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

Closed book examination

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EXAMINERS:

FIRST:	**PROF P KRUGER**	**MS HELENA ERASMUS**
	MR F Z SIMELANE	
SECOND:	**PROF SH VAN DEVENTER**	
EXTERNAL:	**DR LIEZEL KORF**	

This paper consists of 19 pages plus 2 blank pages for rough work (pp 20 & 21) 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 80 and 20% of your year mark (from the assignments) will be added, to produce a mark out of 100 [Note however, that if your exam mark is less than 40% the year 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 the process of setting up a hypothesis as a relationship among variables
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

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

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 which can be applied with absolute certainty
3. 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 devise a systematic procedure to make a construct observable, so 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

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

Question 7

"[W]hether the level of anxiety of persons diagnosed with GAD is actually reduced by psychotherapy" describes - - - - -

1. a theoretical prediction about the effect of psychotherapy
2 the operationalization of the construct 'anxiety'
3 the hypothesis to be investigated

Question 8

The dependent variable in this scenario 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

Question 9

Mean, range, variance and standard deviation are examples of - - - - -

1 inferential statistics
2 test statistics
3 descriptive statistics

Question 10

A researcher would use a - - - - - to make a(n) - - - - - about the nature of the - - - - -

1. sample, inference; population
2 variable, prediction; construct
3. 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

Question 12

A - - - - - is a speculative statement about the relationship among - - - - -, based on observations or expectations

1 hypothesis, statistics
2 theory, variables
3 hypothesis, constructs

Question 13

A jar contains 5 red, 8 blue, 3 green and 4 yellow marbles What is the probability that a blindfolded person would choose a *green* marble purely by chance?

1 0 15
2 0 33
3 0 50

Question 14

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 2/11
3 2/21

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

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

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 0.03, 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

Question 19

The scale along the x-axis of the standard normal distribution indicates - - - - -.

1 probabilities
2. the number of standard deviations below and above the mean
3 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

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

Question 22

Which of the following formulas give an appropriate way in which the probability of a specific event E can be calculated?

(a) $P(E) = \frac{The\ number\ of\ events\ that\ favours\ event\ E}{The\ number\ of\ theoretically\ possible\ outcomes}$

(b) $P(E) = \frac{The\ number\ of\ times\ that\ event\ E\ is\ observed}{The\ total\ number\ of\ times\ that\ the\ experiment\ to\ produce\ the\ event\ was\ performed}$

1 Definition (a) only
2 Definition (b) only.
3. Both definitions (a) and (b) can be used

Question 23

What is a principal advantage of transforming measurements to z scores? They enable one to - - - - -

1. determine whether scores are normally distributed around the mean
2 compare a person's scores on tests with different means and standard deviations
3 determine frequency distributions for tests with different means

Question 24

Consider the following Table which represents the mark of a student (X) on each of three subjects and the class averages for those subjects

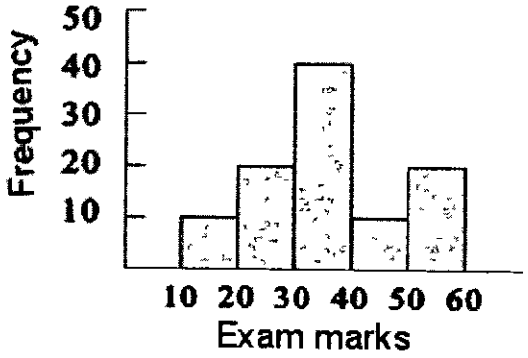
Subject	Student X	Mean of class	Standard deviation of class
History	50%	40%	5%
Geography	65%	62%	5%
Mathematics	60%	50%	10%

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

1 History
2 Geography
3 Mathematics

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 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) The test is standardised in such a way that a higher score implies a better rate of object recognition It is known that the distribution of scores on this test is approximately normal and that a mean of μ=80 and σ=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 $\bar{x}$ = 86 is found The researcher plans to test the hypothesis at α = 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 Rate of object recognition will be better for elderly persons who take the dietary supplement than for those who do not

Question 27

The appropriate alternative hypothesis to be tested for this scenario is - - - - -

1 H_1 $\mu > 80$
2 H_1 $\bar{x} > 80$
3 H_1 $\mu \neq 80$

Question 28

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

1 80
2 86
3 20

Question 29

The standard error is - - - - -.

1 20
2 2
3 0 05

Question 30

With the information as given in the scenario, what would be the appropriate statistical test to test hypothesis?

1 A one sample z-test
2 A two sample t-test
3 A test of the correlation r for a relationship between two variables

Question 31

The appropriate test statistic is calculated and, based on this number, a computer program is used to determine that the one sided p-value = 0 022 What conclusion can be drawn?

The null hypothesis - - - - - which implies that the supplement - - - - - cognitive functioning

1 can be rejected, improves
2 can be rejected, does not improve
3. cannot be rejected, does not improve

Question 32

When applying a statistical test, the probability of a Type I error is equal to - - - - -.

1 the p-value of the test statistic under the alternative hypothesis
2 the level of significance
3 the p-value of the test statistic under the null hypothesis

Question 33

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

1 population parameters
2 sample statistics
3 test statistics

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 alternative, null
2 null; alternative
3. research; statistical

Question 35

When a statistical test yields a large p-value, which of the following statements is most likely to be correct?

1. The alternative hypothesis is probably true.
2 The null hypothesis is probably false.
3 The null hypothesis is probably true

Question 36

The hypothesis "H_1: $\mu < 50$" is a - - - - - hypothesis and requires a - - - - - statistical test

1 non-directional; two-tailed
2 directional, two-tailed
3 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

Question 38

When applying a statistical test a decision is reached by comparing the - - - - - to the - - - - -

1 p-value, level of significance
2 p-value; test statistic
3 test statistic; level of significance

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

Question 40

For a measurement (x) from a population with $\mu = 80$ and $\sigma = 10$, calculate the z-score corresponding to $x = 95$

1. 0 25
2 0 75
3. 1.50

Question 41

Given that a population with $\mu = 80$ and $\sigma = 10$ follows a normal distribution, determine $p(x \geq 95)$ (Hint: use the result of the previous question and select the closest option below).

1 0 0668
2. 0 4332
3 0.9332

Question 42

When doing statistical testing, the size of the level of significance depends on - - - - -

1 a choice made by the researcher
2 the calculation of a test statistic
3 the p-value under H_0

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

Question 44

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 σ
3. ρ

Question 45

The *power* of a statistical test refers to the - - - - -

1. test's ability to give small p-values if the sample size is large
2 test's ability to detect significant results or the 'accuracy' of the test
3 probability that an error of Type I will not be made when the test is used

Question 46

After finding 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 whether a significant effect is sufficiently great to be meaningful from a practical point of view
2 the size of the error that would be made if the null hypothesis is rejected
3 the ability of a statistical test to detect a significant relationship between variables

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 the standard error $s_{\bar{x}}$?

1. 0.37
2 3.0
3. 24

Question 48

Suppose H_0 $\mu = 100$ is tested against H_1 $\mu > 100$ with α=0 05 If the t-statistic based on a sample of data is found to be $t_{\bar{x}} = 1.20$ and the two-tailed p-value is 0.06, what decision regarding the statistical hypothesis can be taken?

1 Reject H_0 and accept H_1.
2 Reject H_1 and accept H_0
3. Do not reject H_0 and accept H_1.

Question 49

Suppose the alternative hypothesis states that $\mu > 60$ The researcher should calculate a test statistic to 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

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 continuous quantitative variables
(c) To compare a group mean with a constant value

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 (c)

Question 51

An educational psychologist wants to establish if raised expectations has an effect on how students do in a maths test. She selects 100 students at random Half of the students (the control group, referred to as Group 1) were told that they have to do 20 maths problems, but that this is just an exercise to practice their skills The remaining 50 students (the treatment group, Group 2) are told to complete the same problems, but that the marks would count towards their final exam mark She decides to use a t-test to compare the results. Which of the test statistics given below is the appropriate test for her to use?

1. $t_{\bar{x}} = \frac{(\bar{x}-\mu)}{s/\sqrt{n}}$

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

3 $t_d = (\bar{d} - \bar{D})/\frac{s_d}{\sqrt{n}}$

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 composition of one sample is not systematically related to the composition of the other one

Base your answers to Questions 53 and 54 on the following scenario:

A researcher wants to investigate the effect of a noisy environment on a task that requires concentration The researcher suspects that people exposed to a noisy environment will react significantly slower in a reaction-speed experiment than those who work in a quiet environment Participants from a random sample of 100 people are requested to perform a test where they have to react to a stimulus on a computer screen by pressing a button as fast as possible The average reaction time of each participant in a quiet environment is recorded for 20 trials. After a break for refreshments, the same participants are asked to repeat the same task a second time. This time however, there are sounds of people in a nearby room playing music and having a loud conversation. The participants are unaware that this is a recording Their reaction times over the same 20 trials are again recorded.

The sample statistics below are the average reaction times (in milliseconds) for each condition.

Condition 1 – no noise. $\overline{x}_1 = 13.8$, $s_1 = 4\ 1$
Condition 2 – noisy environment. $\overline{x}_2 = 14.3$; $s_2 = 3\ 5$

Question 53

Given the scenario above, what type of statistical test is best suited to confirm the relevant statistical hypothesis?

1 A one-tailed t-test for a single group
2 A two-tailed t-test for independent groups
3 A one-tailed t-test for dependent groups

Question 54

After doing the appropriate test, the researcher gets a statistically significant result. He notices however that the difference between the means of the sets of reaction times is quite small He is unsure whether this difference is large enough to be of practical importance Which of the following strategies would be the most appropriate to get a better idea of the practical usefulness of the result?

1. Calculating the effect size, using Cohen's d
2. Calculating the correlation coefficient, using Pearson's r
3. Calculating the power of the test, β

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 program 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.

Base your answers to Questions 56 to 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 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 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

Question 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 $\mu_1 > \mu_2$
3 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 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 30 participants before and after they participate in the workshop

Question 59

The interpersonal skill measurements from before the workshop and those after the workshop should be regarded as samples which comes from - - - - - groups.

1 random
2 independent
3 dependent

Question 60

Which is the appropriate test statistic to calculate?

1 The t-statistic for the mean of a single sample.
2 The t-statistic for the difference between the means of two dependent groups.
3. The t-statistic for the difference between the means of two independent groups

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

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 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 if a person scores low on X, their score on Y will probably be - - - - -

1 high, irrespective of whether the correlation is statistically significant
2 low, irrespective of whether the correlation is statistically significant
3. either high or low, but the relationship will be statistically significant

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

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

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 also measures the spatial ability of each child with a test that measures 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 $\rho = 0$

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 cross-classifying this information against the gender of these patients?

1 A contingency table
2 A scatter plot
3 A histogram

Base your answers to Questions 68 to 70 on the following scenario

As part of an employment equity programme, a researcher is asked to investigate the distribution of male and female staff members across different types of work in a particular IT company After collecting some data, she creates the table below, which represents the *observed frequencies* of managers, administrative staff and staff that provides technical services in the company, cross-classified with genders of the staff members

	Managerial staff	Administrative staff	Technical staff
Female	4	6	2
Male	6	4	8

Question 68

Based on the contingency table above, what would the *expected frequency* of observations in the cell for *female* staff who provide *technical services* be, if no interactions exist between the variables *gender* and *type of work*?

1 2
2 4
3 12

Question 69

Give the scenario, which of the following would be the most appropriate statistical test to use to establish whether a relationship exists between *gender* and *type of work*?

1 The t-test for two independent samples
2 The chi-square (χ^2) test statistic
3 Pearson's correlation test statistic

Question 70

Based on the previous question, which of the following is the appropriate formula for the test statistic which the researcher should use to establish whether a significant relationship between *gender* and type of work exists?

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

2 $\frac{cov(x,y)}{\sqrt{var(x)var(y)}}$

3 $\sum \frac{(O_i - E_i)^2}{E_i}$

[TOTAL: 70]

END OF EXAM PAPER

List of formulae:

$$\frac{\bar{x}-\mu_{\bar{x}}}{\sigma_{\bar{x}}}=\frac{(\bar{x}-\mu)}{\frac{\sigma}{\sqrt{n}}}$$

$$\frac{(\bar{x}-\mu)}{s_{\bar{x}}}=\frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}$$

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

$$\frac{\bar{d}-\bar{D}}{s_{\bar{d}}/\sqrt{n}}=\frac{\bar{d}}{s_{\bar{d}}/\sqrt{n}} \qquad (if\ \bar{D}=0)$$

$$\frac{cov(x,y)}{\sqrt{var(x)\,var(y)}}=\frac{n\Sigma xy-(\Sigma x)(\Sigma y)}{\sqrt{[n\Sigma x^2-(\Sigma x)^2][n\Sigma y^2-(\Sigma y)^2]}}$$

$$\sum_{ij}\frac{(O_{ij}-E_{ij})^2}{E_{ij}}$$

$$\frac{x-\bar{x}}{s} \quad or \quad \frac{x-\mu}{\sigma}$$

$$\sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

$$\frac{\bar{x}_1-\bar{x}_2}{s_p}$$

Appendix: Probabilities associated with the standard normal distribution (z)

z	Mean to z	Larger portion	Smaller portion	z	Mean to z	Larger portion	Smaller portion
0 00	0 0000	0 5000	0.5000	0 51	0.1950	0.6950	0 3050
0.01	0 0040	0 5040	0.4960	0 52	0 1985	0 6985	0 3015
0 02	0 0080	0 5080	0 4920	0.53	0 2019	0 7019	0 2981
0 03	0 0120	0 5120	0 4880	0 54	0.2054	0 7054	0 2946
0 04	0 0160	0.5160	0.4840	0 55	0 2088	0 7088	0 2912
0 05	0.0199	0 5199	0.4801	0 56	0 2123	0.7123	0 2877
0.06	0 0239	0 5239	0.4761	0.57	0 2157	0 7157	0.2843
0 07	0.0279	0 5279	0 4721	0.58	0 2190	0.7190	0 2810
0 08	0.0319	0 5319	0 4681	0 59	0 2224	0 7224	0 2776
0.09	0 0359	0 5359	0.4641	0 60	0 2257	0.7257	0 2743
0 10	0 0398	0 5398	0.4602	0.61	0 2291	0.7291	0 2709
0 11	0 0438	0 5438	0 4562	0 62	0 2324	0 7324	0.2676
0.12	0 0478	0 5478	0 4522	0 63	0 2357	0 7357	0.2643
0.13	0.0517	0 5517	0 4483	0 64	0 2389	0 7389	0.2611
0.14	0 0557	0.5557	0 4443	0.65	0.2422	0 7422	0.2578
0 15	0.0596	0 5596	0.4404	0 66	0.2454	0 7454	0 2546
0 16	0 0636	0 5636	0.4364	0 67	0.2486	0 7486	0 2514
0 17	0 0675	0.5675	0 4325	0.68	0.2517	0 7517	0 2483
0.18	0 0714	0 5714	0 4286	0 69	0.2549	0 7549	0 2451
0 19	0 0753	0 5753	0.4247	0.70	0.2580	0 7580	0 2420
0.20	0.0793	0 5793	0.4207	0 71	0 2611	0 7611	0 2389
0 21	0.0832	0.5832	0.4168	0 72	0.2642	0 7642	0.2358
0 22	0.0871	0.5871	0 4129	0.73	0.2673	0 7673	0 2327
0 23	0 0910	0.5910	0.4090	0.74	0 2704	0.7704	0.2296
0 24	0.0948	0.5948	0 4052	0.75	0.2734	0 7734	0.2266
0.25	0.0987	0 5987	0 4013	0 76	0 2764	0 7764	0 2236
0.26	0 1026	0 6026	0 3974	0.77	0 2794	0.7794	0 2206
0.27	0 1064	0.6064	0 3936	0.78	0 2823	0.7823	0.2177
0 28	0 1103	0 6103	0 3897	0 79	0 2852	0.7852	0.2148
0.29	0 1141	0.6141	0 3859	0.80	0 2881	0.7881	0.2119
0 30	0.1179	0 6179	0.3821	0 81	0 2910	0.7910	0 2090
0 31	0 1217	0.6217	0 3783	0 82	0 2939	0.7939	0.2061
0 32	0.1255	0 6255	0 3745	0 83	0 2967	0.7967	0 2033
0 33	0.1293	0 6293	0.3707	0 84	0.2995	0.7995	0 2005
0.34	0.1331	0.6331	0.3669	0.85	0 3023	0 8023	0.1977
0 35	0 1368	0 6368	0 3632	0 86	0 3051	0.8051	0.1949
0 36	0.1406	0 6406	0.3594	0 87	0.3078	0 8078	0.1922
0 37	0.1443	0 6443	0 3557	0.88	0 3106	0.8106	0 1894
0 38	0.1480	0.6480	0.3520	0 89	0.3133	0 8133	0.1867
0 39	0 1517	0 6517	0 3483	0.90	0 3159	0 8159	0.1841
0 40	0 1554	0.6554	0 3446	0.91	0 3186	0 8186	0.1814
0 41	0 1591	0 6591	0 3409	0 92	0.3212	0 8212	0 1788
0 42	0.1628	0 6628	0.3372	0.93	0.3238	0 8238	0 1762
0.43	0.1664	0.6664	0 3336	0 94	0.3264	0 8264	0 1736
0 44	0.1700	0.6700	0 3300	0.95	0 3289	0 8289	0 1711
0 45	0.1736	0.6736	0 3264	0 96	0 3315	0 8315	0 1685
0 46	0.1772	0 6772	0.3228	0 97	0.3340	0 8340	0 1660
0 47	0.1808	0 6808	0.3192	0.98	0.3365	0 8365	0.1635
0 48	0 1844	0.6844	0 3156	0.99	0 3389	0 8389	0.1611
0 49	0.1879	0.6879	0 3121	1 00	0 3413	0 8413	0 1587
0.50	0.1915	0.6915	0 3085	1.01	0 3438	0 8438	0 1562

Appendix: Probabilities associated with the standard normal distribution (z) continued

z	Mean to z	Larger portion	Smaller portion	z	Mean to z	Larger portion	Smaller portion
1 02	0.3461	0 8461	0.1539	1 53	0 4370	0 9370	0.0630
1 03	0 3485	0 8485	0 1515	1 54	0 4382	0 9382	0 0618
1 04	0.3508	0 8508	0.1492	1.55	0.4394	0 9394	0 0606
1 05	0 3531	0 8531	0.1469	1.56	0 4406	0 9406	0 0594
1.06	0 3554	0 8554	0 1446	1 57	0.4418	0 9418	0 0582
1.07	0.3577	0 8577	0 1423	1 58	0.4429	0 9429	0.0571
1 08	0.3599	0 8599	0.1401	1 59	0 4441	0 9441	0 0559
1 09	0.3621	0 8621	0 1379	1 60	0.4452	0 9452	0 0548
1 10	0 3643	0.8643	0.1357	1 61	0 4463	0.9463	0 0537
1 11	0.3665	0.8665	0 1335	1 62	0 4474	0 9474	0 0526
1 12	0.3686	0 8686	0 1314	1 63	0 4484	0 9484	0 0516
1 13	0 3708	0 8708	0 1292	1 64	0 4495	0 9495	0 0505
1 14	0 3729	0 8729	0 1271	1 65	0 4505	0 9505	0 0495
1 15	0.3749	0 8749	0.1251	1 66	0.4515	0 9515	0 0485
1 16	0 3770	0 8770	0 1230	1 67	0 4525	0 9525	0 0475
1.17	0.3790	0 8790	0 1210	1 68	0.4535	0 9535	0 0465
1.18	0 3810	0 8810	0 1190	1 69	0.4545	0 9545	0 0455
1.19	0 3830	0.8830	0 1170	1.70	0 4554	0 9554	0 0446
1 20	0 3849	0 8849	0 1151	1 71	0 4564	0 9564	0 0436
1.21	0 3869	0 8869	0 1131	1 72	0 4573	0.9573	0.0427
1 22	0 3888	0 8888	0.1112	1 73	0.4582	0.9582	0 0418
1.23	0 3907	0.8907	0 1093	1 74	0 4591	0 9591	0 0409
1 24	0 3925	0.8925	0.1075	1 75	0 4599	0.9599	0 0401
1 25	0 3944	0 8944	0.1056	1 76	0.4608	0 9608	0.0392
1 26	0 3962	0 8962	0.1038	1 77	0 4616	0.9616	0.0384
1 27	0.3980	0 8980	0 1020	1 78	0 4625	0 9625	0.0375
1 28	0 3997	0 8997	0.1003	1 79	0 4633	0 9633	0 0367
1.29	0 4015	0.9015	0 0985	1 80	0 4641	0 9641	0 0359
1 30	0 4032	0 9032	0 0968	1 81	0 4649	0 9649	0 0351
1 31	0 4049	0 9049	0 0951	1.82	0 4656	0 9656	0 0344
1 32	0 4066	0 9066	0 0934	1 83	0 4664	0.9664	0.0336
1 33	0 4082	0.9082	0 0918	1 84	0.4671	0 9671	0 0329
1 34	0 4099	0 9099	0 0901	1.85	0 4678	0 9678	0 0322
1 35	0 4115	0 9115	0 0885	1 86	0.4686	0.9686	0 0314
1 36	0 4131	0.9131	0 0869	1 87	0 4693	0 9693	0 0307
1.37	0 4147	0 9147	0 0853	1 88	0 4699	0.9699	0 0301
1 38	0 4162	0.9162	0 0838	1 89	0 4706	0.9706	0.0294
1.39	0.4177	0 9177	0 0823	1 90	0 4713	0.9713	0.0287
1 40	0.4192	0.9192	0 0808	1 91	0.4719	0 9719	0 0281
1 41	0.4207	0 9207	0 0793	1 92	0 4726	0 9726	0 0274
1 42	0 4222	0 9222	0 0778	1 93	0 4732	0.9732	0.0268
1 43	0 4236	0 9236	0.0764	1 94	0 4738	0 9738	0.0262
1 44	0.4251	0 9251	0 0749	1 95	0 4744	0 9744	0 0256
1 45	0 4265	0 9265	0 0735	1 96	0 4750	0 9750	0 0250
1 46	0 4279	0.9279	0 0721	1 97	0 4756	0 9756	0.0244
1 47	0 4292	0 9292	0 0708	1 98	0 4761	0.9761	0 0239
1 48	0 4306	0.9306	0 0694	1 99	0 4767	0 9767	0 0233
1 49	0 4319	0 9319	0 0681	2.00	0 4772	0 9772	0 0228
1 50	0 4332	0 9332	0.0668	2.01	0 4778	0 9778	0 0222
1 51	0.4345	0.9345	0 0655	2 02	0 4783	0 9783	0 0217
1 52	0 4357	0 9357	0 0643	2 03	0 4788	0 9788	0 0212

Appendix: Probabilities associated with the standard normal distribution (z) continued

z	Mean to z	Larger portion	Smaller portion	z	Mean to z	Larger portion	Smaller portion
2 04	0 4793	0 9793	0.0207	2 55	0 4946	0 9946	0 0054
2 05	0 4798	0 9798	0 0202	2 56	0 4948	0 9948	0.0052
2 06	0 4803	0 9803	0.0197	2 57	0 4949	0 9949	0.0051
2 07	0.4808	0 9808	0 0192	2 58	0 4951	0 9951	0.0049
2.08	0 4812	0 9812	0.0188	2 59	0 4952	0 9952	0 0048
2 09	0 4817	0 9817	0 0183	2 60	0.4953	0 9953	0 0047
2.10	0.4821	0 9821	0.0179	2 61	0.4955	0 9955	0 0045
2 11	0 4826	0 9826	0.0174	2 62	0.4956	0 9956	0 0044
2 12	0 4830	0 9830	0 0170	2.63	0 4957	0 9957	0 0043
2 13	0 4834	0 9834	0.0166	2 64	0.4959	0 9959	0 0041
2 14	0.4838	0 9838	0 0162	2.65	0.4960	0 9960	0.0040
2.15	0.4842	0 9842	0 0158	2.66	0.4961	0 9961	0 0039
2 16	0 4846	0 9846	0 0154	2 67	0 4962	0 9962	0.0038
2.17	0 4850	0 9850	0.0150	2 68	0 4963	0 9963	0.0037
2 18	0.4854	0 9854	0.0146	2 69	0.4964	0.9964	0 0036
2.19	0.4857	0.9857	0.0143	2 70	0.4965	0 9965	0 0035
2 20	0.4861	0 9861	0.0139	2 71	0.4966	0 9966	0 0034
2 21	0.4864	0 9864	0.0136	2 72	0.4967	0 9967	0 0033
2.22	0.4868	0 9868	0 0132	2 73	0 4968	0 9968	0 0032
2.23	0 4871	0 9871	0.0129	2 74	0.4969	0.9969	0.0031
2 24	0 4875	0.9875	0 0125	2 75	0 4970	0.9970	0.0030
2 25	0 4878	0 9878	0 0122	2 76	0 4971	0 9971	0.0029
2.26	0 4881	0.9881	0.0119	2 77	0 4972	0.9972	0 0028
2 27	0.4884	0.9884	0 0116	2 78	0 4973	0.9973	0 0027
2 28	0.4887	0.9887	0 0113	2.79	0 4974	0.9974	0.0026
2 29	0 4890	0 9890	0 0110	2.80	0 4974	0.9974	0.0026
2 30	0.4893	0.9893	0.0107	2.81	0 4975	0.9975	0.0025
2 31	0.4896	0.9896	0 0104	2.82	0.4976	0.9976	0 0024
2 32	0.4898	0.9898	0 0102	2.83	0.4977	0.9977	0.0023
2.33	0.4901	0.9901	0.0099	2.84	0.4977	0 9977	0 0023
2 34	0.4904	0.9904	0 0096	2 85	0.4978	0 9978	0 0022
2 35	0.4906	0.9906	0 0094	2 86	0.4979	0 9979	0 0021
2 36	0 4909	0.9909	0 0091	2.87	0 4979	0 9979	0 0021
2 37	0 4911	0.9911	0.0089	2.88	0.4980	0.9980	0 0020
2.38	0 4913	0.9913	0 0087	2 89	0.4981	0 9981	0 0019
2 39	0 4916	0 9916	0.0084	2 90	0.4981	0.9981	0.0019
2 40	0 4918	0 9918	0.0082	2 91	0.4982	0 9982	0 0018
2 41	0.4920	0.9920	0 0080	2.92	0.4982	0 9982	0.0018
2 42	0 4922	0 9922	0 0078	2 93	0 4983	0 9983	0 0017
2 43	0 4925	0 9925	0 0075	2 94	0.4984	0 9984	0 0016
2 44	0 4927	0 9927	0 0073	2 95	0 4984	0 9984	0.0016
2 45	0.4929	0.9929	0.0071	2.96	0.4985	0.9985	0.0015
2 46	0.4931	0 9931	0 0069	2.97	0.4985	0.9985	0.0015
2 47	0 4932	0 9932	0 0068	2 98	0 4986	0 9986	0 0014
2 48	0 4934	0.9934	0 0066	2 99	0 4986	0.9986	0.0014
2.49	0.4936	0.9936	0 0064	3 00	0.4987	0.9987	0 0013
2 50	0.4938	0.9938	0 0062	3 01	0 4987	0.9987	0.0013
2.51	0.4940	0 9940	0.0060	3 02	0 4987	0.9987	0.0013
2 52	0.4941	0.9941	0 0059	3.03	0.4988	0 9988	0.0012
2 53	0.4943	0.9943	0.0057	3 04	0 4988	0 9988	0 0012
2 54	0.4945	0.9945	0 0055	3.05	0.4989	0 9989	0.0011

Appendix: Probabilities associated with the standard normal distribution (z) continued

z	Mean to z	Larger portion	Smaller portion	z	Mean to z	Larger portion	Smaller portion
3 06	0 4989	0 9989	0.0011	3 19	0 4993	0 9993	0 0007
3 07	0 4989	0 9989	0.0011	3 20	0 4993	0 9993	0.0007
3 08	0 4990	0 9990	0 0010	3.21	0 4993	0 9993	0 0007
3 09	0.4990	0 9990	0 0010	3 22	0 4994	0 9994	0 0006
3 10	0.4990	0 9990	0 0010	3 23	0.4994	0 9994	0 0006
3 11	0 4991	0 9991	0 0009	3 24	0 4994	0 9994	0 0006
3 12	0 4991	0 9991	0.0009	3 25	0 4994	0 9994	0 0006
3 13	0.4991	0 9991	0 0009				
3 14	0 4992	0 9992	0 0008	3 50	0 4998	0.9998	0 0002
3 15	0 4992	0 9992	0 0008				
3 16	0.4992	0 9992	0 0008	3 75	0.4999	0 9999	0.0001
3 17	0 4992	0.9992	0.0008				
3 18	0 4993	0 9993	0.0007	4 00	0 5000	1.000	0 0000

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3 INITIALS AND SURNAME / VOORLETTERS EN VAN

4 DATE OF EXAMINATION / DATUM VAN EKSAMEN

5 EXAMINATION CENTRE (E.G. PRETORIA) / EKSAMENSENTRUM (BV. PRETORIA)

6 STUDENT NUMBER / STUDENTENOMMER

7 c0 c0 c0 c0 c0 c0 c0 c0 c0 c0
c1 c1 c1 c1 c1 c1 c1 c1 c1 c1
c2 c2 c2 c2 c2 c2 c2 c2 c2 c2
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c4 c4 c4 c4 c4 c4 c4 c4 c4 c4
c5 c5 c5 c5 c5 c5 c5 c5 c5 c5
c6 c6 c6 c6 c6 c6 c6 c6 c6 c6
c7 c7 c7 c7 c7 c7 c7 c7 c7 c7
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9 c0 c0 c0 c0 c0 c0
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c9 c9 c9 c9 c9 c9

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10

1 c1 c2 c3 c4 c5	36 c1 c2 c3 c4 c5	71 c1 c2 c3 c4 c5	106 c1 c2 c3 c4 c5
2 c1 c2 c3 c4 c5	37 c1 c2 c3 c4 c5	72 c1 c2 c3 c4 c5	107 c1 c2 c3 c4 c5
3 c1 c2 c3 c4 c5	38 c1 c2 c3 c4 c5	73 c1 c2 c3 c4 c5	108 c1 c2 c3 c4 c5
4 c1 c2 c3 c4 c5	39 c1 c2 c3 c4 c5	74 c1 c2 c3 c4 c5	109 c1 c2 c3 c4 c5
5 c1 c2 c3 c4 c5	40 c1 c2 c3 c4 c5	75 c1 c2 c3 c4 c5	110 c1 c2 c3 c4 c5
6 c1 c2 c3 c4 c5	41 c1 c2 c3 c4 c5	76 c1 c2 c3 c4 c5	111 c1 c2 c3 c4 c5
7 c1 c2 c3 c4 c5	42 c1 c2 c3 c4 c5	77 c1 c2 c3 c4 c5	112 c1 c2 c3 c4 c5
8 c1 c2 c3 c4 c5	43 c1 c2 c3 c4 c5	78 c1 c2 c3 c4 c5	113 c1 c2 c3 c4 c5
9 c1 c2 c3 c4 c5	44 c1 c2 c3 c4 c5	79 c1 c2 c3 c4 c5	114 c1 c2 c3 c4 c5
10 c1 c2 c3 c4 c5	45 c1 c2 c3 c4 c5	80 c1 c2 c3 c4 c5	115 c1 c2 c3 c4 c5
11 c1 c2 c3 c4 c5	46 c1 c2 c3 c4 c5	81 c1 c2 c3 c4 c5	116 c1 c2 c3 c4 c5
12 c1 c2 c3 c4 c5	47 c1 c2 c3 c4 c5	82 c1 c2 c3 c4 c5	117 c1 c2 c3 c4 c5
13 c1 c2 c3 c4 c5	48 c1 c2 c3 c4 c5	83 c1 c2 c3 c4 c5	118 c1 c2 c3 c4 c5
14 c1 c2 c3 c4 c5	49 c1 c2 c3 c4 c5	84 c1 c2 c3 c4 c5	119 c1 c2 c3 c4 c5
15 c1 c2 c3 c4 c5	50 c1 c2 c3 c4 c5	85 c1 c2 c3 c4 c5	120 c1 c2 c3 c4 c5
16 c1 c2 c3 c4 c5	51 c1 c2 c3 c4 c5	86 c1 c2 c3 c4 c5	121 c1 c2 c3 c4 c5
17 c1 c2 c3 c4 c5	52 c1 c2 c3 c4 c5	87 c1 c2 c3 c4 c5	122 c1 c2 c3 c4 c5
18 c1 c2 c3 c4 c5	53 c1 c2 c3 c4 c5	88 c1 c2 c3 c4 c5	123 c1 c2 c3 c4 c5
19 c1 c2 c3 c4 c5	54 c1 c2 c3 c4 c5	89 c1 c2 c3 c4 c5	124 c1 c2 c3 c4 c5
20 c1 c2 c3 c4 c5	55 c1 c2 c3 c4 c5	90 c1 c2 c3 c4 c5	125 c1 c2 c3 c4 c5
21 c1 c2 c3 c4 c5	56 c1 c2 c3 c4 c5	91 c1 c2 c3 c4 c5	126 c1 c2 c3 c4 c5
22 c1 c2 c3 c4 c5	57 c1 c2 c3 c4 c5	92 c1 c2 c3 c4 c5	127 c1 c2 c3 c4 c5
23 c1 c2 c3 c4 c5	58 c1 c2 c3 c4 c5	93 c1 c2 c3 c4 c5	128 c1 c2 c3 c4 c5
24 c1 c2 c3 c4 c5	59 c1 c2 c3 c4 c5	94 c1 c2 c3 c4 c5	129 c1 c2 c3 c4 c5
25 c1 c2 c3 c4 c5	60 c1 c2 c3 c4 c5	95 c1 c2 c3 c4 c5	130 c1 c2 c3 c4 c5
26 c1 c2 c3 c4 c5	61 c1 c2 c3 c4 c5	96 c1 c2 c3 c4 c5	131 c1 c2 c3 c4 c5
27 c1 c2 c3 c4 c5	62 c1 c2 c3 c4 c5	97 c1 c2 c3 c4 c5	132 c1 c2 c3 c4 c5
28 c1 c2 c3 c4 c5	63 c1 c2 c3 c4 c5	98 c1 c2 c3 c4 c5	133 c1 c2 c3 c4 c5
29 c1 c2 c3 c4 c5	64 c1 c2 c3 c4 c5	99 c1 c2 c3 c4 c5	134 c1 c2 c3 c4 c5
30 c1 c2 c3 c4 c5	65 c1 c2 c3 c4 c5	100 c1 c2 c3 c4 c5	135 c1 c2 c3 c4 c5
31 c1 c2 c3 c4 c5	66 c1 c2 c3 c4 c5	101 c1 c2 c3 c4 c5	136 c1 c2 c3 c4 c5
32 c1 c2 c3 c4 c5	67 c1 c2 c3 c4 c5	102 c1 c2 c3 c4 c5	137 c1 c2 c3 c4 c5
33 c1 c2 c3 c4 c5	68 c1 c2 c3 c4 c5	103 c1 c2 c3 c4 c5	138 c1 c2 c3 c4 c5
34 c1 c2 c3 c4 c5	69 c1 c2 c3 c4 c5	104 c1 c2 c3 c4 c5	139 c1 c2 c3 c4 c5
35 c1 c2 c3 c4 c5	70 c1 c2 c3 c4 c5	105 c1 c2 c3 c4 c5	140 c1 c2 c3 c4 c5

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This is to certify that I have read the rules governing the examinations as set out on the inside cover of this examination answer book and in the examination instructions

That the information supplied by me in this answer book is correct and valid

I undertake to adhere to the procedures, rules and regulations of the University of South Africa as published in the official brochures

Signature of candidate

ID Number

Batch No
28092015MCQ

Signature of invigilator

UNISA invigilator s personnel number

NOTE Not a valid document if not completed by the Invigilator