UNIVERSITY EXAMINATIONS

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PSYCHOLOGICAL RESEARCH

Duration 2 Hours 70 Marks

EXAMINATION PANEL AS APPOINTED BY THE DEPARTMENT

Use of a non-programmable pocket calculator is permissible

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This paper consists of 18 pages plus 2 blank pages for rough work (pp 19 & 20) plus 1 page (i) of formulae and 4 pages of tables(ii-v) as well as instructions for the completion of a mark reading sheet

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After completing your answers, you must hand in the following

(i) The mark reading sheet
(ii) The question paper (All the pages must be handed in)

This exam paper consists of seventy items Your mark will be converted to a mark out of 90 and 10% of your assignment mark will be added, to produce a mark out of 100 [Note that if your mark is less than 40% the assignment mark will not be added]

ENSURE THAT YOU HAVE WRITTEN YOUR **STUDENT NUMBER** AND **COURSE CODE** ON THE MARK READING SHEET

Please complete the attendance register on the back page, tear off and hand to the invigilator

[TURN OVER]

ANSWER THE FOLLOWING SEVENTY MULTIPLE CHOICE QUESTIONS ON THE MARK READING SHEET. READ THE ATTACHED INSTRUCTIONS AND FOLLOW THEM CAREFULLY.

Question 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

Question 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 operationalized 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

Question 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

Question 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

Question 5

Empirical knowledge is knowledge that is based on - - - - -

1 careful reasoning
2 appropriate theories
3 the observation of events
4 published research

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 "

Question 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

Question 7

"[W]hether 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 operationalization of the construct 'anxiety'
4 the hypothesis to be investigated

Question 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

Question 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

Question 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

Question 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

Question 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

Question 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

Question 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

Question 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

Question 16

The expression "0 05 < p ≤ 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

Question 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

Question 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

Question 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

Question 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

Question 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

Question 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

Question 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

Question 24

Consider the following Table

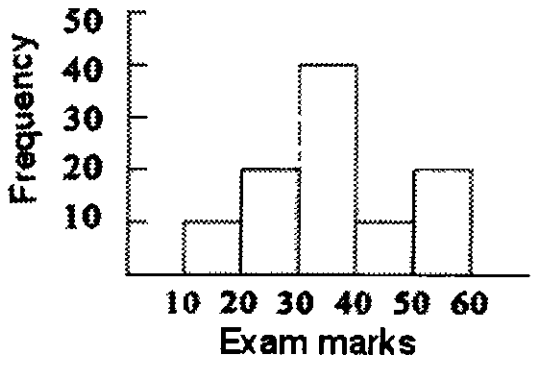
Subject	Student X	Mean of class	Standard deviation of class
A	50%	40%	5%
B	55%	50%	5%
C	60%	50%	10%
D	65%	65%	5%

In which subject did Student X do best, relative to his class?

1 A
2 C
3 D
4 B

Question 25

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

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 speed 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 $\bar{x} = 76$ is found The researcher plans to test the hypothesis at $\alpha = 0\ 05$

Question 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

Question 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 $H_1\ \mu \neq 80$

Question 28

The mean of the sampling distribution of the mean is - - - - -

1 80
2 76
3 20
4 unknown

Question 29

The standard error is - - - - -

1 20
2 2
3 0 05
4 unknown

Question 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

Question 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

Question 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

Question 33

A statistical hypothesis is a formal statement about - - - - -

1 parameters
2 statistics
3 level of significance
4 p-values

Question 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

Question 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

Question 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

Question 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

Question 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

Question 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

Question 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

Question 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
3 the p-value under H_0

Question 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
1 H_0 is true

Question 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

Question 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
3 will be found between the means

Question 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

Question 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

Question 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 $\bar{x} = 127$ 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

Question 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
1 Reject H_0 and accept H_1

Question 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

Question 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)

Question 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

Question 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

Question 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=15 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 sample following sample statistics are calculated from the results

Male voice $\bar{x}_1$= 11 9 seconds, s_1 = 3 5
Female voice $\bar{x}_2$ = 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

Question 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

Question 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 α = 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

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

Question 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

Question 57

Which is an appropriate way to formulate the alternative hypothesis for the analysis of the results?

1 $H_1 \ \underline{\mu}_1 < \underline{\mu}_2$
2 $H_1 \ \overline{x}_1 > \overline{x}_2$
3 $H_1 \ \mu_1 > \mu_2$
4 $H_1 \ \mu_1 \neq \mu_2$

Question 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)

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

Question 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 $\bar{D}$ as the population mean of the differences scores)

1 $H_0\ \mu = 5$
2 $H_0\ \mu_1 = \mu_2$
3 $H_0\ \bar{D} = 0$
4 $H_0\ \mu_1 \neq \mu_2$

Question 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

Question 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
2 two independent groups of subjects, with respect to a single variable

Question 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

Question 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

Question 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

Question 65

What is the most likely value of the correlation coefficient between the following values of variables X and Y?

X	2	7	4	5	1
Y	2	7	4	5	1

1 -1
2 0
3 +1
4 100

Question 66

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 measures 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 $\underline{\mu} = 0$
3 $\overline{x} = 0$
4 $\rho = 0$

Question 67

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

Question 68

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?

	X	Y
A	6	4
B	4	6

1 4
2 5
3 20
4 It cannot be calculated from the information provided

Question 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 (χ^2) test statistic
3 Pearson's correlation test statistic
4 The t-test for two dependent samples

Question 70

Which of the following is the appropnate formula for the chi square test?

1 $\frac{(\bar{x}_1-\bar{x}_2)}{\sqrt{s_1^2/n_1+s_2^2/n_2}}$

2 $\frac{(\bar{x}-\mu_{\bar{x}})}{s_{\bar{x}}}$

3 $\frac{cov(x,y)}{\sqrt{var(x)var(y)}}$

4 $\sum\frac{(O_i-E_i)^2}{E_i}$

[TOTAL: 70]

END OF EXAM PAPER

List of formulae:

$$Z_{\bar{X}} = \frac{\left(\overline{X} - \mu_{\overline{X}}\right)}{\frac{\sigma}{\sqrt{n}}}$$

$$t_C = \frac{\left(\overline{X}_1 - \overline{X}_2\right)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t_{\overline{d}} = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} - 2r\,s_1\,s_2}}$$

$$z_C = \frac{\left(p_1 - p_2\right)}{\sqrt{\frac{p_1\left(1-p_1\right)}{n_1} + \frac{p_2\left(1-p_2\right)}{n_2}}}$$

$$r = \frac{\operatorname{cov}(X,Y)}{\sqrt{\operatorname{var}(X)\operatorname{var}(Y)}}$$

$$r = \frac{N\sum XY - \left(\sum X\right)\left(\sum Y\right)}{\sqrt{\left[N\sum X^2 - \left(\sum X\right)^2\right]\left[N\sum Y^2 - \left(\sum Y\right)^2\right]}}$$

$$t_r = \frac{r\sqrt{N-2}}{\sqrt{1-r^2}}$$

$$\chi_p^2 = \sum_{ij} \frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}}$$

$$t_{\overline{X}} = \frac{\left(\overline{X} - \mu_{\overline{X}}\right)}{s_{\overline{X}}}$$

$$z_p = \frac{\left(p - P_O\right)}{\sqrt{P\left(1 - P_O\right)/n}}$$

The standard normal distribution

z	Mean to z	Larger Portion	Smaller Portion	z	Mean to z	Larger Portion	Smaller Portion
00	0 0000	0 5000	0 5000	45	0 1736	0 6736	0 3264
01	0 0040	0 5040	0 4960	46	0 1772	0 6772	0 3228
02	0 0080	0 5080	0 4920	47	0 1808	0 6808	0 3192
03	0 0120	0 5120	0 4880	48	0 1844	0 6844	0 3156
04	0 0160	0 5160	0 4840	49	0 1879	0 6879	0 3121
05	0 0199	0 5199	0 4801	50	0 1915	0 6915	0 3085
06	0 0239	0 5239	0 4761	51	0 1950	0 6950	0 3050
07	0 0279	0 5279	0 4721	52	0 1985	0 6985	0 3015
08	0 0319	0 5319	0 4681	53	0 2019	0 7019	0 2981
09	0 0359	0 5359	0 4641	54	0 2054	0 7054	0 2946
10	0 0398	0 5398	0 4602	55	0 2088	0 7088	0 2912
11	0 0438	0 5438	0 4562	56	0 2123	0 7123	0 2877
12	0 0478	0 5478	0 4522	57	0 2157	0 7157	0 2843
13	0 0517	0 5517	0 4483	58	0 2190	0 7190	0 2810
14	0 0557	0 5557	0 4443	59	0 2224	0 7224	0 2776
15	0 0596	0 5596	0 4404	60	0 2257	0 7257	0 2743
16	0 0636	0 5636	0 4364	61	0 2291	0 7291	0 2709
17	0 0675	0 5675	0 4325	62	0 2324	0 7324	0 2676
18	0 0714	0 5714	0 4286	63	0 2357	0 7357	0 2643
19	0 0753	0 5753	0 4247	64	0 2389	0 7389	0 2611
20	0 0793	0 5793	0 4207	65	0 2422	0 7422	0 2578
21	0 0832	0 5832	0 4168	66	0 2454	0 7454	0 2546
22	0 0871	0 5871	0 4129	67	0 2486	0 7486	0 2514
23	0 0910	0 5910	0 4090	68	0 2517	0 7517	0 2483
24	0 0948	0 5948	0 4052	69	0 2549	0 7549	0 2451
25	0 0987	0 5987	0 4013	70	0 2580	0 7580	0 2420
26	0 1026	0 6026	0 3974	71	0 2611	0 7611	0 2389
27	0 1064	0 6064	0 3936	72	0 2642	0 7642	0 2358
28	0 1103	0 6103	0 3897	73	0 2673	0 7673	0 2327
29	0 1141	0 6141	0 3859	74	0 2704	0 7704	0 2296
30	0 1179	0 6179	0 3821	75	0 2734	0 7734	0 2266
31	0 1217	0 6217	0 3783	76	0 2764	0 7764	0 2236
32	0 1255	0 6255	0 3745	77	0 2794	0 7794	0 2206
33	0 1293	0 6293	0 3707	78	0 2823	0 7823	0 2177
34	0 1331	0 6331	0 3669	79	0 2852	0 7852	0 2148
35	0 1368	0 6368	0 3632	80	0 2881	0 7881	0 2119
36	0 1406	0 6406	0 3594	81	0 2910	0 7910	0 2090
37	0 1443	0 6443	0 3557	82	0 2939	0 7939	0 2061
38	0 1480	0 6480	0 3520	83	0 2967	0 7967	0 2033
39	0 1517	0 6517	0 3483	84	0 2995	0 7995	0 2005
40	0 1554	0 6554	0 3446	85	0 3023	0 8023	0 1977
41	0 1591	0 6591	0 3409	86	0 3051	0 8051	0 1949
42	0 1628	0 6628	0 3372	87	0 3078	0 8078	0 1922
43	0 1664	0 6664	0 3336	88	0 3106	0 8106	0 1894
44	0 1700	0 6700	0 3300	89	0 3133	0 8133	0 1867

The standard normal distribution

z	Mean to z	Larger Portion	Smaller Portion	z	Mean to z	Larger Portion	Smaller Portion
90	0 3159	0 8159	0 1841	1 35	0 4115	0 9115	0 0885
91	0 3186	0 8186	0 1814	1 36	0 4131	0 9131	0 0869
92	0 3212	0 8212	0 1788	1 37	0 4147	0 9147	0 0853
93	0 3238	0 8238	0 1762	1 38	0 4162	0 9162	0 0838
94	0 3264	0 8264	0 1736	1 39	0 4177	0 9177	0 0823
95	0 3289	0 8289	0 1711	1 40	0 4192	0 9192	0 0808
96	0 3315	0 8315	0 1685	1 41	0 4207	0 9207	0 0793
97	0 3340	0 8340	0 1660	1 42	0 4222	0 9222	0 0778
98	0 3365	0 8365	0 1635	1 43	0 4236	0 9236	0 0764
99	0 3389	0 8389	0 1611	1 44	0 4251	0 9251	0 0749
1 00	0 3413	0 8413	0 1587	1 45	0 4265	0 9265	0 0735
1 01	0 3438	0 8438	0 1562	1 46	0 4279	0 9279	0 0721
1 02	0 3461	0 8461	0 1539	1 47	0 4292	0 9292	0 0708
1 03	0 3485	0 8485	0 1515	1 48	0 4306	0 9306	0 0694
1 04	0 3508	0 8508	0 1492	1 49	0 4319	0 9319	0 0681
1 05	0 3531	0 8531	0 1469	1 50	0 4332	0 9332	0 0668
1 06	0 3554	0 8554	0 1446	1 51	0 4345	0 9345	0 0655
1 07	0 3577	0 8577	0 1423	1 52	0 4357	0 9357	0 0643
1 08	0 3599	0 8599	0 1401	1 53	0 4370	0 9370	0 0630
1 09	0 3621	0 8621	0 1379	1 54	0 4382	0 9382	0 0618
1 10	0 3643	0 8643	0 1357	1 55	0 4394	0 9394	0 0606
1 11	0 3665	0 8665	0 1335	1 56	0 4406	0 9406	0 0594
1 12	0 3686	0 8686	0 1314	1 57	0 4418	0 9418	0 0582
1 13	0 3708	0 8708	0 1292	1 58	0 4429	0 9429	0 0571
1 14	0 3729	0 8729	0 1271	1 59	0 4441	0 9441	0 0559
1 15	0 3749	0 8749	0 1251	1 60	0 4452	0 9452	0 0548
1 16	0 3770	0 8770	0 1230	1 61	0 4463	0 9463	0 0537
1 17	0 3790	0 8790	0 1210	1 62	0 4474	0 9474	0 0526
1 18	0 3810	0 8810	0 1190	1 63	0 4484	0 9484	0 0516
1 19	0 3830	0 8830	0 1170	1 64	0 4495	0 9495	0 0505
1 20	0 3849	0 8849	0 1151	1 65	0 4505	0 9505	0 0495
1 21	0 3869	0 8869	0 1131	1 66	0 4515	0 9515	0 0485
1 22	0 3888	0 8888	0 1112	1 67	0 4525	0 9525	0 0475
1 23	0 3907	0 8907	0 1093	1 68	0 4535	0 9535	0 0465
1 24	0 3925	0 8925	0 1075	1 69	0 4545	0 9545	0 0455
1 25	0 3944	0 8944	0 1056	1 70	0 4554	0 9554	0 0446
1 26	0 3962	0 8962	0 1038	1 71	0 4564	0 9564	0 0436
1 27	0 3980	0 8980	0 1020	1 72	0 4573	0 9573	0 0427
1 28	0 3997	0 8997	0 1003	1 73	0 4582	0 9582	0 0418
1 29	0 4015	0 9015	0 0985	1 74	0 4591	0 9591	0 0409
1 30	0 4032	0 9032	0 0968	1 75	0 4599	0 9599	0 0401
1 31	0 4049	0 9049	0 0951	1 76	0 4608	0 9608	0 0392
1 32	0 4066	0 9066	0 0934	1 77	0 4616	0 9616	0 0384
1 33	0 4082	0 9082	0 0918	1 78	0 4625	0 9625	0 0375
1 34	0 4099	0 9099	0 0901	1 79	0 4633	0 9633	0 0367

The standard normal distribution

z	Mean to z	Larger Portion	Smaller Portion	z	Mean to z	Larger Portion	Smaller Portion
1 80	0 4641	0 9641	0 0359	2 25	0 4878	0 9878	0 0122
1 81	0 4649	0 9649	0 0351	2 26	0 4881	0 9881	0 0119
1 82	0 4656	0 9656	0 0344	2 27	0 4884	0 9884	0 0116
1 83	0 4664	0 9664	0 0336	2 28	0 4887	0 9887	0 0113
1 84	0 4671	0 9671	0 0329	2 29	0 4890	0 9890	0 0110
1 85	0 4678	0 9678	0 0322	2 30	0 4893	0 9893	0 0107
1 86	0 4686	0 9686	0 0314	2 31	0 4896	0 9896	0 0104
1 87	0 4693	0 9693	0 0307	2 32	0 4898	0 9898	0 0102
1 88	0 4699	0 9699	0 0301	2 33	0 4901	0 9901	0 0099
1 89	0 4706	0 9706	0 0294	2 34	0 4904	0 9904	0 0096
1 90	0 4713	0 9713	0 0287	2 35	0 4906	0 9906	0 0094
1 91	0 4719	0 9719	0 0281	2 36	0 4909	0 9909	0 0091
1 92	0 4726	0 9726	0 0274	2 37	0 4911	0 9911	0 0089
1 93	0 4732	0 9732	0 0268	2 38	0 4913	0 9913	0 0087
1 94	0 4738	0 9738	0 0262	2 39	0 4916	0 9916	0 0084
1 95	0 4744	0 9744	0 0256	2 40	0 4918	0 9918	0 0082
1 96	0 4750	0 9750	0 0250	2 41	0 4920	0 9920	0 0080
1 97	0 4756	0 9756	0 0244	2 42	0 4922	0 9922	0 0078
1 98	0 4761	0 9761	0 0239	2 43	0 4925	0 9925	0 0075
1 99	0 4767	0 9767	0 0233	2 44	0 4927	0 9927	0 0073
2 00	0 4772	0 9772	0 0228	2 45	0 4929	0 9929	0 0071
2 01	0 4778	0 9778	0 0222	2 46	0 4931	0 9931	0 0069
2 02	0 4783	0 9783	0 0217	2 47	0 4932	0 9932	0 0068
2 03	0 4788	0 9788	0 0212	2 48	0 4934	0 9934	0 0066
2 04	0 4793	0 9793	0 0207	2 49	0 4936	0 9936	0 0064
2 05	0 4798	0 9798	0 0202	2 50	0 4938	0 9938	0 0062
2 06	0 4803	0 9803	0 0197	2 51	0 4940	0 9940	0 0060
2 07	0 4808	0 9808	0 0192	2 52	0 4941	0 9941	0 0059
2 08	0 4812	0 9812	0 0188	2 53	0 4943	0 9943	0 0057
2 09	0 4817	0 9817	0 0183	2 54	0 4945	0 9945	0 0055
2 10	0 4821	0 9821	0 0179	2 55	0 4946	0 9946	0 0054
2 11	0 4826	0 9826	0 0174	2 56	0 4948	0 9948	0 0052
2 12	0 4830	0 9830	0 0170	2 57	0 4949	0 9949	0 0051
2 13	0 4834	0 9834	0 0166	2 58	0 4951	0 9951	0 0049
2 14	0 4838	0 9838	0 0162	2 59	0 4952	0 9952	0 0048
2 15	0 4842	0 9842	0 0158	2 60	0 4953	0 9953	0 0047
2 16	0 4846	0 9846	0 0154	2 61	0 4955	0 9955	0 0045
2 17	0 4850	0 9850	0 0150	2 62	0 4956	0 9956	0 0044
2 18	0 4854	0 9854	0 0146	2 63	0 4957	0 9957	0 0043
2 19	0 4857	0 9857	0 0143	2 64	0 4959	0 9959	0 0041
2 20	0 4861	0 9861	0 0139	2 65	0 4960	0 9960	0 0040
2 21	0 4864	0 9864	0 0136	2 66	0 4961	0 9961	0 0039
2 22	0 4868	0 9868	0 0132	2 67	0 4962	0 9962	0 0038
2 23	0 4871	0 9871	0 0129	2 68	0 4963	0 9963	0 0037
2 24	0 4875	0 9875	0 0125	2 69	0 4964	0 9964	0 0036

The standard normal distribution

z	Mean to z	Larger Portion	Smaller Portion	z	Mean to z	Larger Portion	Smaller Portion
2 70	0 4965	0 9965	0 0035	2 90	0 4981	0 9981	0 0019
2 71	0 4966	0 9966	0 0034	2 91	0 4982	0 9982	0 0018
2 72	0 4967	0 9967	0 0033	2 92	0 4982	0 9982	0 0018
2 73	0 4968	0 9968	0 0032	2 93	0 4983	0 9983	0 0017
2 74	0.4969	0.9969	0 0031	2.94	0 4984	0 9984	0 0016
2 75	0 4970	0 9970	0 0030	2 95	0 4984	0 9984	0 0016
2 76	0 4971	0 9971	0 0029	2 96	0 4985	0 9985	0 0015
2 77	0 4972	0 9972	0 0028	2 97	0 4985	0 9985	0 0015
2 78	0 4973	0 9973	0 0027	2 98	0 4986	0 9986	0 0014
2 79	0 4974	0 9974	0 0026	2.99	0 4986	0 9986	0 0014
2 80	0 4974	0 9974	0 0026	3 00	0 4987	0 9987	0 0013
2.81	0.4975	0.9975	0 0025				
2 82	0 4976	0.9976	0 0024	3 25	0 4994	0 9994	0 0006
2 83	0 4977	0 9977	0 0023				
2 84	0.4977	0 9977	0 0023	3 50	0 4998	0 9998	0 0002
2 85	0 4978	0 9978	0 0022				
2.86	0 4979	0 9979	0 0021	3 75	0 4999	0 9999	0 0001
2 87	0 4979	0 9979	0 0021				
2 88	0 4980	0 9980	0 0020	4 00	0 5000	1 0000	0 0000
2 89	0 4981	0 9981	0 0019				

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VRAESTELNOMMER

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INITIALS AND SURNAME
VOORLETTERS EN VAN

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DATE OF EXAMINATION
DATUM VAN EKSAMEN

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EKSAMENSENTRUM (BV PRETORIA)

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BELANGRIK

1 GEBRUIK SLEGS N HB POTLOOD OM HIERDIE BLAD TE VOLTOOI
2 MERK AS VOLG
3 KONTROLEER DAT U VOORLETTERS EN VAN REG INGEVUL IS
4 VUL U STUDENTENOMMER VAN LINKS NA REGS IN
5 KONTROLEER DAT U DIE KORREKTE STUDENTENOMMER VERSTREK HET
6 KONTROLEER DAT DIE UNIEKE NOMMER REG INGEVUL IS
7 MAAK SEKER DAT NET EEN ALTERNATIEF PER VRAAG GEMERK IS
8 MOENIE VOU NIE

PART 2 (ANSWERS/ANTWOORDE) DEEL 2

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