sample back to your population of all students. If they had said experimental that would also have been correct. We don't really used the word EMPIRICAL to refer to a TYPE of research, its used to describe the nature of the research, ie that your research should be testable

#	Question	Ans	Page	Comments
3	Which of the following definitions best describe the meaning of ‘measurement’ in the context of psychological research? Measurement means to ________ 1. find a way to observe a specific construct or phenomenon which is hidden 2. determine the extent to which a specific phenomenon is present on a numeric scale 3. specify the relationship that is believed to exist between two (or more) constructs or phenomena 4. calculate a summary value which describes an aspect of a specific construct or phenomenon	1	P6 P7	The taking of a measurement is regarded as an act of observation A construct that has been measured in some way produces a variable. A variable refers to a number that can take on any one of a range of possible values. They can be discrete (when only whole numbers like 1, 2, 3 are allowed) or continuous (what mathematicians refer to as 'real numbers'). In some cases variables also take on values smaller than zero to produce negative numbers. So the (visible) variable reflects the intensity of the underlying (invisible) construct, in terms of how it was measured. We say that the variable is manifest (it is visible in the sense that we can observe it) and the construct is latent (it is invisible in the sense that we need some way to make it appear). So the latent construct is made manifest by the use of an appropriate measurement procedure.
4	A variable is described as ‘manifest’ because it is a[n] (a) ______ measurement of a construct which is (b) ______ 1. (a) latent (b) observable 2. (a) dependent (b) independent 3. (a) independent (b) dependent 4. (a) observable (b) latent	4	P7 P23	So the (visible) variable reflects the intensity of the underlying (invisible) construct, in terms of how it was measured. We say that the variable is manifest (it is visible in the sense that we can observe it) and the construct is **latent (it is invisible in the sense that we need some way to make it appear).** So the latent construct is made manifest by the use of an appropriate measurement procedure. To say that a construct is 'latent' is another way of saying it is hidden from direct observation
5	When a specific psychological construct or phenomenon is measured on a quantitative scale, the resulting value is referred to as a ______ 1. parameter 2. descriptive statistic 3. variable 4. test statistic	3	P6 P7	The taking of a measurement is regarded as an act of observation **A construct that has been measured in some way produces a variable**. A variable refers to a number that can take on any one of a range of possible values. They can be discrete (when only whole numbers like 1, 2, 3 are allowed) or continuous (what mathematicians refer to as 'real numbers'). In some cases variables also take on values smaller than zero to produce negative numbers. So the (visible) variable reflects the intensity of the underlying (invisible) construct, in terms of how it was measured. We say that the variable is manifest (it is visible in the sense that we can observe it) and the construct is latent (it is invisible in the sense that we need some way to make it appear). So the latent construct is made manifest by the use of an appropriate measurement procedure.

#	Question	Ans	Page	Comments
6	Operational definitions of a concept are definitions which define a concept in terms of _______ 1. other concepts 2. observable instances 3. latent variables 4. underlying constructs	2	P24-26	Operational definitions of psychological constructs should define constructs in terms of observable behaviour. "Operational" refers to practical procedures by which constructs are made visible. "Operationalisation" is where you make the construct (which is usually an abstract concept, so it is difficult to observe it clearly) visible by finding some suitable way to measure it.
7	Which of the following is appropriate as a research or operational hypothesis? (a) Gender plays a role in determining employees' salaries in Winston & Johnson Inc. (b) Male employees earn more than female employees in Winston & Johnson Inc (c) Male employees at Winston & Johnson Inc earn higher annual salaries than female employees at the same company, at corresponding post levels 1. (a), (b) and (c) 2. (b) and (c) but not (a) 3. (c) only, but not (a) and (b) 4. (a) only, but not (b) and (c)	3	P9	a) $H_0: \mu_M = \mu_F$ $H_1: \mu_M \neq \mu_F$ Too many independent factors like job level or seniority etc b) $H_0: \mu_M = \mu_F$ $H_1: \mu_M > \mu_F$ Too many independent factors like job level or seniority, amount of male vs female etc c) $H_0: \mu_M = \mu_F$ $H_1: \mu_M > \mu_F$ Compared at corresponding levels

#	Question	Ans	Page	Comments
8	Quantities that summarise aspects of a population are called (a) _______, while (b) _______ do the same for samples 1. (a) statistics (b) parameters 2. (a) parameters (b) statistics 3. (a) constructs (b) variables 4. (a) variables (b) parameters	2	P11 P161	These summary quantities are sometimes referred to as **parameters** (when they refer to the whole collection or population of data You should take careful note of the following important distinctions between samples and populations. Summary values for populations are called 'parameters' and are usually denoted by Greek letters, while summary values for samples are called 'statistics' and are denoted by Roman letters.

Summary value	Symbol	
	Populations (Parameter)	**Samples (Statistic)**
Arithmetic mean	μ	$\bar{x}$
Standard deviation	σ	s
Variance	σ^2	s^2 ($s=\sqrt{s^2}$)
Standard error of mean (Also called Standard deviation of the sampling distribution of the mean)	$\sigma_{\bar{x}}$ (= $\sigma/\sqrt{n}$)	$s_{\bar{x}}$ (= $s/\sqrt{n}$)
Mean of sampling distribution of the mean (Mean of all means. This is equal to the mean under H_0)	$\mu_{\bar{x}}$	
Z score for means		$z_{\bar{x}}$
Correlation between two measurements (Pearson's R)	ρ	r
Proportions	P	p

#	Question	Ans	Page	Comments
9	Values which are calculated to test hypotheses about relationships among variables are referred to as (a) ______ statistics, while values which summarise aspects of data such as the mean and standard deviation are referred to as (a) ______ statistics 1. (a) inferential (b) descriptive 2. (a) descriptive (b) correlational 3. (a) descriptive (b) inferential 4. (a) theoretical (d) empirical	1	P2 P10-11	An inference is a conclusion that follows from existing information, by generalising from the specific information to the general type of phenomenon, where the conclusion is not absolutely certain. So in summary inferential statistics are techniques for making generalisations based on imperfect numeric data, where the conclusions have a high probability of being true, but you can never be completely certain. A distinction exists between inferential statistics and descriptive statistics. **Descriptive statistics** refers to a set of quantities used to summarise aspects of numerical data. Examples that you may be familiar with are means, range, variance and standard deviation (see Appendix C for a quick introduction). These summary quantities are sometimes referred to as parameters (when they refer to the whole collection or population of data; see section 1.4.3 below). **Inferential statistics** refers to the use of statistical techniques to make generalisations about the relationships among (two or more) variables. Here the patterns that may exist in the data are carefully investigated.
10	A researcher believes that people who make eye contact with others when they speak to them are generally perceived to be more trustworthy than those who do not. She sets up an experiment where a group of 100 research participants are each interviewed by a research assistant. In half of the cases the interviewer makes a lot of eye contact with the participants during the interview and in half of the cases no or very little eye contact is made. Afterwards participants are asked to rate the research assistant for level of trustworthiness. In this scenario, whether eye contact was made or not is the (a) _______ variable, while perceived level of trustworthiness is the (b) _______ variable 1. (a) independent (b) dependent 2. (a) hidden (b) latent 3. (a) dependent (b) independent 4. (a) latent (b) manifest	1	P8-9 P24	The dependent variable is the one that is predicted or explained, and the independent variable is manipulated to see how it affects the dependent variable. The independent variable is that variable which affects the dependent variable; or, conversely, the dependent variable depends on the independent variable. When a researcher focuses on the interaction of only two variables at a time, the dependent variable is usually the one that the researcher is interested in, the variable that is the focus of the research. The independent variable is something that the researcher manipulates, to see how this affects the dependent variable (in other words, the dependent variable is dependent on the independent variable).

#	Question	Ans	Page	Comments
11	A researcher conducts an experiment with two groups of university students. The students in the first group are all given 125 ml of alcohol to drink, while the students in the second group are required to drink 350 ml of alcohol each. She then tests their motor coordination in a series of tests and finds that the subjects in the second group are significantly slower in these tests than the subjects in the first group. Which of the following is the most appropriate formulation of the researcher's research hypothesis? 1. A study of the speed of motor coordination among students who use alcohol 2. Comparing two groups of students on alcohol consumption and motor performance 3. The level of alcohol consumption among the students has an effect on their motor performance 4. Some students can consume more alcohol than others before their motor coordination is affected	3		Group 1 - 125ml alcohol Group 2 - 350ml alcohol She finds that the subjects in the second group are significantly slower in these tests than the subjects in the first group. Therefore: The level of alcohol consumption among the students has an effect on their motor performance
12	Which of the descriptions given below is the most accurate description of the meaning of the word 'theory' in scientific research? It refers to a ______ 1. synonym for hypothesis 2. reasonable guess about a relationship that may exist among two or more variables 3. best explanation of why a specific relationship that is observed among variables is as it is observed to be 4. careful description of the facts that have been observed in a specific situation	4	P4 P15 P18-19 P21-26 P15-16	A theory is a well-established principle that has been developed to explain some aspect of the natural world. A theory arises from repeated observation and testing and incorporates facts, laws, predictions, and tested hypotheses that are widely accepted. In science, a theory is a framework for facts. It is some kind of description that tells you how the facts are connected, and why the facts are as they are (where the word 'facts' refers to things or events that were **observed and described in a careful way**). A theory is a network of relations among facts that were **proposed** to be true and explanations for observed phenomena in terms of constructs. Option 3 refers more to an hypothesis. • An hypothesis can be informally described as an educated guess. As we indicated above, research usually tries to establish relationships among constructs in order to develop a theory or to test an existing theory. • This is the research hypothesis (although there could be more than one), which expresses the problem in terms of very specific **relationships among constructs** that we expect to find (if our guess is true). It is important that this possible relationship should be clear and unambiguous. An hypothesis that is stated clearly and specifies exactly what is to be observed and what should be true if it is valid, is often called an operational hypothesis.

#	Question	Ans	Page	Comments
13	A famous hypnotist performs at Meanie Hall before a crowd of 350 students and 180 non-students. The hypnotist knows from previous experience that one half of the students and two-thirds of the non-students are hypnotizable. What is the probability that a randomly chosen person from the audience will be hypnotizable? 1. 0.557 2. 0.340 3. 0.869 4. 0.670	1		So for probability questions the formula is P(event) = f/p (this is for a SINGLE event) Here the favourable outcome is being hypnotizable: The total possible outcome is all the audience members as they all have a chance of being selected (p= 350 + 180 = 530) So the only tricky part is the favourable outcomes: 1/2 of 350 + 1/3 of 180 = 175 + 120 = 295 So you can now go back to your formula: P(hypnotizable) = 295/530 = 0.5566 Rounded off is P= 0.557
14	The expression '$0.05 \leq p < 0.10$" denotes a probability value _______ 1. smaller than or equal to 0.05 and smaller than 0.10 2. larger than or equal to 0.10 or smaller than or equal to 0.05 3. larger than or equal to 0.05 and smaller than 0.10 4. of exactly 0.05	3	P33-34	Larger than or equal to 0.05 and smaller than 0.1 Because probabilities fall in a range from 0.0 to 1.0 when expressed decimally, a probability can never be higher than 1 or lower than 0. The general rule is written symbolically as follows: $0 \leq p \leq 1$. Note that a probability can be 0, but to say that a probability is 0 is actually the same as saying that the event is impossible and can never happen. Likewise, to say that the probability of an event is 1 is to assert that it is an absolute certainty. In actual practice, probabilities fall within these two extremes. You will typically encounter reference to probabilities in expressions such as "$p > 0.05$". This statement is interpreted as "the probability value is higher than 0.05".
15	The probability of correctly guessing a two-digit number is 1. 0.100 2. 0.010 3. 0.200 4. 0.500	2	P35-36	Two digit numbers can be from 01....99 Thus 99 possible outcomes A single correct guess = 1 favourable outcome $\text{Prob(guessing)} = \frac{\text{no of favourable outcomes}}{\text{Total no of possible outcomes}}$ = 1 / 99 = 0.010

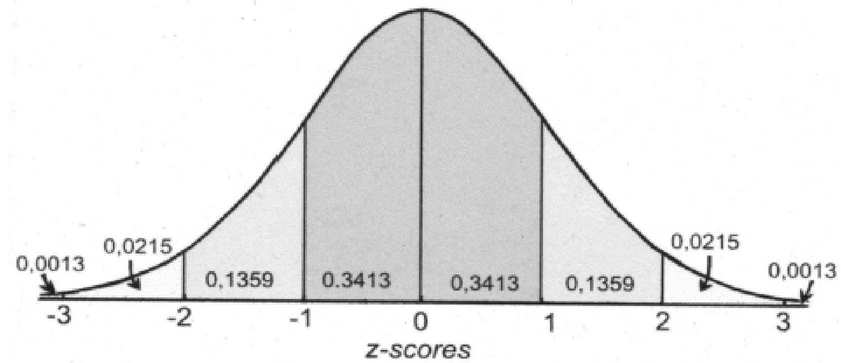
#	Question	Ans	Page	Comments
16	Suppose that over the years 2 000 students wrote the examinations in PYC 304-C and that 1200 of them passed, of which 600 obtained exactly 50%. This means that for randomly selected students the probability of obtaining exactly 50% is ______ while the probability of obtaining 50% or more is ______ 1. 0.60; 0.30 2. 0.05; 0.60 3. 0.30; 0.60 4. 0.60; 0.50	3	P35-36	**Part 1:** $p(E) = \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}} = \frac{600}{2000} = \frac{3}{10} = 0.30$ **Part 2:** $p(E) = \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}} = \frac{1200}{2000} = \frac{6}{10} = 0.6$
17	The probability value "p is larger than or equal to 0.2" is ______ the probability value "p is smaller than or equal to 10%" 1. larger than 2. larger than or equal to 3. smaller than or equal to 4. exactly the same as	1	P33-34	p is larger than or equal to 0.2 ($p \geq 0.2$) p is smaller than or equal to 10% ($p \leq 10\%$ or $p \leq 0.1$) So the probability value "p is larger than or equal to 0.2" is **larger than** the probability value "p is smaller than or equal to 10%"

The following scenario applies to Questions 18 and 19 below.

In a business management test the following sample scores were recorded:

Individual	A	B	C	D	E	F	G	H	I	J
Test score	12	12	7	10	9	12	13	8	9	8

#	Question	Ans	Page	Comments
18	The mean of the test scores is? 1. 12.00 2. 10.00 3. 9.00 4. 8.00	2	P59-60	Formula is : $$\mu = \frac{\sum x_i}{N}$$ So: μ = ∑x_i / N = (12+12+7+10+9+12+13+8+9+8) / 10 = 100 / 10 = 10
19	The standard deviation of the distribution of sample scores is 2.11 Therefore the z-score for individual E is 1. 0.47 2. 1.42 3. -0.47 4. -1.42	3	P53	Formula is $$Z = \frac{x - \mu}{\sigma}$$: Where: X = 9 (test score for Student E) μ = 10 (calculated in previous question) σ = 2.11 (standard deviation) So: Z = (x - μ) / σ = (9 - 10) / 2.11 = -1 / 2.11 = -0.474
20	The proportion of scores less than z=0.00 is 1. 0.00 2. 0.50 3. 1.00 4. -0.50	2	App D	P(Z < z) = 0.5000 See standard normal distribution table in Appendix D for Smaller Portion of z=0.00 If z=0.00, then half half the scores will be less and half will be more than the mean.

#	Question	Ans	Page	Comments
21	In a normal distribution, approximately _______ of the scores fall within 1 standard deviation of the mean 1. 14% 2. 95% 3. 68% 4. 83%	3	P53	The normal curve (also known as the bell curve) is the most common distribution of data. The normal curve is completely determined by two parameters: mean (μ = 0) and standard deviation (σ = 1). The normal curve is symmetric about the mean which is also the median and the mode. Most data is clumped in close to the mean. **Theorem 1 The 68-95-99.7 Rule**: In every normal distribution with mean μ and standard deviation σ, approximately 68% of the data falls within one standard deviation of the mean. Approximately 95% of the data falls within two standard deviations of the mean. And finally, approximately 99.7% (almost everything) of the data falls within three standard deviations of the mean.  FIGURE 2.7: The standard normal distribution According to the standard normal distribution tabel (z-tabel), if z=1 then the mean to z = 0.3413. Multiply by 2 to get both sides of the mean = 0.6826 or 68.26% So: 68.27% of the values lie within one standard deviation of the mean. (0.3413 + 0.3413 = 0.6826 = 68.26% - numbers were rounded) 95.45% of the values lie within two standard deviations of the mean. (0.1359 + 0.3413 + 0.3413 + 0.1359 = 0.9544 = 95.44%) 99.73% of the values lie within three standard deviations of the mean. (0.0215 + 0.1359 + 0.3413 + 0.3413 + 0.1359 + 0.0215 = 0.9974 = 99.74%) 0.0013 (0.13%) are outside 3 standard deviations

#	Question	Ans	Page	Comments
22	The sampling distribution of a test statistic _______ (a) gives all the values a test statistic can take (b) gives the probability of getting each value of a test statistic under the assumption the results are due to chance alone (c) is a probability distribution 1. (a) and none of the other options 2. (b) and none of the other options 3. (b) and (c) but not (a) 4. (a) (b) and (c)	4	P57-60	The sampling distribution of a statistic gives all the values that the statistic can take, (a) and the probability of each value occurring by chance alone. (b) The sampling distribution tells us what values we might expect to obtain for a particular statistic if some predefined conditions are true (e.g., the conditions stated by the null hypothesis). The sampling distribution assumes that the null hypothesis is true. When we compare an obtained test statistic to the sampling distribution, we're asking how likely it is that we would get that statistic if we were sampling from a population that has the null hypothesis characteristics (e.g., P = 0.50). The sampling distribution of a sample statistic of size n is defined as follows: The experiment consists of choosing a sample of size n from the population and measuring the statistic S. The sampling distribution is the resulting probability distribution. The sampling distribution of a statistic is the s**et of all possible values of the statistic** when all possible samples of a fixed size are taken from the population. The sampling distribution refers to the variation of a statistic, for example, the sample mean ($\bar{x}$), from sample to sample. Note that here we are not concerned with the variation of individual elements in the sample, or individual elements in the population, but with the variation of a summary value (such as the mean) for a sample. The sampling distribution refers to variation over a hypothetical set of all possible samples. This may be a rather difficult concept to grasp. It is easy to visualise the variation of individual elements in a sample because the values are there for you to see. It is also easy to think of the variation of individual elements in a population because you can picture the set of individual units. But it is much more difficult to imagine the set of all possible samples because (1) we typically deal with one or two samples so that the idea of a sampling distribution is not really intuitive, and (2) the set of all possible samples is typically extremely large (conceptually infinitely many samples).

#	Question	Ans	Page	Comments
23	Data analysis involving statistical inference basically involves _______ (a) first determining the standard deviation of the scores (b) calculating the appropriate test statistic (c) evaluating the test statistic based on the sampling distribution 1. (a) but not (b) or (c) 2. (a) and then (c) 3. (b) but not (a) or (c) 4. (b) and (c) but not necessarily (a)	4	P55-56	First calculate the z-transformation scores to determine the standard deviation of the scores (z = ???). This is not standard deviation of the population (σ) Then lookup the z-score in the z-table to determine the smaller or larger portion of the distribution The standard deviation of the population (σ) is not required to perform a t-test, therefore we do not necessarily require (a)
24	A normally distributed set of population scores has a mean of 65 and a standard deviation of 10.2. A number of samples, each of size 48 is taken from this population. **The mean of the sampling distribution of the mean** for these samples equals _______ 1. 4.71 2. 65/√48 3. 65 4. 10.2/√48	3	P61	$\mu_{\bar{x}} = \mu = 65$ Just as the normal distribution is defined by its mean and standard deviation, so the distribution of sample means is described by the same two quantities. The central value of the sampling distribution equals the population mean (i.e. **the mean of the distribution of all possible means is the same as the mean of the population from which the samples were drawn, or $\mu_{\bar{x}} = \mu$** while the standard deviation of the sample means is estimated by a value we call the standard error of the mean. Like a standard deviation, the standard error of the mean tells us by what average amount the sample means deviate from the mean of the sampling distribution. It is an estimate of the size of the error we shall make if we use the mean of the distribution of sample means as an estimate of the true population mean, that is, if we use $\mu_{\bar{x}}$ to estimate μ.
25	An alpha level of 0.05 indicates that _______ 1. if H_0 is true, the probability of falsely rejecting it is limited to 0.05 2. 95% of the time, chance is operating. 3. the probability of a Type II error is 0.05 4. the probability of a correct decision is 0.05	1	SG 82-86	An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance represents the greatest risk of doing this that we are willing to take. The alpha level is the level of significance, in this case 0.05 or 5%.

#	Question	Ans	Page	Comments
	Use the following scenario for Questions 26 - 28 A researcher believes that women today weigh less than in previous years. To investigate this belief she randomly samples 41 adult women and records their weights. The scores have a mean of 51 kg and a standard deviation of 5.6. A local census taken several years ago shows the mean weight of adult women was 52.6 kg at that time			
26	Given the data above, what would be the most appropriate statistical approach to establish whether there is a statistically significant difference between the average weight of the women in the sample and the weight of the women recorded in the census? 1. A correlational study focusing on the linear increase in weight 2. A study of the group differences using a single sample t-test 3. A study of the group differences using the t-test for independent groups 4. The z-test	2	P102-106	In this question the population standard deviation (σ) is considered to be unknown because the given standard deviation comes from the sample. So we have to use the t-test ($t_{\bar{x}}$) The important point is that - as in the case of the z-distribution - the t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means when the population standard deviation σ is **unknown**. $t_{\bar{x}} = \frac{(\bar{x} - \mu)}{s_{\bar{x}}}$
27	If the population standard deviation was available instead of the sample standard deviation, which technique would then have been the most appropriate for the statistical analysis of the data? 1. A correlational study focusing on the linear increase in weight 2. A study of the group differences using a single sample t-test 3. A study of the group differences using the t-test for independent groups 4. The single-sample z-test	4	P80 P100-102	When the population standard deviation (σ) is **known** we use the z-test ($z_{\bar{x}}$) In Topic 3 (section 3.2.2), in the process of explaining the logic of statistical testing in general, we introduced you to the $z_{\bar{x}}$ test for single-sample comparisons. This is used when you have only one sample of data of a variable from which a mean could be derived, and you want to compare this mean with a specific constant value. $z_{\bar{x}} = \frac{(\bar{x} - \mu)}{\sigma_{\bar{x}}} = \frac{(\bar{x} - \mu)}{\frac{\sigma}{\sqrt{n}}}$

#	Question	Ans	Page	Comments
28	Suppose the obtained value of the appropriate statistic is -2.07, and subsequently a p-value of 0.025 was found. What can be concluded based on these results if a significance level of $\alpha = 0.01$ (one-tailed) is used? 1. Accept H1 2. Do not accept H0 3. Reject H0 4. Do not reject H0	4		p-value = 0.025 $\alpha = 0.01$ (one-tailed) Since $p > \alpha$ ($0.025 > 0.01$), do not reject H_0
29	The nominal distribution is useful for interpreting psychological measurements because _______ 1. many psychological variables are approximately normally distributed 2. it has a mean of zero and a standard deviation of 1 3. it represents an arbitrarily large population of scores 4. it is symmetrical in shape	1	P51 App B P156	Many psychological and educational variables are distributed approximately normally, so that the normal curve can be used as a theoretical model for interpreting the distribution of these variables. The distributions relating to psychological variables such as measures of reading ability, introversion, job satisfaction and memory can all be plotted on a normal curve, and psychometric tests are often standardised in such a way that they conform to this distribution. Almost all the statistical tests discussed in this module assume normal distributions. Furthermore, many psychological measurements work very well even if the distribution is only approximately normally distributed. Some tests work well even with very wide deviations from normality. Also, apart from its theoretical significance, the normal distribution is useful because it is easy to work with in practice, and because many kinds of statistical tests can be derived for normal distributions.. On a nominal scale, numbers show category membership, but are otherwise arbitrary. They do not represent a size or intensity of something, but are only used as labels to distinguish among qualities or characteristics. They can also be referred to as categorical variables, or qualitative variables. This is because differences in the numbers represent differences in quality, character or type, but not in amount. For example, we could code a variable like 'region' into 1 = North; 2 =West; 3 = South; and 4 = East. But these four categories can be coded in a different sequence if we choose, without any information being lost. Note in the special case where there are only two options, for example, when we code 'Gender' as 1 = male and 2 = female, we refer to it as a dichotomy. The important point about nominal scale measurements is that you cannot do arithmetic with them. Adding them and obtaining an average makes no sense (e.g. adding telephone numbers to obtain an 'average telephone number').

#	Question	Ans	Page	Comments
30	If examination scores are approximately nominally distributed with a mean of 60% and a standard deviation of 8% and Pete's score is 66%, he did better than about _______ of the candidates 1. 27% 2. 23% 3. 77% 4. 13%	3		Calculate the z-score for each class. The subject with the highest z-score is where student X did the best in. Formula is: $Z = \frac{x - \mu}{\sigma}$ Where x = 66% (Pete's score) μ = 60% (Mean of examination) σ =8% (Std dev) Pete's score: Z = (x- μ) / σ = (66%-60%) / 8% = 6% / 8% = 0.75 P(score < 66%) = P(X < 66%) So P(Z < 0.75) = 0. 7734 = 77.34% = 77% (Refer to standard normal distribution table where z=0.75. Since we are looking for < 0.75, refer to the larger portion column). Pete did better than 77% who got less than 66% **Alternatively:** P(score > 66%) = P(X > 66%) So P(Z > 0.75) = 0. 2266 = 22.66% = 23% (Refer to standard normal distribution table where z=0.75. Since we are looking for > 0.75, refer to the smaller portion column). To summarize, 23% did better than 66% so Pete did better than 77% who got less than 66%.

#	Question	Ans	Page	Comments
31	After findings that a significant difference exists between male and female participants on a test which tests level of creativity, a researcher decides to also calculate an effect size, using Cohen's d. This is used to determine ______ 1. the size of the error that would be made if the null hypothesis is rejected 2. the ability of a statistical test to detect a significant relationship between variables 3. the level of confidence one can have that the test is valid 4. whether a significant effect is meaningful from a practical point of view	4	P86-87	**Due to errors of measurements especially in the standard error, a statistical hypothesis test may indicate a significant relationship yet such a relationship is questionable in real life.** For example, a study on reckless driving may indicate that taxi drivers in Johannesburg to be the most careful drivers in South Africa, yet, such a result is questionable in really life. Now to determine, if indeed this is significant or is not due to error of measurements we do the effect size test using **Cohen's *d* test.** $Effect\ \ size = d = \frac{mean\ difference}{s\tan dard\ deviation}$ A result of d > 1 would imply a difference of greater than one standard deviation between the means, which is quite large. The rule of the thumb we can interpret the effect size as follows: Around 0.2 "small" Around 0.5 "medium" Around 0.8 "large effect size"
32	Transforming variables to z-scores is useful because it ______ 1. is used to calculate the test statistic 2. enables one to compare variables with different means and standard deviations from scores with different original units 3. can be used to test whether a score is normally distributed 4. is easy to calculate the mean and standard deviation of most scores	2	P55	Transforming a set of measurements, each with a different mean and a different standard deviation, into a z-score can be used to compare an individual across different distributions. After transformation, all the scores will fall on a common standard normal distribution with a mean of 0 and a standard deviation of 1, which makes it possible to compare them directly.

#	Question	Ans	Page	Comments
33	A probability of an event occurring which depends on something else occurring, such as passing a test when you do not understand your course, can be described as _______ 1. conditional probability 2. an independent event 3. mutually exclusive events 4. a multiplicative probability	1	P36-37	In the formulation of the multiplicative rule given above we assume that the probabilities of the two events, A and B, are independent of one another. However, in some cases a particular probability is conditional on something else happening. For example, the probability of event A occurring may be conditional on the prior occurrence of event B. **Conditional probabilities** are written as p(B|A), where | indicates that a condition applies. p(B|A) is read as 'the probability of B given A.' Likewise p(A|B) is read as 'the probability of A given B', or equivalently, as 'the probability of A happening on condition that B has occurred'. The multiplicative rule that we use when we have conditional probabilities is p(A and B) = p(A) x p(B|A) (Formula 1) Suppose we let A denote 'Marie wins the race' and B|A stand for 'Marie gets a trophy given that she won the race'. We further assign a probability of 0.5 to A and a probability of 0.6 to B|A. Therefore, the probability that Marie will win the race and get a trophy is p(A and B) = (0.5) x (0.6) = 0.3. Note that from the formula for conditional probability, using simple algebra, we can derive formula 2 below. p(B|A) = p(A and B) / p(A) (Formula 2) Let us assume that we know that the chance of Marie winning the race and also a trophy is 0.3. We also know that the probability of winning the race is 0.6. What is the conditional probability of her winning a trophy provided she had won the race? We use formula 2, insert the given probabilities and, therefore, have p(B|A) = 0.3 / 0.5 = 0.6

#	Question	Ans	Page	Comments
34	The sampling error of the mean will be smaller in cases where _______ 1. the sample is larger and the standard deviation of the population smaller 2. the population is larger and the variability of the scores in the sample is smaller 3. the sample mean is smaller 4. a medium-size rather than a large sample is used	1	P61-62	We can estimate the size of the error we would make if we used the sample mean as an estimate of the population mean. This is referred to as the **standard error**, and it is specified in the central limit theorem. **The standard error is denoted by $\sigma_{\dot{x}}$.** The σ indicates that we are describing a population, and the subscript ẋ informs us that we are dealing with a population of sample means. The standard error is given by dividing the population standard deviation by the square root of the sample size $\sigma_{\dot{x}} = \sigma / \sqrt{n}$ Like a standard deviation, the standard error of the mean tells us by what average amount the sample means deviate from the mean of the sampling distribution. **It is an estimate of the size of the error we shall make if we use the mean of the distribution of sample means as an estimate of the true population mean, that is, if we use $\mu_{\dot{x}}$ to estimate μ.** The sampling error is given by $\sigma_{\dot{x}} = \sigma / \sqrt{n}$. So for it to be smaller, the sample (n) must be larger and the standard (σ) deviation must be smaller. For instance: Assume σ = 5 and n=36: $\sigma_{\dot{x}} = \sigma / \sqrt{n} = 5 / \sqrt{36} = 5/6 = 0.833$ Now we increase n (n = 49) : $\sigma_{\dot{x}} = \sigma / \sqrt{n} = 5 / \sqrt{49} = 5/7 = 0.714$ By increasing the sample size (from 36 to 49), the standard error ($\sigma_{\dot{x}}$) has reduced
	Base your answers to Questions 35 to 37 on the following scenario. Suppose that the memory span of adults is normally distributed with a mean of 7 items and a standard deviation of 2 items. A researcher predicts that 'dyslexic adults have a shorter memory span than adults in general'			

#	Question	Ans	Page	Comments

35	Which of the following is an appropriate null hypothesis for testing the above prediction?
	
	1. The mean memory span of the population of dyslexic adults is smaller than 7
	2. The mean memory span of the population of **dyslexic adults** equals 7
	3. The mean memory span of the population of adults equals 7
	4. The mean memory span of the population of adults does not equal 7
		2	P73-75	The null hypothesis **will always contain equal signs**. In this case $H_0 : \mu = 7$. Since the hypothesis should verify dyslexic people's memory span, option 2 is correct
				
				H_0 is defined as the hypothesis of no effect.
				
				• The null hypothesis (H_0) represents the status quo or the current belief in a situation. The null hypothesis **will always contain equal signs**.
				• The alternative hypothesis (H_1) is the opposite of the null hypothesis and represents a research claim or specific inference you would like to prove. This means that the alternative hypothesis takes the sign of the test depending on the situation.
				    ○ If we are testing the ***difference***, H_1 is indicated with ≠.
				    ○ Otherwise we can use signs like less than (<) or greater than (>) depending on the problem statement.
				• If you reject H_0, you have statistical proof that the alternative is correct.
				• If you do not reject H_0, you have failed to prove that the alternative hypothesis is correct. Failure to prove the alternative hypothesis does not necessarily mean that the null hypothesis is true.
				• The null hypothesis (H_0) always refers to a specific value of a parameter (such as μ, not a statistic (such as $\bar{x}$). This value is *always* known or will come from the given scenario.

36	Which of the following is an appropriate alternative hypothesis for testing the above prediction? 1. The mean memory span of the population of dyslexic adults is smaller than 7 2. The mean memory span of the population of adults is not equal to 7 3. The mean memory span of the population of dyslexic adults equals 7 4. The mean memory span of the population of adults does not equal 7	1	P73-75	The alternative will take the direction of the question. Hence, “The mean memory span of the population of dyslexic adults is smaller than 7”. In this case $H_1 : \mu < 7$

#	Question	Ans	Page	Comments
37	Testing the above prediction will require a ______ statistical test 1. non-directional 2. two-tailed 3. directional 4. (1) and (2) are both correct	3	P75	Directional because $H_1 : \mu < 7$. It is also one-tailed because it only focus on smaller than 7 and not larger than 7 as well. Two-tailed is when $H_1 : \mu \neq 7$. Now the focus will be on smaller than and larger than 7 results
38	When applying a statistical test, the p-value represents the probability of observing the ______ 1. sample statistic under the alternative hypothesis 2. population parameter under the null hypothesis 3. sample statistic under the null hypothesis 4. population parameter under the alternative hypothesis	3	Tut201 2014 Q10 P78-82	The observed results are the values which you find in your sample(s) of data, for example the sample mean and sample standard deviation, or (if it is relevant), the correlation coefficient which you calculated. The p-value shows you the probability of seeing some relationship among these variables based on your calculations (such as a difference between means or a high correlation), if in fact this observed relationship is merely the consequence of chance (in other words, *if the null hypothesis was true*). You are in fact comparing the observed relationships in the data with what you would expect if the null hypothesis is true by calculating a relevant test statistic. The p-value is the probability that the NULL hypothesis is true. You test the H_0 using SAMPLE data This test statistic can then be used to find the p-value if we know the probability distribution of the test statistic. If this probability is small, it implies the null hypothesis is probably *not* true. Here is a summary of the important points regarding the p-value: • The p-value gives the probability of **obtaining the sample result under H_0**. • If the p-value is very small, the probability is very small that the sample result would occur under H_0, and one should consider rejecting H_0 in favour of H_1. • The smaller the p-value, the more likely that the null hypothesis is false and should be rejected in favour of the alternative hypothesis.

#	Question	Ans	Page	Comments
39	The hypothesis "H_1 μ < 30" is a ______ hypothesis and requires a ______ statistical test 1. non-directional, one-tailed 2. directional, two-tailed 3. directional, one-tailed 4. non-directional, two-tailed	3	P75	Directional because $H_1 : \mu < 30$. It is also one-tailed because it only focus on smaller than 30 and not larger than 30 as well. Two-tailed is when $H_1 : \mu \neq 30$. Now the focus will be on smaller than and larger than 7 results
40	An alpha level of 0.05 indicates that ______ 1. if H_0 is true, the probability of falsely rejecting it is limited to 0.05 2. 95% of the time chance is operating 3. the probability of a Type II error is 0.05 4. the probability of a correct decision is 0.05	1	P82-83	The decision rule for H_0 is simply as follows: If the probability (p-value) of the sample result is smaller than α (alpha) (i.e. if the p-value < α), the null hypothesis is rejected. If the p-value is not smaller than α (i.e if the p-value ≥ α), the null hypothesis is not rejected. The α-value specifies the maximum risk that we are willing to take of making an error if we reject the null hypothesis
41	If alpha is changed from 0.05 to 0.01, the ______ 1. probability of a Type II error decreases. 2. probability of a Type I error increases 3. error probabilities stay the same but the probability that we will retain a false H_0 increases 4. probability that we will retain a false H_0 increases	4	SG 82-86 P85	When alpha reduces, the probability of Type I (α) error decreases and Type II (β) increases. An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance (α) represents the greatest risk of doing this that we are willing to take. An error of Type II is the opposite of Type I. We fail to reject the null hypothesis when we were supposed to. Generally, though, the smaller α, the larger β. If we wish to avoid Type I errors, we set α to a small value such as 0.01 or even 0.001, but if we want to avoid Type II errors, we could set α to a larger value.

#	Question	Ans	Page	Comments

42	If the alternative hypothesis states that alcohol affects short-term memory, the null hypothesis states that
	
	1. alcohol does not decrease short-term memory
	2. alcohol has no effect on short-term memory
	3. alcohol decreases short-term memory
	4. all of the above
		2	P73-75	The null hypothesis **will always contain equal signs** so in this case "alcohol has no effect on short-term memory"
				
				H_0 is defined as the hypothesis of no effect.
				
				• The null hypothesis (H_0) represents the status quo or the current belief in a situation. The null hypothesis **will always contain equal signs**.
				• The alternative hypothesis (H_1) is the opposite of the null hypothesis and represents a research claim or specific inference you would like to prove. This means that the alternative hypothesis takes the sign of the test depending on the situation.
				    ○ If we are testing the ***difference,*** H_1 is indicated with $\neq$.
				    ○ Otherwise we can use signs like less than ($<$) or greater than ($>$) depending on the problem statement.
				• If you reject H_0, you have statistical proof that the alternative is correct.
				• If you do not reject H_0, you have failed to prove that the alternative hypothesis is correct. Failure to prove the alternative hypothesis does not necessarily mean that the null hypothesis is true.
				• The null hypothesis (H_0) always refers to a specific value of a parameter (such as μ, not a statistic (such as $\bar{x}$). This value is *always* known or will come from the given scenario.

43	When the results are statistically significant, this means that _______ (a) the obtained probability is equal to or less than alpha (b) the independent variable has had a large effect (c) we can reject H_0 1. (a) is correct but neither of the other statements 2. (b) and (c) are correct but not necessarily (a) 3. (a) and (b) are correct but not (c) 4. (a) and (c) are both correct but not necessarily (b)	4	P82-83	This question examines judgement using the p-value (results are statistically significant). We generally would reject the null hypothesis when the p-value is less than the level of significance (α), therefore A and C are correct The dependent variable is the one that is predicted or explained, and the independent variable is manipulated to see how it affects the dependent variable. This has nothing to do with this question.

#	Question	Ans	Page	Comments
44	A researcher draws a single random sample from a population to test his hypothesis about the mean population score on a psychological test. Scores on this test are distributed normally in the general population with a known mean but an unknown standard deviation. Which test statistic should the researcher calculate to test his hypothesis? 1. The t-statistic for the mean of a single sample 2. The z-statistic for the mean of a single sample 3. The standard deviation of the sampling distribution of the mean of a single sample 4. The t-statistic for independent groups	1	P102-106	In this case the population standard deviation is unknown. So we use the t-test ($t_{\bar{x}}$). The important point is that - as in the case of the z-distribution - the t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means when the population standard deviation σ is **unknown**. $t_{\bar{x}} = \frac{(\bar{x} - \mu)}{s_{\bar{x}}}$
	Base your answers to Questions 45 to 48 on the following scenario: A researcher hypothesizes that chess-playing students are better at non-verbal reasoning than students in general. He draws a random sample of 25 students from the members of the chess clubs of South African universities and measures their non-verbal reasoning ability by means of a test developed for this purpose. The scores of a large group of students on this test were found in earlier research to be distributed normally with a mean of 20. Suppose the researcher finds that the mean score of his sample is 22.3 and the standard deviation of the scores is 6.0			
45	Which research design did the researcher use? 1. Single-sample groups design 2. Two-groups design 3. Two-groups design with a known population mean 4. A correlational design	1	P100-106	He drew one random sample which he is comparing to the general population
46	Which are the appropriate statistical hypotheses for testing the researcher's hypothesis? 1. H_0 μ is not equal to 20, H_1 μ is larger than 20 2. H_0 μ equals 20, H_1 μ is Larger than 20 3. H_0 μ equals 20, H_1 μ is not equal to 20 4. H_0 μ equals 20, H_1 μ is smaller than 20	2		$H_0 : \mu = 20$ $H_1 : \mu > 20$. The researcher hypothesised that chess-playing students are better in non-verbal reasoning than students in general therefore $H_1 : \mu$ **>** 20

#	Question	Ans	Page	Comments
47	Which is the appropriate test statistic to calculate? 1. The z-statistic for the mean of a single sample 2. The t-statistic for the difference between the means of two independent samples 3. The t-statistic for the mean of a single sample 4. The Chi Square test statistic	3	P102-106	The t-statistic for the mean of a single sample. This is because the standard deviation is unknown. What is given (s=6) was the scores extracted from a sample of 25. So we have to use the t-test ($t_{\bar{x}}$) The important point is that - as in the case of the z-distribution - the t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means when the population standard deviation σ is **unknown**. $t_{\bar{x}} = \frac{(\bar{x} - \mu)}{s_{\bar{x}}}$
48	Which of the following values most accurately reflects the correct result when calculating the test statistic? 1. 2.3/1.2 2. 2.3/5 3. -2.3/1.2 4. -2.3/5	1	P104-105	Formula: $t_{\bar{x}} = \frac{(\bar{x} - \mu)}{s_{\bar{x}}}$ or $t_{\bar{x}} = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$ where: $\bar{x} = 22.3$ $\mu = 20$ $s = 6$ $n = 25$ so: $t_{\bar{x}}$ = (22.3 - 20) / (6 / sqrt(25)) = 2.3 / (6 / 5) = **2.3/1.2**
49	Two samples can be considered independent when ______ 1. the composition of one sample is not systematically related to the composition of the other one 2. the samples are drawn under different experimental conditions 3. one sample comes from a treatment or experimental group while the other comes from a control group 4. care was taken that the samples are drawn at random	1	P110	**Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample.** The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design.

#	Question	Ans	Page	Comments
	Base your answers to Questions 50 and 51 on the following scenario: A researcher wants to validate a new depression scale where a high score indicates a high incidence of depression. She applies it to a sample of 40 patients diagnosed with depression and a control group of 40 persons who were Judged not to suffer from depression by a panel of clinical psychologists			
50	Which is an appropriate alternative hypothesis to test the validity of the depression scale based on group mean values? 1. µDepression ≠ µControl 2. µDepression >µControl 3. µDepression < µControl 4. The population mean of the difference scores equals zero	2		A researcher wants to validate a new depression scale where a **high** score indicates a high incidence of depression. So the depression must be larger than the control Therefore: µDepression >µControl
51	Which of the following would be the most appropriate statistical test to determine whether a significant difference exist between the scores for the two groups (measuring depression and non-depression scores)? 1. A test for a correlation coefficient 2. The t-test for dependent samples 3. The t-test for independent samples 4. The chi-square (x^2) test	3	P110 SG P140 Tut202 2014 Q22	Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample. The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design. The chi-square test is usually used when you have a cross tabulation of frequency counts of events which are nominal scale measurements. This table is referred to as a contingency table. It is used to compare an observed frequency distribution (frequency counts based on a sample of observation) with the frequency distribution which we would expect to find if the null hypothesis of no relationship between two cross-tabulated variables were true.

#	Question	Ans	Page	Comments
52	A researcher wants to determine whether a significant difference exists in the scores on a test of creativity between a group of students who are studying for a BSc degree and a group of students who are studying for a BA degree. She finds a mean score of ẋ1 = 20.4 for the BSc students and a mean score of ẋ2 = 22.3 for the BA students. A t-test shows that this difference is statistically significant. In spite of the significant difference, the researcher feels that the difference between the two means is too small to be really important. What calculation can she do to confirm this suspicion? 1. Level of significance 2. Variance 3. Degrees of freedom 4. Effect size	4	P87	The effect size is to assess whether a significant effect is meaningful from a practical point of view. The implication is that we have to be careful how we interpret significant results. A p-value of smaller than our chosen level of significance (a) simply implies that, relative to this sample, it is improbable that the effect we see in our observations is purely due to chance. It does not imply that the effect is big or important. This is something that we have to decide by looking at what the data means. One way that statisticians have suggested to deal with this problem is by the notion of effect size. Different procedures exist to determine the effect size of a result. In the case of a comparison between means, one way of calculating this is by the use of Cohen's d. We do this by expressing the mean difference that we observed relative to the standard deviation: $Effect\ size = d = \frac{mean\ difference}{standard\ deviation}$
53	A researcher plans to use the t-test to compare two independent samples of data with 20 individuals each. Consider the following assumptions that may be relevant here a) The sample standard deviations have to be equal b) The data from both samples has to come from populations that are nominally distributed What minimum assumptions from the ones given above needs to be met before she may proceed? 1. At least one of (a) or (b) must be true 2. (a) and (b) must both be true 3. Neither (a) nor (b) is relevant but other assumptions exist that will have to be considered 4. The t-test should never be used with such a small sample	2	P115 P116	In order to use the t-test (t_c) statistic, we need to make two assumptions regarding the data: • that the two populations being compared are normally distributed • with the same variance (or standard deviation). (Remember that the square root of the variance is equal to the standard deviation.) We can also assume that the samples are independent - since the samples were selected randomly, we can safely consider them to be independent of each other. All of this makes the t_c-test an appropriate test. Note: Even the most elementary statistics program makes provision for performing t-tests. Such programs usually require that we indicate which variable should be used to identify the two groups and which is the dependent variable. In addition, we have to choose between **a t_c test for independent samples or a t_d test for dependent or correlated groups**

#	Question	Ans	Page	Comments
54	In which of the following cases should the scores being investigated be regarded as dependent when a test for significance is selected? 1. The variables represent exam scores of children from two schools, matched on demographic criteria like grade and gender 2. The variables represent scores from subjects on a motivational scale, who were tested before and after listening to a presentation by a motivational speaker 3. The scores on a test for mathematical ability and a test for attention span 4. The variables represent frequency counts for gender and favourite colour, cross-classified in a contingency table	2	P117-118	Often the two samples are not 'independent'. This happens when each subject in one sample is matched with regard to some characteristic (usually a nuisance or external variable that we wish to control) to a particular subject in the other sample. **The samples are dependent if each measurement of a variable for a particular case can be paired with the measurement of a matching case in the other sample**. The implication is that the two samples will always have to be of the same size (that is, $n_1 = n_2$). This design is, therefore, often referred to as a matched-pairs design. This implicit matching usually causes the scores to be correlated (see Topic 6 for the meaning of this term). A typical example would be if the same research participants are measured twice, once before and again after an intervention. From the point of view of research design, we would refer to this type of comparison as a two-sample repeated measures design.
	Base your answers to Questions 55 to 57 on the following scenario: A psychologist develops a series of workshops providing assertiveness training to a group of persons who suffer from low self esteem. To test the efficacy of the workshops, she applies a psychometric test which measures level of self esteem to 50 persons at the start and again after the end of the series of workshops, predicting that the latter scores will be higher (reflecting higher self esteem). The self esteem scale was standardised on the general population with a mean score of 30 and a standard deviation of 10.			
55	Which constructs are related to one another by the research hypothesis? 1. Attending a workshop of assertiveness training, self esteem 2. Self esteem before a workshop; self esteem after a workshop 3. Self esteem in the treatment group, self esteem in the general population 4. Level of assertiveness; level of self esteem	2	P117-118	To test the efficacy of the workshops, she applies a psychometric test which measures level of self esteem to 50 persons **at the start and again after the end** of the series of workshops

#	Question	Ans	Page	Comments
56	Which is an appropriate null hypothesis for the analysts of the results? 1. $\mu = 30$ 2. $\mu1 = \mu2$ 3. The population mean of the difference scores equals zero 4. $\mu1 \neq \mu2$	1		If they give you POPULATION values you MUST use them!!! *(The self esteem scale was standardised on the* ***general population*** *with a* ***mean score of 30*** *and a* ***standard deviation of 10****.)* So here you will need to do t_d first (for the pre-test post test design) and then $z_{\bar{x}}$ (for the single sample groups design) to test your hypothesis. If they didn't give you the population mean then option 3 would be correct.
57	Which is the appropriate test statistic to calculate? 1. The z-statistic for the difference between the means of two independent samples 2. The t-statistic for the difference between the means of two dependent samples 3. The t-statistic for the difference between the means of two independent samples 4. A test of the correlation coefficient for the two sets of scores	2		In the previous question both t_d and $z_{\bar{x}}$ tests were performed, but the test is done on dependant samples, therefore option 1 and 3 are incorrect. The appropriate test statistic to calculate is the t-statistic for the difference between the means of two dependent samples Having said that, option 1 was incorrectly phrased. It should have read "The z-test for single sample groups design". In this case option 1 would be the correct answer since this is a single group and the population standard deviation was given. If σ is given, you have to use it for your tests and therefore the $z_{\bar{x}}$ test must be performed
58	A researcher wants the compare the cognitive development of two groups of children using the mean score of each group to test the following hypotheses H_0: $\mu1 = \mu2$ H_1: $\mu1 > \mu2$ Her results derived from a random sample from each group of children shows that the mean sample score on a scale which measures level of cognitive development for the first group is less than the mean sample score for group two (i.e. $\dot{x}1 < \dot{x}2$). What may she conclude? 1. She needs to find the relevant p-value before making any conclusion 2. She can reject H_0 3. She will not be able to reject H_0 4. She needs to calculate a t-test before any conclusion is made	1	P114-116	The t-test is performed before the p-value can be determined. Only if the p-value is smaller than the level of significance (α) should the null hypothesis (H_0) not be accepted. Therefore: She needs to find the relevant p-value before making any conclusion

#	Question	Ans	Page	Comments
59	A researcher wants to test the following hypotheses H_0: $\mu_1 = \mu_2$ H_1: $\mu_1 > \mu_2$ On the basis of data provided, the output from a computer programme indicates that a t-value of t = -2.3 was found, with the p-value for a non-directional test (two-tailed) given as p=0.07. What should the researcher do to evaluate this result? 1. Divide 0.07 with 2 before comparing it with the pre-selected alpha level 2. Multiply 0.07 by 2 before comparing It with the pre-selected alpha level 3. Compare the computed p-value as given with the pre-selected alpha level 4. A calculation error was made since a t-value cannot be less than 0	1	P78-81	The relationship between one-tailed and two-tailed p-values can be summarised as follows: • One-tailed p-value = (two-tailed p-value) / 2 • Two-tailed p-value = (one-tailed p-value) x 2 The important point to remember is that the p-value indicates more or less how likely the particular result we have observed in our data is if the null hypothesis were true; or, as we say, 'under the null hypothesis'. Bacause the p-value is for a non-directional test (two-tailed) given as p=0.07, it must be divided with 2 before comparing it with the pre-selected alpha level
60	Correlation is used in data analysis when one investigates the relation between ______ 1. the mean of a single sample of subjects and a population mean 2. two groups of subjects, with respect to a single variable 3. two variables measured on the same group of subjects 4. two variables from independent samples	3	P129-130	Correlation: measuring the association between variables **Correlation is a measurement of the extent to which a measurement on one variable is related to a measurement on another variable for the same sample of individual cases.** This can be visualised by way of a graphical representation called a scatter plot. A scatter plot is a graph that represents the measurements of two variables on two perpendicular axes, usually called the x-axis (horizontal axis or abscissa) and the y-axis (vertical axis or ordinate).
61	A positive correlation between variables X and Y implies that persons scoring low on X will generally score ______ on Y 1. high 2. low 3. either high or low 4. in a totally unpredictable way	2	P133	If a correlation exists, the way in which one variable varies will be related to variation on the other one. A negative correlation implies that as one variable changes, the other changes *in the opposite direction*. A *high* value on X will imply a *low* value on Y, while a *low* value on X will be matched by a *high* value on Y. **Conversely, if the correlation is positive, the variable values will generally vary in the same direction (both high or both low).**

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<tr><th>#</th><th>Question</th><th>Ans</th><th>Page</th><th>Comments</th></tr>
<tr><td>62</td><td>Which of the values given below is the best estimate of the Pearson correlation coefficient between the following values of X and Y?

<table><tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td></tr><tr><td>Y</td><td>2</td><td>1</td><td>0</td><td>-1</td><td>-2</td></tr></table>
1. -1
2. 0
3. +1
4. 0.5</td><td>1</td><td>P132-133</td><td>As variable X increases (from -2 to 2), variable Y (decreases (from 2 to -2). This implies a negative correlation.

I also changes exactly the same amounts, so we have a perfect negative correlation which is -1

We use 'r' as the symbol that represents a correlation coefficient (as in the case of the Pearson product-moment correlation coefficient), and the following applies:
• r = 1 implies a perfect positive linear relationship (the dots in a scatter plot will run from lower left to upper right in a perfectly straight line)
• r = 0 implies no linear relationship at all (the dots may be scattered all over the place)
• r = -1 implies a perfect negative linear relationship (the dots will run from upper left to lower right in a straight line)</td></tr>
<tr><td>63</td><td>A researcher hypothesizes that the drug treatment of hospitalised schizophrenic patients improves their mental alertness. He studies a random sample of 27 such patients and finds a correlation coefficient of 0.6 between the number of days of drug treatment and patients' scores on the Mental Alertness Test. Which is an appropriate null hypothesis for this research?

1. ρ = 0
2. μ = 0
3. r = 0
4. μ1 = μ2</td><td>1</td><td>SG P137

Tut202 2014 Q13</td><td>The symbol 'ρ' (the Greek letter 'rho') is used to represent the population parameter being tested when you calculate the Pearson's correlation coefficient 'r.' That is, you calculate r for the sample, then have to decide whether this is likely to represent a significant linear correlation between two variables for the whole population (with this population correlation symbolised by ρ), by looking at the p-value associated with this calculated sample statistic r.

In a similar way 'μ' represents the population parameter (statistic) for a mean, and 'σ' the population parameter for a standard deviation. These two are not applicable in this question.</td></tr>
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<tr>
<td>64</td>
<td>The table below gives the number of persons observed to be in each of the categories in a cross classification of gender (male/female) and place of residence (rural/urban). What would the expected value be for persons classified as both 'urban' and 'male', if no relationship exists between gender and place of residence?

<table>
<tr><th></th><th>Male</th><th>Female</th><th>Row Total</th></tr>
<tr><td>Urban</td><td>6</td><td>4</td><td>10</td></tr>
<tr><td>Rural</td><td>6</td><td>8</td><td>14</td></tr>
<tr><td>Column Total</td><td>12</td><td>12</td><td>24</td></tr>
</table>

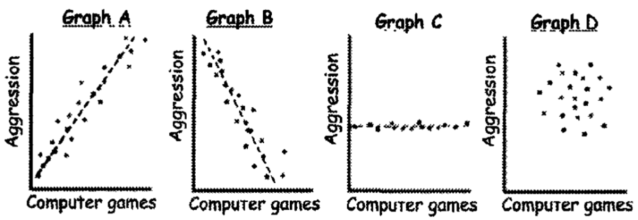
1. 24
2. 6
3. 10
4. 5</td>
<td>4</td>
<td>P143-144</td>
<td>It is important to note that the relation between the variables is described by the cell and not by the row or column frequencies. These cell frequencies represent the way the information is distributed relative to the two variables. These cell frequencies are often referred to as the observed or empirical cell frequencies.

To find the expected frequency for a particular cell, the row total for that row is multiplied by the column total for that column and this result is then divided by the overall total. These expected frequencies show what the results would have been like if the distribution of frequencies through the cells were homogeneous, in proportion to the respective row and column totals. If the observed frequencies correspond precisely with the expected frequencies, we know that the null hypothesis cannot be rejected. But the observed frequencies will seldom be precisely equal to the expected frequencies - even if H_0 is not rejected - because of sampling error.

It is the differences between these expected and observed frequencies that interest us, that is, we want to know how far the actual (observed) results are removed from the expected situation, if there is no interaction effect.
Row total ($O_{.1}$) = 10
Column total ($O_{1.}$) = 12
Sample total (size) ($O_{..}$) = 24

E_{11} = (Row total x Column total) / Sample total
$E_{11} = (O_{.1} \times O_{1.}) / O_{..} = (10 \times 12) / 24 = 120 / 24 = 5$</td>
</tr>
</table>

#	Question	Ans	Page	Comments
65	A researcher wants to **determine whether a relationship exists between** students' general level of anxiety and their exam marks. He presents each student from a random sample with a general anxiety scale just before they are to write an important exam. Which of the following is the most appropriate test statistic to use to determine whether a relationship exists between the two variables (anxiety level and exam results)? 1. t-test for independent samples 2. Pearson's r test statistic 3. t-test for dependent samples 4. Chi-square test (x^2)	2	P130 Tut202 2014 Q22 P132 P136-141 P144	Correlation is a measurement of the extent to which a **measurement on one variable is related to a measurement on another variable** for the same sample of individual cases. This can be visualised by way of a graphical representation called a scatter plot. A scatter plot is a graph that represents the measurements of two variables on two perpendicular axes, usually called the x-axis (horizontal axis or abscissa) and the y-axis (vertical axis or ordinate). Correlation coefficients that measure the linear relationship between two variables, such as the Pearson product-moment correlation coefficient, can have a continuous value that ranges from ±1 to 1 (a positive value is usually written without the sign, so '1' is presumed to mean '+1'). We use 'r' as the symbol that represents a correlation coefficient The Pearson correlation coefficient is really a descriptive statistic: it describes the relationship between two variables. The chi-square test is usually used when you have a cross tabulation of frequency counts of events which are nominal scale measurements. This table is referred to as a contingency table. It is used to compare an observed frequency distribution (frequency counts based on a sample of observation) with the frequency distribution which we would expect to find if the null hypothesis of no relationship between two cross-tabulated variables were true. The Pearson chi-square test statistic is a calculation of the difference between the observed and expected frequencies and is qualitative of nature.
66	Which of the following is the appropriate formula for the Chi square test? 1 $\sum\frac{(O_i-E_i)^2}{E_i}$ 2 $\frac{(\bar{x}-\mu_{\bar{x}})}{s_{\bar{x}}}$ 3 $\frac{cov(x,y)}{\sqrt{var(x)var(y)}}$ 4 $\frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}$	1	P144-145	The Pearson chi-square test statistic, is a calculation of the difference between the observed and expected frequencies. The formula is: $\chi_p^2 = \Sigma_{ij}\frac{(O_{ij}-E_{ij})^2}{E_{ij}}$ This means the expected value for each cell in the contingency table is subtracted from the observed value for that cell, squared, and divided by the expected value for that cell. Then all of these terms are added together to yield χ_p^2

#	Question	Ans	Page	Comments
	Base your answers to Questions 67 and 68 on the following scenario: A psychologist reads an article in which the author claims that playing computer games leads to higher levels of aggression in children. She decides to test this by asking a sample of children to report the number of computer games they play per month and measuring the aggression level of each child with an appropriate psychometric test. She expects to find that a positive correlation will exist in her sample between level of aggression and number of computer games played			
67	The researcher draws a graph of the relationship between aggression and number of computer games. Which of the scatter plots below give the most probable representation of the data if the expected relationship exists?  1. Graph A 2. Graph B 3. Graph C 4. Graph D	1	P130-132 Tut202 2014 Q18	A graph showing the position of each of a number of sampling units on each of two variables A *scatter plot* is a graph showing the relationship between two numerical variables. In such a graph the data of the one variable are plotted on the horizontal axis (usually referred to as the X axis), and the data of the other variable on the vertical (or Y) axis. It is not a comparison of sample and population, nor has it to do with spread of data or the independence of variables The closer the dots in the plot are to a straight line, the closer the correlation coefficient is to 1 (it can be either a positive number (+1) or a negative number (-1)). The more arbitrary or spread out the dots, the closer the correlation coefficient is to 0. If the plot seems to form a line from lower left to upper right, the correlation is positive. On the other hand, if the line runs from upper left to lower right, the correlation is negative. She expects to find that a **positive correlation** will exist in her sample between level of aggression and number of computer games played. Therefore the plot must form a line from lower left to upper right

#	Question	Ans	Page	Comments
68	The researcher calculates the Pearson product moment correlation coefficient of the relationship between level of aggression and number of computer games played. Which of following expressions best represent the relationship if the expectations of the researcher about the relationship are true? 1. $r \neq 0$ 2. $r = 0$ 3. $r < 0$ 4. $r > 0$	4	P130-132	She expects to find that a **positive correlation** will exist in her sample between level of aggression and number of computer games played. This implies that the relationship must be between 0 and 1 (or greater than 0) Therefore: $r > 0$

Base your answers to Questions 69 and 70 on the following scenario:

A sample of 300 clients are drawn from three community mental health centres (indicated in the table as A, B and C). Counts are made of those clients who are diagnosed as having social adjustment problems, those with problems related to anxiety, and the remaining clients are classified under 'other problems '. Counts of the number of clients from the different centres which fall in each of the categories are supplied below.

Mental Health Centre (columns) By Type of Problem (rows)	**A**	**B**	**C**	**Row Totals**
Social adjustment problems	50	40	40	130
Anxiety related	26	34	20	80
Other	24	26	40	90
Column totals	**100**	**100**	**100**	**300**

#	Question	Ans	Page	Comments
69	What is the type of arrangement of data above called? 1. Histogram 2. Contingency table 3. Correlation matrix 4. Classification table	2	SG P142-144	A contingency table is a table indicating the number of individual objects falling in each cell of cross-tabulated data. In other words, it is a two-dimensional table in which each observation is classified in terms of two categories simultaneously.

#	Question	Ans	Page	Comments
70	A researcher want to establish whether the types of diagnoses made differs significantly among the different mental health centres or not. Which of the following would be the most appropriate statistical test to use? 1. The Chi-square (x^2) test 2. A test of the correlation coefficient 3. The t-test for two samples 4. The z-test for two samples	1	P140 P144-145 Tut202 2014 Q22	The chi-square test is usually used when you have a cross tabulation of frequency counts of events which are nominal scale measurements. This table is referred to as a contingency table. It is used to compare an observed frequency distribution (frequency counts based on a sample of observation) with the frequency distribution which we would expect to find if the null hypothesis of no relationship between two cross-tabulated variables were true.

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#	Question	Ans	Page	Comments
1	Research is called empirical research when _______ 1. descriptive statistics are calculated from data 2. use is made of inferential statistics 3. hypotheses are carefully formulated and tested using statistical tests 4. observations or measurements are made of objects or entities being studied	4	P2	All scientific knowledge begins with description of the phenomena being studied, based on careful observation. **Knowledge based on observation of physical events is referred to as empirical knowledge** (as distinct from knowledge based on contemplation, unexplained insights, mystical experiences or claims by authority figures).
2	In science, including social science, the word 'theory' refers to _______ 1. a plausible guess based on one's previous knowledge about a phenomenon 2. an explanation of why a phenomenon appears as it is observed to be 3. an explanation of the procedure by which a construct should be measured 4. the process where independent variables are varied to see how they affect the dependent variables	2	SG P4 Tut201 2013 Q7	A theory is a framework for facts: it is the explanation of why the facts (i.e. observations, measurements, phenomenon) are as they are, or are related in the way in which they are related, based on empirical investigations. Option 1 is a description of a hypothesis, but this is often how the word 'theory' is used in informal conversation.

#	Question	Ans	Page	Comments
3	Inferential statistics refer to ______ 1. calculating statistics which summarises the data 2. using probability theory to make conclusions based on observations of data 3. the process of converting general research questions into specific formal hypotheses 4. the process of finding a way to measure an abstract construct	2	P2 P10-11	An inference is a conclusion that follows from existing information, by generalising from the specific information to the general type of phenomenon, where the conclusion is not absolutely certain. So in summary inferential statistics are techniques for making generalisations based on imperfect numeric data, where the conclusions have a high probability of being true, but you can never be completely certain. A distinction exists between inferential statistics and descriptive statistics. **Descriptive statistics** refers to a set of quantities used to summarise aspects of numerical data. Examples that you may be familiar with are means, range, variance and standard deviation (see Appendix C for a quick introduction). These summary quantities are sometimes referred to as parameters (when they refer to the whole collection or population of data; see section 1.4.3 below). **Inferential statistics** refers to the use of statistical techniques to make generalisations about the relationships among (two or more) variables. Here the patterns that may exist in the data are carefully investigated.
4	When doing research, the term 'Operationalisation' is used to refer to the process of ______ 1. calculating a test statistic to test a particular hypothesis 2. converting a general research question into a formal statistical hypothesis 3. determining a way to get a numeric measurement of a construct which is being measured 4. converting a calculated test statistic into a probability value called the p-value	3	P24-26	Operational definitions of psychological constructs should define constructs in terms of observable behaviour. "Operational" refers to practical procedures by which constructs are made visible. "Operationalisation" is where you make the construct (which is usually an abstract concept, so it is difficult to observe it clearly) visible by finding some suitable way to measure it.
5	In social science research, the total collection of measurements across a group of research participants is referred to as ______ 1. descriptive statistics 2. parameters 3. sample statistics 4. data	4	P10	When several measurements are collected from a number of people, the collected information is referred to as the data (while a single item of information is a datum). Data are all the variables for all the cases in the research.

#	Question	Ans	Page	Comments
6	Psychological measurements are always imperfect. The way in which a measurement varies around its 'true' value is referred to as ______ 1. measurement error 2. variance 3. hidden variables 4. standard deviation	1	P14-15	One of the consequences of using samples to represent populations is that this always leads to a certain degree of measurement error, no matter how rigorous our sampling procedure is. Another source of measurement error lies in the fact that our measurements are imprecise, that the measurement of a psychological construct is only more or less accurate. This measurement error is a kind of hidden variable, which we always presume to exist in social scientific research. This is referred to as the error component or the error term. This is one of the major reasons for using statistical probability theory in our data analysis: we assume that any variable we measure contains a 'true' element and an 'error' component. Furthermore, we assume that the mean of the error component is zero. We can do this because it is reasonable to assume that positive deviations and negative deviations from the perfect score (measurements that are too high or too low) will cancel each other out. We also need to make an additional assumption, namely, that these error terms are distributed around this mean of zero in a normal distribution Variance (s^2) and standard deviation (s) are the same concept so they can't both be correct (2 and 4)
7	A social science researcher is told by a grade 1 teacher that some children are terribly shy while other children seem to be quite comfortable in the social group. The researcher decides to investigate, using a test for shyness which was developed especially for young children. In this study, 'shyness' would be a ______ while the measurement of it is referred to as a ______ 1. variable, construct 2. construct, test 3. construct, variable 4. concept, scale	2	P3 P7	Constructs and their interrelations (how they affect each other, their patterns of interaction) are used in this way to **develop theoretical explanations** of why people behave in certain ways in certain contexts, or why mental phenomena appear to be as they are. Psychologists try to develop explanations for human experiences and behaviour. To do this, they often have to make use of abstract concepts (also called constructs) that serve as explanations for the behaviour they observe. **A construct that has been measured in some way produces a variable**. A variable refers to a number that can take on any one of a range of possible values. They can be discrete (when only whole numbers like 1, 2, 3 are allowed) or continuous (what mathematicians refer to as 'real numbers'). In some cases variables also take on values smaller than zero to produce negative numbers. So the (visible) variable reflects the intensity of the underlying (invisible) construct, in terms of how it was measured. We say that the variable is manifest (it is visible in the sense that we can observe it) and the construct is latent (it is invisible in the sense that we need some way to make it appear). So the latent construct is made manifest by the use of an appropriate measurement procedure.

#	Question	Ans	Page	Comments
8	A researcher wants to study the attitude to safety of workers in the construction industry. She randomly selects 200 workers from the employment records of 10 major construction companies in the Gauteng Province of South Africa. The group which was selected is referred as the ______ and the general group of construction workers is the ______ 1. population, sample 2. dependent variable, independent variable 3. independent variable, dependent variable 4. sample, population	4	P11	The entire collection of cases that you are interested in when you make your measurements for a particular construct is referred to as the **population.** The population depends on which people or objects or events you are interested in studying. Because populations can be very large, and we rarely have access to them, we would draw a **sample** of observations from the population and use that sample to **infer** certain things about the population's characteristics. The most appropriate sample is usually a simple random sample, where each individual has the same chance of being included. If our samples are not random, they may lack external validity: it may not be possible to generalise beyond the group from which we drew the sample.
9	Numeric values which represent some kind of psychological measurement and which can change from one measurement to the next are referred to as ______ 1. statistics 2. variables 3. parameters 4. constructs	2	P7	**A construct that has been measured in some way produces a variable**. A variable refers to a number that can take on any one of a range of possible values. They can be discrete (when only whole numbers like 1, 2, 3 are allowed) or continuous (what mathematicians refer to as 'real numbers'). In some cases variables also take on values smaller than zero to produce negative numbers.
10	A psychologist is conducting research into hypnosis. She believes that a relationship exists between a person's suggestibility (susceptibility to hypnosis) and his or her level of self esteem. In this design, 'suggestibility' is the ______ variable and 'level of self esteem' is the ______ variable 1. dependent, independent 2. latent, manifest 3. independent, dependent 4. hidden, operational	1	P8-9 P24	The dependent variable is the one that is predicted or explained, and the independent variable is manipulated to see how it affects the dependent variable. The independent variable is that variable which affects the dependent variable; or, conversely, the dependent variable depends on the independent variable. When a researcher focuses on the interaction of only two variables at a time, the dependent variable is usually the one that the researcher is interested in, the variable that is the focus of the research. The independent variable is something that the researcher manipulates, to see how this affects the dependent variable (in other words, the dependent variable is dependent on the independent variable).

<table>
<tr><th>#</th><th>Question</th><th>Ans</th><th>Page</th><th>Comments</th></tr>
<tr><td>11</td><td>The symbol ______ is usually used to indicate the mean of a sample, while the mean of the population from which the sample comes is indicated by the symbol ______

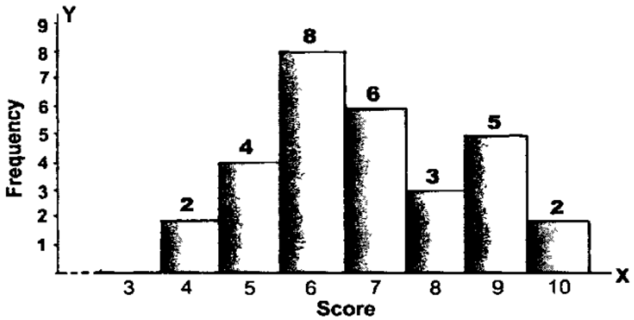
1. $\bar{x}$, μ
2. s, σ
3. α, $\bar{x}$
4. μ, σ</td><td>1</td><td>P161</td><td>
<table>
<tr><th rowspan="2">Summary value</th><th colspan="2">Symbol</th></tr>
<tr><th>Populations (Parameter)</th><th>Samples (Statistic)</th></tr>
<tr><td>Arithmetic mean</td><td>μ</td><td>$\bar{x}$</td></tr>
<tr><td>Standard deviation</td><td>σ</td><td>s</td></tr>
<tr><td>Variance</td><td>σ^2</td><td>s^2 $(s=\sqrt{s^2})$</td></tr>
<tr><td>Standard error of mean
(Also called Standard deviation of the sampling distribution of the mean)</td><td>$\sigma_{\bar{x}}$ $(= \sigma/\sqrt{n})$</td><td>$s_{\bar{x}}$ $(= s/\sqrt{n})$</td></tr>
<tr><td>Mean of sampling distribution of the mean
(Mean of all means. This is equal to the mean under H_0)</td><td>$\mu_{\bar{x}}$</td><td></td></tr>
<tr><td>Z score for means</td><td></td><td>$z_{\bar{x}}$</td></tr>
<tr><td>Correlation between two measurements (Pearson's R)</td><td>ρ</td><td>r</td></tr>
<tr><td>Proportions</td><td>P</td><td>p</td></tr>
</table>
</td></tr>
<tr><td>12</td><td>Which best describes “research hypothesis"?

1. A proven relation between two constructs
2. A proposed relation between two or more variables
3. A network of all the possible relations between constructs
4. A scientific theory</td><td>2</td><td>Tut201 2012 Q8

P1
P18-19</td><td>A psychological hypothesis formulates a testable empirical claim (something that can in principle be observed), and this usually involves postulating a relationship between two or more variables.

A research hypothesis is formed as a clear statement in terms of a relationship among the constructs (and the variables by which they are measured). It is a statement about a possible relationship among constructs that may explain some set of observations that one intends to investigate.</td></tr>
</table>

#	Question	Ans	Page	Comments
13	Which of the following does NOT represent a possible value for a probability'? 1. 99% 2. 0 3. -0.05 4. 1.0	3	P33	The probability value tells us at a glance how frequent or infrequent the event is, and what the likelihood is of obtaining a favourable outcome associated with it. • Probabilities can be expressed as percentages (e.g. a 10% probability), as fractions (e.g. a 1/10 probability), or as a decimals (e.g. a 0.10 probability). • A probability value represents a proportion (i.e. the proportion of outcomes supporting the event). A proportion is a decimal number between 0 and 1 and indicates the fraction of the total. • We often refer to the probability of an event (or statistic) as its p-value. • When decimal notation is used to describe probabilities, they fall in a range between 0 and 1, with values closer to 1 indicating a greater likelihood (or chance of success) than values close to zero. • Because probabilities fall in a range from 0.0 to 1.0 when expressed decimally, a probability can never be higher than 1 or lower than 0. The general rule is written symbolically as follows: $0 \le p \le 1$.
14	A jar contains 5 red, 8 blue, 3 green and 4 yellow marbles. What is the probability that a person who is blindfolded will choose a blue marble purely at random? 1. 0.20 2. 0.25 3. 0.50 4. 0.40	4	P29	Number of possible outcomes = Total marbles = 20 (5+8+3+4) Number of favourable events = Pick one blue marble = 8 $p(E) = \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}}$ $= \frac{8}{20} = 2/5 = 0.40$
15	Consider the same jar, filled with the same number of marbles than in the previous question. What is the probability that a person would choose either a red marble or a yellow one? 1. 0.50 2. 0.45 3. 0.25 4. 0.90	2	P29	Number of possible outcomes = Total marbles = 20 (5+8+3+4) Number of favourable events = Pick one red marble = 5 **OR** Pick one yellow marble = 4 $p(E) = \frac{\text{Number of favourable events}}{\text{Number of possible outcomes}}$ $= \frac{5+4}{20} = \frac{9}{20} = 4.5/10 = 0.45$

#	Question	Ans	Page	Comments
16	A researcher applies a test of creativity on a sample of fine arts students She creates the following graph based on the results, where the horizontal (x) axis represents the scores on the creativity test and the vertical axis (Y) are frequencies (counts for each score are indicated on top of the bars in the graph)  Based on this information, what is the probability that a particular art student, chosen at random, would get a score of 8 or greater on this test? 1. 0.33 2. 0.25 3. About 50% 4. More information is needed, the p-value will have to be calculated from the raw data	1	P53	Score of 8 or more : Score of 8 = 3 Score of 9 = 5 Score of 10 = 2 Number of participants (N) = 30 (2+4+8+6+3+5+2) Formula is : $\mu = \frac{\sum x_i}{N}$ So: $\mu = \sum x_i / N$ = (3+5+2) / 30 = 10 / 30 = 0.33
17	The expression “0.05 ≤ p ≤ 0.10" denotes a probability value which is _______ 1. a number halfway between 0.05 and 0.10 2. larger than or equal to 0.10 or smaller than or equal to 0.05 3. larger than 0.05 and smaller than 0.10 4. larger than or equal to 0.05 and smaller than or equal to 0.10	4	P33-34	Larger than or equal to 0.05 and smaller than or equal to 0.10 Because probabilities fall in a range from 0.0 to 1.0 when expressed decimally, a probability can never be higher than 1 or lower than 0. The general rule is written symbolically as follows: $0 \le p \le 1$. Note that a probability can be 0, but to say that a probability is 0 is actually the same as saying that the event is impossible and can never happen. Likewise, to say that the probability of an event is 1 is to assert that it is an absolute certainty. In actual practice, probabilities fall within these two extremes. You will typically encounter reference to probabilities in expressions such as "$p > 0.05$". This statement is interpreted as "the probability value is higher than 0.05".

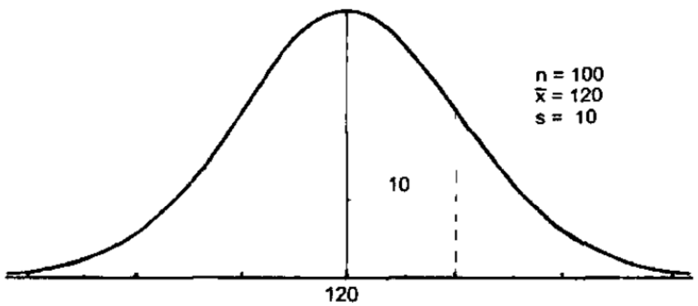
#	Question	Ans	Page	Comments
	Use the scenario below to answer Questions 18 and 19 A researcher is studying post-traumatic stress among a number of soldiers who recently returned from a peace-keeping mission. She applies a psychometric instrument which measures stress on each of a sample of 100 soldiers. She finds that their scores are approximately normally distributed with a mean of 3.5 and a standard deviation of 2.0.			
18	What would the z-score be for a soldier with a score of 5.5? 1. -0.25 2. 0 3. 0.5 4. 1	4	P53	Formula is $Z = \frac{x - \mu}{\sigma}$: Where: X = 5.5 (score of soldier) μ = 3.5 (normally distributed mean) σ = 2.0 (standard deviation) So: Z = (x - μ) / σ = (5.5 - 3.5) / 2.0 = 2 / 2.0 = 1
19	What would the probability be of a soldier getting a score of greater than 5.5? 1. 0.84 2. 0.16 3. 0.34 4. The p-value will have to be calculated using the raw data	2		The z-score for a soldier getting 5.5 = 1 (1.00) Refer to the standard normal distribution table and lookup 1.00 • The larger portion for z=1 is 0.8413 (0.84) • The smaller portion for z=1 is 0.1587 (0.16) Since the mean is 3.5 and the soldier is already at 5.5, that forms the larger portion. For a soldier to get a score of greater than 5.5, we have to look at the smaller portion which is 0,1587 (0.16)

#	Question	Ans	Page	Comments
20	A variable X is found to be normally distributed. If the probability distribution of this variable is plotted, what would the total size of the area under the curve be, to the left side of the sample mean? 1. 100% 2. 0.5 3. 1 4. 0	2	P53-54	Figure 2.7 above shows the approximate proportions of scores distributed under the area covered by the curve. • **The total area under the curve** gives the probability of the interval -∞ and +∞, and is **equal to +1** (i.e., the probability of any value of z falling between minus and plus infinity is equal to 1). • **Because the distribution is symmetrical, 0.5 of the area lies to the left of the mean and the same proportion to the right of the mean.** • Approximately 0.341 of the area lies between the mean and 1 standard deviation in each direction. • Roughly two-thirds, or 0.682 (0.341 x 2) of the area of the curve lies within one standard deviation of the mean. • Approximately 0.477 (i.e. 0.3413 + 0.1359) of the area lies between the mean and 2 standard deviations in each direction. • Approximately 0.954 (i.e. 0.477 x 2) of the area lies within 2 standard deviations from the mean. • Approximately 0.998 (i.e. 0.954 + (0.0215 x 2)) of the area lies within three standard deviations from the mean.

Questions 21 to 24 are based on the scenario below

A psychologist is conducting research on xenophobia (hatred of foreigners). She makes use of a Xenophobia Scale which measures attitudes towards foreign language speakers and which consists of 60 items, each one scored 0 - 4. This scale is applied to a random sample of n=100 citizens. The results for each research participant are added to produce an overall xenophobia score which falls in a range from a minimum score of 0 to a maximum score of 240.

The researcher calculates descriptive statistics for this sample, and finds a mean of Y = 120 and a standard variation of 10. Since the sample data is roughly normally distributed, she draws the graph below.



#	Question	Ans	Page	Comments
21	Based on the data in the scenario, what would the variance of the distribution of the scores be? 1. 100 2. 10 3. 12 4. 1	1	P68 P160	The standard deviations in the graph are the square roots of the variances s^2 ($s=\sqrt{s^2}$) The variance is just the square of the standard deviation. Conversely, the standard deviation is the square root of the variance. Variance gives an indication of how much the data varies around the mean; the 'width' of the distribution (in both directions). The advantage of using standard deviation is that it is expressed in the same units (the same measurement scale) as the original data, while the variance represents a measurement in squares (x^2). • For a sample, the variance is s^2 • For a population, the variance is σ^2 So, the variance = s^2 and the standard deviation = 10 $s=10$ so $s^2 = 10^2$ (or 10 x 10) = 100
22	What would the z-score be for a xenophobia score of 130? 1. 0.0 2. 1.0 3. 0.5 4. It cannot be calculated based on given information	2	P55-56	**$Z = \frac{X - \bar{x}}{S}$ or $Z = (X - \bar{x}) / S$** Where: $x = 130$ (xenophobia score) $\bar{x} = 120$ (sample mean) $S = 10$ (standard deviation) z = (130 - 120 / 10 = 10/10 = 1
23	If x is taken to represent a score on the xenophobia scale, which of the values below is the closest to the value of p(x<100)? 1. 0.500 2. 0.159 3. 0.977 4. 0.023	4	P55-56 App D	**$Z = \frac{X - \bar{x}}{S}$ or $Z = (X - \bar{x}) / S$** Where: $x = 100$ (xenophobia score) $\bar{x} = 120$ (sample mean) $S = 10$ (standard deviation) z = (100 - 120 / 10 = -20/10 = -2 Since we are looking for the proportion smaller than 100 (p(x<100), refer to the z-table where z is 2 and look at the smaller portion value. The value is 0.0228 (rounded to 0.023)

#	Question	Ans	Page	Comments
24	The way in which the mean is distributed can be estimated by finding the standard error. What would the standard error of the distribution of means be, based on the information in the scenario? 1. 120 2. 10 3. 1 4. It is the range of values between 110 and 130	3	P60-62	$s_{\bar{x}} = s/\sqrt{n}$ $= 10 / \sqrt{100}$ $= 10 / 10$ $= 1$
25	Which of the following expressions of the rule for combining mutually exclusive probabilities is correct? P(A or B) = 1. P(A) / P(B) 2. P(A) + P(B) 3. P(A) x P(B) 4. P(A) - P(B)	2	P34-36	The **additive rule** is p(A or B) = p(A) + p(B). This rule is used **when two or more events are mutually exclusive**. The additive rule is used to determine the sum of two or more probabilities, and is signalled by the use of the word 'or' (i.e. the probability of A or B). The **multiplicative rule** states that p(A and B) = p(A) x p(B) where A and B are both independent events. This rule is used to determine the product of two or more probabilities and is indicated by the word 'and' (i.e. the probability of A and B). The **multiplicative rule** that we use when we have **conditional probabilities** is p(A and B) = p(A) x p(B|A)
26	Which of the following statements are true? 1. Parameters describe sample characteristics and statistics describe population characteristics 2. Statistics describe significance tests while parameters are measurements of samples or populations 3. Parameters describe population characteristics and statistics describe sample characteristics 4. Statistics describe measurements of independent variables while parameters are measurements of dependent variables	3	P11 P161	These summary quantities are sometimes referred to as **parameters** (when they refer to the whole collection or population of data You should take careful note of the following important distinctions between samples and populations. **Summary values for populations are called 'parameters'** and are usually denoted by Greek letters, while **summary values for samples are called 'statistics'** and are denoted by Roman letters.

#	Question	Ans	Page	Comments
27	A researcher in social science wants to compare a sample mean to a known population mean and chooses to calculate the value of $z_{\bar{x}}$. What do we call this calculated value? 1. A test statistic 2. A sample statistic 3. A population parameter 4. An inferential statistic	1	P14 P82	A test statistic is the quantity you calculate (often by making use of sample statistics) to test a statistical hypothesis. When we transform a value such as 104 in this way to an equivalent z-score so that we can use the z-tables to determine the p-value, this z-statistic is referred to as a 'test statistic'. We use special symbols to denote such test statistics. In the present case, we use the symbol zx}, which indicates the z-test for a single sample mean. One of the tasks a researcher faces is to decide on the appropriate test statistic to use. We can refer to a test statistic as a variable that has a known theoretical probability distribution. In other words, the probabilities of various values for the test statistic can be calculated, although this usually requires using appropriate computer programs. Examples of test statistics are the $z_{\bar{x}}$, the $t_{\bar{x}}$ and the x^2
28	When a statistical test is performed, the size of the p-value will be a consequence of ______ 1. the value of the test statistic 2. a choice made by the researcher 3. the null hypothesis 4. the level of significance at which the test is performed	1	P84	The test statistic is a value with a known probability distribution: we can use it to determine what the probability is of finding an effect of a particular size, which we refer to as the p-value. It is because of our knowledge of the probability distribution of the test statistic that we can determine the p-value. We compare this p-value with a level of significance (α) that we chose before we did the sampling and made the observation. This is chosen by the researcher, based on the risk of being wrong when rejecting the null hypothesis that he or she is willing to take. If the p- value associated with the test statistic is smaller than this α -value, the null hypothesis is rejected and the alternative hypothesis accepted. If not, the null hypothesis is not rejected.

#	Question	Ans	Page	Comments
29	When a researcher sets the level of significance to $\alpha = 0.01$ during hypothesis testing, it implies that the probability of making an error of ______ will be at ______ 1% 1. Type I, most 2. Type I, least 3. Type II, most 4. Type II, least	1	SG 82-86 P85	When alpha reduces, the probability of Type I (α) error decreases and Type II (β) increases. An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance (α) represents the greatest risk of doing this that we are willing to take. An error of Type II is the opposite of Type I. We fail to reject the null hypothesis when we were supposed to. Generally, though, the smaller α, the larger β. **If we wish to avoid Type I errors, we set α to a small value such as 0.01 or even 0.001**, but if we want to avoid Type II errors, we could set α to a larger value.
30	Before doing statistical testing, a researcher sets the level of significance to 0.05. This is the ______ 1. minimum probability of making an error of Type I 2. p-value at which the test is to be preformed 3. maximum probability of making an error of Type I 4. probability of rejecting H_0	3	P85	See above comments
31	Which of the statements below are true? A test statistic ______ (a) is used to determine a p-value (b) is used to determine the value of α (c) shows how far an observed measurement deviates from what can be expected by chance (d) indicates the probability of making an error if the null hypothesis is rejected 1. Only (a) 2. Only (b) 3. Both (c) and (d) 4. Both (a) and (c)	4	P83 P84	A **test statistic is used to determine a p-value** **We calculate a test statistic that is an indication of how far the observed effect - as reflected in the sample data - deviates from what the null hypothesis tells us to expect (if it were true).** The test statistic is a value with a known probability distribution: we can use it to determine what the probability is of finding an effect of a particular size, which we refer to as the p-value. It is because of our knowledge of the probability distribution of the test statistic that we can determine the p-value. We compare this p-value with a level of significance (a) that we chose before we did the sampling and made the observation. This is chosen by the researcher, based on the risk of being wrong when rejecting the null hypothesis that he or she is willing to take. If the p-value associated with the test statistic is smaller than this a-value, the null hypothesis is rejected and the alternative hypothesis accepted. If not, the null hypothesis is not rejected. The p-value represents the probability that the null hypothesis is true: that the effect we see in our observation is due to chance effects like measurement error.

#	Question	Ans	Page	Comments
32	When a statistical test yields a large p-value, which of the following statements is most correct? 1. The alternative hypothesis is probably true 2. The null hypothesis is probably false 3. The null hypothesis is probably true 4. The alternative hypothesis cannot be rejected	3	P83-84	The p-value represents the probability that the null hypothesis is true: that the effect we see in our observation is due to chance effects like measurement error. **If this probability is small, we conclude that H_0 is not true, and we reject it. If this probability is large, we conclude that H_0 is probably true, and we fail to reject it (the research hypothesis could not be confirmed)** This p-value is also a direct indication of the probability that the null hypothesis is being mistakenly rejected. In other words, it shows the probability that the researcher is rejecting a null hypothesis that is actually true.
33	When applying a t-test to compare a sample mean calculated from a measurement to a known population mean, the p-value represents _______ 1. the probability of correctly rejecting the null hypothesis 2. the probability of obtaining the sample mean under the alternative hypothesis 3. the probability of obtaining the sample mean under the null hypothesis 4. the largest risk of making an error by rejecting the null hypothesis that one is willing to take	3	P110 P77-78	Determine the p-value, which tells you what the probability of this observed relationship (indicated by the test statistic) would be under the null hypothesis. Calculating the probability of the sample result under the null hypothesis
34	Under which of the circumstances below would you make use of a t-test statistic? 1. When comparing from two independent variables 2. The sample standard deviation is unknown 3. The population standard deviation is unknown 4. The sample is not known to be normally distributed	3	P103 App F P177	The t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means **when the population standard deviation σ is unknown.** **Three types of t-tests:** $t_{\bar{x}}$ test - Difference between one group and a constant, σ is unknown t_c test - Difference between two **independent** groups, σ is unknown t_d test - Difference between two **dependent** groups, σ is unknown

#	Question	Ans	Page	Comments
35	When a statistical test yields a very small p-value, we know that the sample result is very _______ 1. likely under the null hypothesis 2. unlikely under the alternative hypothesis 3. likely at a specific level of significance 4. unlikely under the null hypothesis	4	P81	Here is a summary of the important points regarding the p-value: • The p-value gives the probability of obtaining the sample result under H_0. • If the p-value is very small, the probability is very small that the sample result would occur under H_0, and one should consider rejecting H_0 in favour of H_1. • The smaller the p-value, the more likely that the null hypothesis is false and should be rejected in favour of the alternative hypothesis. So, if the p-value is very **large**, the probability is very big that the sample result would occur under H_0, and one should consider accepting H_0 in favour of H_1. **The null hypothesis is then probably true**
36	A type I error occurs when the _______ 1. null hypothesis is wrongly rejected 2. null hypothesis is not rejected when it should be 3. alternative hypothesis is wrongly rejected 4. p-value exceeds the level of significance	1	SG 82-86 P85	**An error of Type I is the error we make if we reject the null hypothesis when we should not have done so**, and the level of significance (α) represents the greatest risk of doing this that we are willing to take. An error of Type II is the opposite of Type I. We fail to reject the null hypothesis when we were supposed to. Generally, though, the smaller α, the larger β. If we wish to avoid Type I errors, we set α to a small value such as 0.01 or even 0.001, but if we want to avoid Type II errors, we could set α to a larger value.
37	Which one of the following alternative hypotheses requires a non-directional test of significance? 1. The mean anxiety score for boys is greater than that of girls 2. The mean verbal ability score for boys is lower than that of girls 3. There is no correlation between the test marks and examination marks for a group of boys and girls 4. There is not a significant correlation between the anxiety scores of boys and those of girls	4	P75	The alternative hypothesis can contain any of the symbols '>', '<' or '≠' respectively, the symbols for 'larger than', 'smaller than' or 'not equal to'. When a comparison is between a value that is greater (more) than another, we use the symbol '>' and when a comparison is between a value that is smaller (less than) than another, we use '<'. The statistical test that must be performed in either of these cases is a **directional or one-tailed statistical test** (we use these expressions interchangeably). **When we do not specify what the direction of the difference should be, and both a larger and a smaller difference between means are considered as relevant, the symbol '≠' must be used. The statistical test to be performed will now be a non-directional or two-tailed test**. H_0: $\mu = 100$ H_1: $\mu \neq 100$ Where both values of the mean, either greater than or smaller than 100 are to be considered, a non-directional or two-tailed test is required.

#	Question	Ans	Page	Comments
38	Which of the following statements about the p-value are true? a) It gives the probability of making an error of Type I b) It should exceed the level of significance c) If it is relatively large the null hypothesis will probably have to be rejected d) If it is less than or equal to the level of significance, H_0 should be rejected 1. (d) and none of the others 2. (b) and (c) 3. (a) and (b) 4. (a) and (d)	4	P81	Here is a summary of the important points regarding the p-value: • The p-value gives the probability of obtaining the sample result under H_0. • If the p-value is very small, the probability is very small that the sample result would occur under H_0, and one should consider rejecting H_0 in favour of H_1. • The smaller the p-value, the more likely that the null hypothesis is false and should be rejected in favour of the alternative hypothesis. So, if the p-value is very **large**, the probability is very big that the sample result would occur under H_0, and one should consider accepting H_0 in favour of H_1. **The null hypothesis is then probably true**
39	Which of the following are appropriate ways to express an alternative hypothesis when a formal statistical hypothesis is being formulated? a) $\mu_1 = \mu_2$ b) $\mu_1 \neq \mu_2$ c) $\mu_1 > \mu_2$ d) $\mu_1 < \mu_2$ 1. Only (a) 2. Only (b) 3. Both (c) and (d) only 4. (b), (c) and (d)	4	P75	The alternative hypothesis (H_1) can contain any of the symbols '>', '<' or '≠' respectively, the symbols for 'larger than', 'smaller than' or 'not equal to'. When a comparison is between a value that is greater (more) than another, we use the symbol '>' and when a comparison is between a value that is smaller (less than) than another, we use '<'. The statistical test that must be performed in either of these cases is a **directional or one-tailed statistical test** (we use these expressions interchangeably). **When we do not specify what the direction of the difference should be, and both a larger and a smaller difference between means are considered as relevant, the symbol '≠' must be used. The statistical test to be performed will now be a non-directional or two-tailed test.**
40	During statistical hypothesis testing, a p-value is calculated based on a test statistic. If this p-value is ______ than the level of significance, the ______ hypothesis should be ______ 1. greater, null, rejected 2. less, alternative, rejected 3. less, null, rejected 4. less, null, accepted	3	P82	The decision rule for H_0 is simply as follows: If the p-value of the sample result is smaller (less) than α (level of significance), the null hypothesis is rejected. If the p-value is not smaller than α, the null hypothesis (H_0) is not rejected.

#	Question	Ans	Page	Comments
41	An error of Type II is committed when ______ 1. H_0 is rejected in error 2. H_0 is not rejected when it should be 3. the p-value is found to exceed α 4. the rejection H_0 is rejected based only on the p-value without looking at the effect size	2	SG 82-86 P85-86	An error of Type I is the error we make if we reject the null hypothesis when we should not have done so, and the level of significance (α) represents the greatest risk of doing this that we are willing to take. **An error of Type II is the opposite of Type I. We fail to reject the null hypothesis (H_0) when we were supposed to.** What if the p-value is not smaller than the α -level and we decide not to reject H_0? Now we run the risk of not rejecting H_0 when - in fact - H_0 is false and H_1 is true. This is referred to as a Type II error. The decision not to reject H_0 is based on the test statistic, from which we determine a p-value that is not smaller than our chosen level of significance (i.e., p-value > α). However, this outcome may also be the result of measurement error. The effect may be close to what H_0 predicts purely by chance.
42	The size of the p-value depends on the ______ 1. z-tables 2. size of the test statistic 3. null hypothesis statement 4. level of significance	2	P83 P84	A **test statistic is used to determine a p-value** **We calculate a test statistic that is an indication of how far the observed effect - as reflected in the sample data - deviates from what the null hypothesis tells us to expect (if it were true).** The test statistic is a value with a known probability distribution: we can use it to determine what the probability is of finding an effect of a particular size, which we refer to as the p-value. It is because of our knowledge of the probability distribution of the test statistic that we can determine the p-value. We compare this p-value with a level of significance (α) that we chose before we did the sampling and made the observation. This is chosen by the researcher, based on the risk of being wrong when rejecting the null hypothesis that he or she is willing to take. If the p-value associated with the test statistic is smaller than this a-value, the null hypothesis is rejected and the alternative hypothesis accepted. If not, the null hypothesis is not rejected. The p-value represents the probability that the null hypothesis is true: that the effect we see in our observation is due to chance effects like measurement error.

#	Question	Ans	Page	Comments
43	A failure to reject H_0 implies that a difference between the calculated sample mean and its expected value under H_0 is due to ______ 1. the dependent variable 2. the independent variable 3. chance 4. the test statistic	3	P83 P87	We would say that our result does not enable us to conclude that H_0 is false, or even that the result favours the null hypothesis, but that we cannot accept it is literally true. Even if our sample mean is $\bar{x}$=100 exactly, there is a remote possibility that this is a **chance event** (due to measurement or sampling error). What we do know in such a case is that there is no indication that H_1 can be true and no reason to do a test to confirm this. The implication is that we have to be careful how we interpret significant results. A p-value of smaller than our chosen level of significance (α) simply implies that, relative to this sample, it is improbable that the effect we see in our observations is purely due to chance. It does not imply that the effect is big or important. This is something that we have to decide by looking at what the data means.
	Base your answers to Questions 44 to 47 on the following scenario Based on her experience, a developmental psychologist formulates a hypothesis that infants of younger than four months old tend to look at their mother's faces for longer periods of time than at the faces of strangers. She also knows that past research has established that an infant will look at a picture of a random human face for an average of ten seconds before looking away. To test her hypothesis, the psychologist selects a sample of n = 25 infants of between one and four months old. She presents each infant with a picture of their mother on a video screen and records for how long each infant attends to the image before looking away. After collecting the data, she calculates that the infants in her sample spend a mean of $\bar{x}$ = 12.5 seconds looking at the images before looking away, with a standard deviation of s = 5.5 seconds.			
44	Which research design is the most appropriate? 1. Correlational design 2. Single sample group design 3. Two-groups design for dependent samples 4. Two-groups design with a known population mean	2	P99	A mean based on a single sample is to be compared to a specific value - a population mean that is treated as a given.
45	Which is the most appropriate way of formulating the relevant statistical hypotheses? 1. H_0 $\mu = 10$, H_1 $\mu > 10$ 2. H_0 $\mu = 10$, H_1 $\mu < 10$ 3. H_0 $\mu \neq 10$, H_1 $\mu > 10$ 4. H_0 $\mu = 10$, H_1 $\mu \neq 10$	1		"a developmental psychologist formulates a hypothesis that infants of younger than four months old tend to look at their mother's faces for **longer** periods of time than at the faces of strangers" The term "longer" indicates a directional hypothesis (greater than ">")

#	Question	Ans	Page	Comments
46	Based on the information presented in the scenario, which would be the most appropriate test statistic to use out of the following'? 1. The z-statistic for the mean of a single sample ($z_{\bar{x}}$) 2. The t-statistic for the difference between the means of two independent samples (t_c) 3. The t-statistic for the difference between the means of two dependent samples (t_d) 4. The t-statistic for the mean of a single sample ($t_{\bar{x}}$)	4	P103 App F P177	The t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means **when the population standard deviation σ is unknown.** **Three types of t-tests:** $t_{\bar{x}}$ test - Difference between one group and a constant, σ is unknown t_c test - Difference between two **independent** groups, σ is unknown t_d test - Difference between two **dependent** groups, σ is unknown $z_{\bar{x}}$ test - Difference between one group and a constant, σ is known
47	Given the scenario above, what would the calculated value of the standard deviation of the distribution of the means (the standard error) be? 1. 5.5 2. 1.1 3. 0.2 4. There is insufficient information to calculate it	2	P105	$s_{\bar{x}} = s/\sqrt{n}$ where: $s = 5.5$ $n = 25$ $s_{\bar{x}} = 5.5 / \sqrt{25}$ $= 5.5 / 5$ $= 1.1$
48	The standard error of the mean for samples of a specific size is the ______ 1. standard deviation of the population mean 2. mean of the standard deviations of repeated samples of this specific size 3. standard deviation of the sampling distribution of the mean 4. standard deviation of the sample mean	3	P103-104	This is the standard deviation of the distribution of the means (or standard error of the mean), which we can calculate using the central limit theorem: $s_{\bar{x}} = s/\sqrt{n}$ $$s_{\bar{x}} = \frac{s}{\sqrt{n}}$$

#	Question	Ans	Page	Comments
49	During the process of using statistical procedures to establish whether a relationship exists between the variables x and y, a researcher considers the effect size of the findings. What does this refer to? 1. It indicates the extent of a relationship among variables irrespective of the significance of the statistical test 2. It is another way of saying that the statistical test was significant 3. It refers to the probability of making an error of Type II it the null hypothesis is not rejected 4. It refers to the extent to which the obtained p-value differs from the chosen level of significance	1	P139 P140	The squared correlation (r^2) measures the proportion of variance in one variable that can be determined from its relationship with the other, or how much variance they have in common. It can be used as an indication of the size of the effect. **Evaluating r^2** • $r^2 = 0.01$ Small effect • $r^2 = 0.09$ Medium effect • $r^2 = 0.25$ Large effect
50	Suppose a test statistic is calculated, and based on this the p-value is determined to be 0.03. Which of the following decisions should the researcher make'? 1. Reject H_0 if the level of significance was set in advance at 0.01 2. Since p = 0.03, set the level of significance to 0.05 to make it possible to reject H_0 3. Reject H_0 if the level of significance was set in advance at 0.05 4. Do not reject H_0 if the level of significance was set in advance at 0.05	3		p=0.03 If α=0.01, then do not reject H_0 If α=0.05, then reject H_0
	Base your answers Questions 51 to 53 on the following scenario A researcher in educational psychology wants to investigate the possibility that primary school children who regularly watch educational programmes on television get better general grades in primary school than those who do not. She draws a random sample of 100 children from a specific primary school and after investigation of their histories of television watching, allocates them into two groups, a TV-Group of 45 children with a history of watching educational programmes and a Non-TV Group of 55 children with no such history. At the end of the school year, she compares the final year marks of the two groups			

#	Question	Ans	Page	Comments
51	Considering the scenario above, which of the following statements are true? (a) The two groups are dependent because they come from the same school (b) Watching television is the dependant variable and year mark is the independent variable (c) A one-tailed test would be required 1. (a) and none of the others 2. (a) and (c) 3. (b) and (c) 4. (c) and none of the others	2	P112	**Note:** • The two groups are dependent. • The dependent variable will be their final year marks as this will be influenced by the independent variable. • The independent variable is watching educational programmes on TV • She hypothesises that the primary school children who regularly watch educational programmes on television get better general grades in primary school than those who do not o This means the grades are greater than (>) Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample. The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design. Sometimes dependent samples are produced when the researcher deliberately matches subjects into pairs, based on the value of some hidden or 'nuisance' variable. In this case, the groups are specific primary school children. Another example of such a design would be a repeated measures design, where the same research participant is observed under more than one treatment or experimental condition
52	Which of the following is an appropriate description of the research population in the scenario? 1. Primary school children 2. Primary school children who watch educational television 3. Children in general 4. 100 children from a specific school	1		The researcher only focuses on primary school children, so that will be the whole population from which she will take a sample.

#	Question	Ans	Page	Comments
53	When comparing the year marks of the two groups of children (using 'TV' and 'NoTV' to indicate the group that watches educational TV and the one that does not watch it, respectively) which is of the options below are the most appropriate way to express the formal alternative hypothesis suggested by this scenario? 1. $\mu_{TV} < \mu_{NoTV}$ 2. $\mu_{TV} > \mu_{NoTV}$ 3. $\mu_{TV} \neq \mu_{NoTV}$ 4. $\bar{x}_{TV} > \bar{x}_{NoTV}$	2		She hypothesises that the primary school children who regularly watch educational programmes on television get better general grades in primary school than those who do not This means the grades are greater than (>)
54	A psychotherapist wants to test the effectiveness of a programme of cognitive behavioural therapy on clients who were diagnosed as suffering from high social anxiety. She uses a sample of 50 persons who were diagnosed as persons with high anxiety and tests them on a Social Anxiety Scale before the commencement of the series of therapy sessions, and again afterwards. The two sets of measurements should be regarded as _______ 1. dependent 2. independent 3. drawn from a single population 4. highly correlated	1	P112	Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample. The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design. Sometimes dependent samples are produced when the researcher deliberately matches subjects into pairs, based on the value of some hidden or 'nuisance' variable. Another example of such a design would be a repeated measures design, where the same research participant is observed under more than one treatment or experimental condition

#	Question	Ans	Page	Comments
55	A researcher wants to compare two group means by testing the following hypotheses at a significance level of $\alpha = 0.05$ H_0 $\mu_1 = \mu_2$ H_1 $\mu_1 > \mu_2$ On the basis of data provided, the output from a computer program indicates that a t-value of t = -1.9 was found. The computer program also indicates that a p-value for a non-directional (two-tailed) t-test would be p=0.07. What conclusion can the researcher make, and why? 1. H_0 can be rejected because $\alpha <$ p-value 2. H_0 cannot be rejected because $\alpha <$ p-value 3. H_0 can be rejected because $\alpha / 2 <$ p-value 4. H_0 cannot be rejected because $\alpha \times 2 >$ p-value		P81	**There is no correct answer for this question.** Remember that H_1 $\mu_1 > \mu_2$ is a directional hypothesis and requires a one-tail test. The p-value provided by the computer is non-directional (two-tailed) and must therefore be divided by 2 to give a one-tail value. So p=0.07 / 2 = 0.035 We know $\alpha = 0.05$, so $p < \alpha$ (0.035 < 0.05) and therefore H_0 should be rejected. This would be the normal way of calculating it But also remember that the alpha value is normally indicated for one-tail. Therefore we should also be able to multiply it by 2 to get it to a two tail comparisson with the two-tailed p-value. So: $\alpha \times 2 >$ p-value is the same as p-value / 2 $< \alpha$ This means in the question that α=0.05 x 2 = 0.10 which is greater than p=0.07 So $p < \alpha$ and therefore H_0 should be rejected.
56	Two samples can be considered independent when ______ 1. care was taken that there were no hidden variables that could affect them 2. care was taken that the samples are drawn under different experimental or treatment conditions 3. the samples are drawn from more than a single population of subjects 4. there is no systematic matching of individuals of one sample with individuals from the other one	4	P112	Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample. The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design. Sometimes dependent samples are produced when the researcher deliberately matches subjects into pairs, based on the value of some hidden or 'nuisance' variable. Another example of such a design would be a repeated measures design, where the same research participant is observed under more than one treatment or experimental condition

#	Question	Ans	Page	Comments
57	A researcher wants to test the hypothesis that girls are generally less assertive than boys. He draws a sample of 100 boys and a sample of 100 girls, and gives each child a test that measures their general level of assertiveness. Which would be the most appropriate statistical test to use, out of the following? 1. The t-test for independent samples 2. The chi-square (x^2) test 3. The t-test for dependent samples 4. The test statistic based on the Pearson product-moment correlation (r)	1	P103 App F P177	The t-distribution is a statistical distribution with a probability distribution that can be determined, which means that we can use it to predict the chances of obtaining specific outcomes when testing for comparisons of means **when the population standard deviation σ is unknown.** **Three types of t-tests:** $t_{\bar{x}}$ test - Difference between one group and a constant, σ is unknown t_c test - Difference between two **independent** groups, σ is unknown t_d test - Difference between two **dependent** groups, σ is unknown $z_{\bar{x}}$ test - Difference between one group and a constant, σ is known
58	The difference score ($\bar{d} = X_2 - X_1$) is used in the calculation of the t-test statistic in the case of _______ (a) dependent samples (b) independent samples (c) random samples 1. only (a) 2. only (b) 3. both (a) and (b) 4. (c)	1	P112 P118	Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample. The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design. Sometimes dependent samples are produced when the researcher deliberately matches subjects into pairs, based on the value of some hidden or 'nuisance' variable. Another example of such a design would be a repeated measures design, where the same research participant is observed under more than one treatment or experimental condition. Each subject is matched with himself or herself, which is why the samples are regarded as dependent. It is to compensate for this existing relationship between the samples that we require an adjustment in the t-statistic. To develop this adjusted t-test, we use the two matched samples to create a new variable called '$\bar{d}$ '. We do this by computing a 'difference score' between $\bar{x}_1$ and $\bar{x}_2$ so that $\bar{d}$ reflects the mean of the differences between the measurements before and after. **$\bar{d} = \bar{x}_1 - \bar{x}_2$**

#	Question	Ans	Page	Comments
59	Which of the following statements about the relationship between the value of a t-test statistic and the p-value is true, if the sample size (n) remains constant? 1. The larger the value of the t-test statistic, the smaller p will be 2. The smaller the value of the t-test statistic, the smaller p will be 3. If the sample size n remains the same, the relationship between the test statistic and the p-value will remain constant 4. There is no specific relationship between the p-value and the t-test statistic	1	P106	Note that the bigger the t-value the greater the likelihood of rejecting H0 (as is the case with z-statistics), because it refers to how far the observed value of the sample statistic differs from the population parameter that was provided and refers to the areas on the edges of the distribution. This implies, the bigger the t-value, the smaller the p-vlaue
60	Which of the following gives the best description of a null hypothesis? The null hypothesis is the hypothesis that ______ 1. expresses the research hypothesis through the use of appropriate symbols 2. indicates the direction of the difference that is expected between two groups 3. expresses the probability that observed relationship will be significant 4. states that there is no relationship between the variables	4	P73-75	By convention, the null hypothesis is usually indicated with the symbol H0 This hypothesis is referred to as the 'null hypothesis' because it is the hypothesis that implies no effect. The null hypothesis always contains the 'equal to' symbol '='. The null hypothesis is the hypothesis that **no effect exists**, and in cases where we are testing a mean, this implies that two group means (or a group mean and a specific constant value) do not differ.
61	In correlational research one investigates the relation between ______ 1. the mean of a single sample of subjects and a population mean 2. two groups of subjects, with respect to a single variable 3. two variables measured on the same group of subjects 4. the difference scores of two groups of test measurements	3	P130	**Correlation** is a measurement of the extent to which a measurement on one variable is related to a measurement on another variable for the same sample of individual cases.

<table>
<tr><th>#</th><th>Question</th><th>Ans</th><th>Page</th><th>Comments</th></tr>
<tr>
<td>62</td>
<td>A researcher hypothesizes that the greater the number of books read by pupils over a specific school year, the greater their language comprehension will be at the end of that year. He studies a random sample of 100 pupils in grades 10 — 12 in a specific school, collecting information on the number of books they read in a specific year and letting them do a reading comprehension test at the end of the year

Which is an appropriate formal expression of the alternative hypothesis for this research?

1. $\rho > 0$
2. $\mu > 0$
3. $r > 0$
4. $\rho \neq 0$</td>
<td>1</td>
<td>P161

P131</td>
<td>You should take careful note of the following important distinctions between samples and populations. Summary values for populations are called 'parameters' and are usually denoted by Greek letters, while summary values for samples are called 'statistics' and are denoted by Roman letters.
<table>
<tr><th rowspan="2">Summary value</th><th colspan="2">Symbol</th></tr>
<tr><th>Populations (Parameter)</th><th>Samples (Statistic)</th></tr>
<tr><td>Arithmetic mean</td><td>μ</td><td>$\bar{x}$</td></tr>
<tr><td>Standard deviation</td><td>σ</td><td>s</td></tr>
<tr><td>Variance</td><td>σ^2</td><td>s^2 ($s=\sqrt{s^2}$)</td></tr>
<tr><td>Standard error of mean (Also called Standard deviation of the sampling distribution of the mean)</td><td>$\sigma_{\bar{x}}$ ($= \sigma/\sqrt{n}$)</td><td>$s_{\bar{x}}$ ($= s/\sqrt{n}$)</td></tr>
<tr><td>Mean of sampling distribution of the mean (Mean of all means. This is equal to the mean under H_0)</td><td>$\mu_{\bar{x}}$</td><td></td></tr>
<tr><td>Z score for means</td><td></td><td>$z_{\bar{x}}$</td></tr>
<tr><td>Correlation between two measurements (Pearson's R)</td><td>ρ</td><td>r</td></tr>
<tr><td>Proportions</td><td>P</td><td>p</td></tr>
</table>

It is a correlational design where we are measuring a relationship between two variables (populations).

The population correlation value is indicated by ρ (Greek letter rho corresponding to the sample r). This would be the correlation if the entire population provided scores on the two measured variables you are interested in. Remember we're going to state hypotheses in terms of our population correlation, which here is stated as positive

H_1: r = 0 This implies that a relationship that differs significantly from zero does in fact exist, but we are making no `educated guesses' as to whether it is a positive or negative relationship: we just want to know whether there is in fact a relationship.
H_1: r > 0 This implies that we want to establish whether a significant relationship of greater than zero exists, that is, a significant positive relationship.
H_1: r < 0 This implies that we want to establish whether a significant relationship of less than zero exists, that is, a significant negative relationship.</td>
</tr>
</table>

#	Question	Ans	Page	Comments
63	Which of the following can never be exactly zero? 1. a probability 2. a level of significance 3. a correlation coefficient 4. a t-test statistic	2	P83-85	If the significance level (α) = 0, then there would be no possibility of the p-value being lower than α so the null hypothesis H_0 will always be true
64	A graph showing the position of each of a number of measurements on each of two variables is called a _______ 1. histogram 2. contingency table 3. scatter plot 4. correlation coefficient	3	P130-132 Tut202 2014 Q18	A graph showing the position of each of a number of sampling units on each of two variables A *scatter plot* is a graph showing the relationship between two numerical variables. In such a graph the data of the one variable are plotted on the horizontal axis (usually referred to as the X axis), and the data of the other variable on the vertical (or Y) axis. It is not a comparison of sample and population, nor has it to do with spread of data or the independence of variables
65	For a larger sample size (n) _______ 1. a smaller value of a Pearson's correlation coefficient r will reach significance 2. a larger value of a Pearson's correlation coefficient r is required before the result will be significant 3. the size of Pearson's correlation coefficient r is likely to increase 4. the size of Pearson’s correlation coefficient r is likely to move closer to zero	4	P139	If you randomly put three dots on a blank square of paper, they may, purely by chance, fall into something approximating a straight line. If you make a hundred marks on the same piece of paper, also in a totally random way, the chance of them falling in a straight line is, however, a lot less. This tells you something about the relationship between r (a measure of whether the dots on a scatter plot fall in a straight line) and the number of dots (the sample size n): the smaller n, the more likely it is that the plot will represent a straight line purely by chance. Therefore, for a smaller sample n, the test must be much more conservative. You must, therefore, put up a bigger hurdle to be crossed before you conclude that the result is not the consequence of chance. You, therefore, require a larger value of r before you can conclude that the result is not a chance event due to sampling or measurement error, but an actual representation of the state of affairs in the population. The consequence of this is that, **for a large sample, a relatively modest correlation can turn out to be significant**. For example, for a sample of n = 40 (as in the HIV/AIDS research project in Appendix A), the value of r must be at least r = 0.26 for α = 0.05 (a 5% level). If we increase the sample size to 100, a smaller result of r = 0.16 would be significant at the same level of α = 0.05. This shows that, for a large value of n, a very modest r can be significant. The implication of this is that significance does not indicate that a relationship is large. It merely tells you that some relationship exists (perhaps a modest one), and that it is large enough not to be regarded as purely due to the effect of chance, given the size of the sample.

#	Question	Ans	Page	Comments
66	A Pearson correlation of r = -0.71 is found when the linear correlation between two variables is calculated. What kind of relationship between two variables X and Y does this represent? 1. As one variable grows larger, so the other gets larger 2. As one variable grows smaller, so the other gets smaller 3. As one variable grows larger, the other grows smaller 4. A correlation coefficient cannot get smaller than 0, since it implies a relationship of less than nothing	3	P132-133	Correlation coefficients that measure the linear relationship between two variables, such as the Pearson product-moment correlation coefficient, can have a continuous value that ranges from -1 to 1 (a positive value is usually written without the sign, so '1' is presumed to mean '+1'). We use 'r' as the symbol that represents a correlation coefficient (as in the case of the Pearson product-moment correlation coefficient), and the following applies: • r = 1 implies a perfect positive linear relationship (the dots in a scatter plot will run from lower left to upper right in a perfectly straight line) • **r = 0 implies no linear relationship at all** (the dots may be scattered all over the place) • r = -1 implies a perfect negative linear relationship (the dots will run from upper left to lower right in a straight line) When positive relationships occur, this implies that as one variable gets larger, so does the other. When negative relationships occur, this implies that as one variable gets larger, the other gets smaller. The relationship is called **linear** because Pearson's correlation coefficient measures the extent to which the relationship approximates a straight line.
67	After finding the correlation of r = -0.71 (as indicated in the previous question), the researcher decides to also calculate the size of the effect of one variable on the other. Given the information at his disposal, what is he likely to conclude? 1. About half of the variance in one of the variables is accounted for by the other one 2. About a quarter of the variance in one of the variables is accounted for by the other 3. About three quarters of the variance in one of the variables is accounted for by the other one 4. He decides that before he can find the size of the effect between the two variables, the two group means and standard variations will first have to be calculated	1	P139 P140	The squared correlation (r^2) measures the proportion of variance in one variable that can be determined from its relationship with the other, or how much variance they have in common. It can be used as an indication of the size of the effect. **Evaluating r^2** • r^2 = 0.01 = 1% Small effect • r^2 = 0.09 = 9% Medium effect • r^2 = 0.25 = 25% Large effect r = -0.71 r^2 = (-0.71 x -0.71) = 0.5041 = 50% At least 50% variance in one of the variables is accounted for by the other one

#	Question	Ans	Page	Comments
	Base your answers to Questions 68 to 70 on the following scenario A sample of clients are drawn from three community welfare centres (indicated as A, B and C). Based on interviews, the clients are categorised into one of four categories • Those that have psychological problems, that is, they may require intervention by psychotherapists, • Those that have welfare problems, that is, those who may require intervention by social workers, • Those with health-related problems, who may require interventions by health care givers • Others - these are clients who do not fit into any of the other three groups Counts are made of those clients from the different centres who fit into each of these categories, and this is reflected in the contingency table below			

Mental Health Centre (columns) by Type of Problem (rows)	A	B	C	Row totals
'Psychological'	27	35	32	**94**
'Welfare'	16	28	22	**66**
'Health-related'	16	20	34	**70**
Other	29	17	24	**70**
Column totals	**88**	**100**	**112**	**300**

#	Question	Ans	Page	Comments
68	Which of the following is an appropriate null hypothesis to test relationships given the data above? 1. There is a correlation between the type of intervention which the clients need and the particular community mental health centres that they visit 2. The particular community mental health centres that the clients visit have no relationship to the type of intervention which the clients may require 3. There are no significant difference among clients needing psychological, welfare, health-related or those with other problems 4. There is no correlation between the type of intervention which the clients need and the particular community mental health centres that they visit	4	P137	1. H_0 : $\rho \neq 0$ 2. H_0 : $\rho \neq 0$ 3. H_0 : $\rho \neq 0$ 4. H_0 : $\rho = 0$ H_0 can only be "=". Options 1, 2 and 3 are alternative hypothesis statements. So the null hypothesis (H_0) - the hypothesis of no effect - will state that no relationship exists: **H_0 : $\rho = 0$** **H_1: $\rho \neq 0$** This implies that a relationship that differs significantly from zero does in fact exist, but we are making no `educated guesses' as to whether it is a positive or negative relationship: we just want to know whether there is in fact a relationship. **H_1: $\rho > 0$** This implies that we want to establish whether a significant relationship of greater than zero exists, that is, a significant positive relationship. **H_1: $\rho < 0$** This implies that we want to establish whether a significant relationship of less than zero exists, that is, a significant negative relationship.

#	Question	Ans	Page	Comments
69	Given the data above, which of the options below would be the most appropriate test statistic to use to test the null hypothesis above against an appropriate alternative hypothesis'? 1. The test statistic for the Pearson product-moment correlation coefficient (r) 2. The t-test statistic tor two in dependent samples (t_c) 3. The t-test statistic tor two dependent samples (t_d) 4. The chi-square (X^2) test statistic	4	P110 SG P140 Tut202 2014 Q22	Samples are considered as comprising independent groups if the composition of the one sample in no way affects, in any systematic way, the composition of the other sample. The two samples come from two groups that have no obvious relationship. For example, where one sample is measurements of a construct like 'self-esteem' among men, and the other among women, but both groups were sampled purely randomly. On the other hand, the concept of dependent groups refers to situations where the samples are related, and it implies that each subject in one group can be systematically paired off with a subject from the other group. For this reason, a dependent groups research design is often referred to as a matched-pairs design. The chi-square test is usually used when you have a cross tabulation of frequency counts of events which are nominal scale measurements. This table is referred to as a contingency table. It is used to compare an observed frequency distribution (frequency counts based on a sample of observation) with the frequency distribution which we would expect to find if the null hypothesis of no relationship between two cross-tabulated variables were true. The Pearson chi-square test statistic, which we indicate with , is a calculation of the difference between the observed and expected frequencies. The formula is $\chi^2_p = \Sigma_{ij} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$ This means is that the expected value for each cell in the contingency table is subtracted from the observed value for that cell, squared, and divided by the expected value for that cell. Then all of these terms are added together to yield χ^2_p

#	Question	Ans	Page	Comments
70	Given the data above, what would be the expected value (it the null hypothesis is true) for health-related problems in community centre B? 1. 20 2. 23.3 3. 70 4. 100	2	P142	See tables and text below

Mental Health Centre (columns) by Type of Problem (rows)	A	B	C	Row totals
'Psychological'	27 (O11)	35 (O12)	32 (O13)	**94 (O1.)**
'Welfare'	16 (O21)	28 (O22)	22 (O23)	**66 (O2.)**
'Health-related'	16 (O31)	20 (O32)	34 (O33)	**70 (O3.)**
Other	29 (O41	17 (O42)	24 (O43)	**70 (O4.)**
Column totals	**88 (O.1)**	**100 (O.2)**	**112**	**300 (O..)**

The cell frequencies represent the way the information is distributed relative to the variables. These cell frequencies are often referred to as the observed or empirical cell frequencies. The question now is: How would these cell frequencies be distributed under the null hypothesis, that is, if H0 is actually true? Asked differently: What are the expected frequencies if the two categorical variables are truly independent?

We can indicate these expected cell frequencies by Eij and they are computed as follows:
E11 = (O1. x O.1)/O.. = (94 x 88)/300 = 27.57 .... (row 1, column 1)
E12 = (O1. x O.2)/O.. = (94 x 100)/ 300 = 31.33 ... (row 1, column 2)
E13 = (O1. x O.3)/O.. = (94 x 112)/ 300 = 35.09 ... (row 1, column 3)
E21 = (O2. x O.1)/O.. = (66 x 88)/ 300 = 19..36 ... (row 2, column 1)
E22 = (O2. x O.2)/O.. = (66 x 100)/ 300 = 22.00 ... (row 2, column 2)
E23 = (O2. x O.3)/O.. = (66 x 112)/ 300 = 24.64.... (row 2, column 3)
E21 = (O3. x O.1)/O.. = (70 x 88)/ 300 = 20.53 ..... (row 3, column 1)
E22 = (O3. x O.2)/O.. = (70 x 100)/ 300 = 23.33 ... (row 3, column 2)
E23 = (O3. x O.3)/O.. = (70 x 112)/ 300 = 26.13 ... (row 3, column 3)
E21 = (O4. x O.1)/O.. = (70 x 88)/ 300 = 20.53 ..... (row 4, column 1)
E22 = (O4. x O.2)/O.. = (70 x 100)/ 300 = 23.33 ... (row 4, column 2)
E23 = (O4. x O.3)/O.. = (70 x 112)/ 300 = 26.13 ... (row 4, column 3)

Mental Health Centre (columns) by Type of Problem (rows)	A	B	C	Row totals
'Psychological'	27 (27.57)	35 (31.33)	32 (35.09)	**94**
'Welfare'	16 (19.36)	28 (22)	22 (24.64)	**66**
'Health-related'	16 (20.53)	20 (23.33)	34 (26.13)	**70**
Other	29 (20.53)	17 (23.33)	24 (26.13)	**70**
Column totals	**88**	**100**	**112**	**300**