NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES
SCHOOL OF NATURAL AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCE

QUALIFICATION: Bachelor of Science in Applied Mathematics and Statistics Bachelor of Tourism Innovation and Development Bachelor of Natural Resource Management and Nature Conservation	
QUALIFICATION CODE: 07BSAM ; 07BTID ; 07BNTC	**LEVEL:** 5
COURSE CODE: IAS501S	**COURSE NAME:** INTRODUCTION TO APPLIED STATISTICS
SESSION: JUNE 2023	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	MR. ROUX, AJ & MR. KASHIHALWA, S
MODERATOR:	DR. D. NRIRAMPEBA

INSTRUCTIONS
1. Answer ALL the questions.

PERMISSIBLE MATERIALS

1. Non-Programable Scientific Calculator

ATTACHMENTS

1. Statistical Tables (z-tables)
2. 1 x A4 Graph Paper (to be supplied by Examinations Department)
3. Formulae Sheets

THIS QUESTION PAPER CONSISTS OF 6 PAGES (Including this front page)

QUESTION 1 [15 X 2 = 30]

1. A parameter is:
A. a sample characteristic
B. a population characteristic
C. unknown
D. normal normally distributed

2. A statistic is:
A. a sample characteristic
B. a population characteristic
C. unknown
D. normally distributed

3. A researcher is interested in the travel time of Utrecht University students to college. A group of 50 students is interviewed. Their mean travel time in 16.7 minutes. For this study the mean of 16.7 minutes is an example of a(n)
A. Parameter
B. Statistic
C. Population
D. Sample

4. A researcher is curious about the IQ of students at the Utrecht University. The entire group students is an example of a:
A. Parameter
B. Statistic
C. Population
D. Sample

5. Statistical techniques that summarize and organize the data are classified as:
A. Population statistics
B. Sample statistics
C. Descriptive statistics
D. Inferential statistics

6. A researcher studies the factors that determine the number of children future couples decide to have. The variable 'number of children' is a :
A. Discrete variable
B. Continuous variable
C. Categorical variable
D. Ordinal variable

7. A teacher asks students to identity their favorite reality television show. What type of measurement scale do the different television shows make up?

A. Nominal
B. Ordinal
C. Interval
D. Ratio

8. The median is always:

A. The most frequently occurring score in a data set
B. The middle score when results are ranked in order of magnitude
C. The same as the mean
D. The difference between the maximum and minimum scores.

9. The seminar rooms in the library are identified by the letters A to H. A researcher records the number of classes held in each room during the first semester. What kind of graph would be appropriate to present the frequency distributions of these data?

A. Histogram
B. Scatterplot
C. Bar chart
D. Box plot

10. The sum of the percent frequencies for all classes will always equal

A. ten
B. the number of classes
C. the number of items in the study
D. 100
E. None of the above answers is correct

11. The difference between the largest and the smallest data values is the

A. variance
B. interquartile range
C. range
D. coefficient of variation
E. None of the above answers is correct.

12. Which of the following is not a measure of central location?

A. mean

B. median

C. variance

D. mode

E. None of the above answers is correct.

13. The most frequently occurring value of a data set is called the

A. range

B. mode

C. mean

D. median

E. None of the above answers is correct

14. The value that has half of the observations above it and half the observations below it is called the

A. range

B. mean

C. median

D. mode

E. None of the above answers is correct.

15. Which of the following is not a measure of dispersion?

A. the range

B. the 50th percentile

C. the standard deviation.

D. the interquartile range

E. the variance

QUESTION 2 [15]

The Ministry of Education summarized the mathematics grades of ten thousand Grade 12 learners. The result was to categorize into the following categories *A, B, C, D* and *E* respectively. The following table shows data on mathematics results for a sample of 50 Grade 12 learners.

A	C	E	B	D	C	D	B	D	C
D	*B*	*D*	*E*	*C*	*A*	*D*	*C*	*D*	*E*
D	C	A	B	D	C	B	E	C	D
B	*C*	*D*	*C*	*D*	*C*	*E*	*A*	*D*	*C*
C	*B*	*D*	*D*	*B*	*D*	*C*	*E*	*B*	*A*

2.1) Construct the frequency distribution for the set of qualitative data in the table. (8)
2.2) Construct the relative frequency distribution for the data set. (2)
2.3) Draw the bar chart for the absolute frequency distribution for the data set. (5)

QUESTION 3 [15]

The Namibian Agricultural Union compiled a record of rainfall recorded over 56 farms over the past three months. The information is displayed in the table below:

Rainfall (mm)	Number of farms
3-<7	12
7-<11	24
11-<15	14
15-<19	9
19-<23	1

3.1 Find the mean rainfall [3]
3.2 Find the median rainfall [6]
3.2 Find the modal rainfall [6]

QUESTION 4 [15]

A popular retail store receives, on average 6 calls per day.

4.1) What is the probability that on any given day:

4.1.1) No calls will be received (3)

4.1.2) At most two calls will be received (4)

4.1.3) At least four calls will be received (4)

4.2) What is the probability that the retail store will receive exactly ten calls during the next two days (4)

QUESTION 5 [15]

If IQs of a large group of people have a normal distribution with a mean of 100 and a standard deviation of 15, find the probability of randomly selecting a person with an IQ:

5.1) Between 85 and 115 (inclusive) [5]

5.2) Of more than 130 (inclusive) [5]

5.3) of either less than 80 or more than 120 (inclusive) [5]

QUESTION 6 [10]

The asset turnovers, excluding cash and short-term investments, for the Super Spar Company from 2013 to 2022 are listed below (in $mil):

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Invest	3.0	4.2	4.8	3.7	3.4	4.3	5.6	4.4	3.8	4.1

61) Determine the least squares trend line equation, using the sequential coding method with X=1 in 2013. [8]

6.2) Use the trend line equation to estimate turnovers for 2025 [2]

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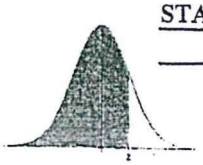
Standard Normal Distribution Tables

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414



STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

APPENDIX A

Population mean, raw data

$$\mu = \frac{\sum x}{N}$$

Sample mean, raw data

$$\bar{X} = \frac{\sum x}{n}$$

Weighted mean

$$\overline{X_w} = \frac{w_1 X_1 + w_2 X_2 + \ldots + w_n X_n}{w_1 + w_2 + \ldots + w_n}$$

Geometric mean

$$GM = \sqrt[n]{(X_1)\ (X_2)\ (X_3)\ \ldots\ (X_n)}$$

Geometric mean rate of increase

$$GM = \sqrt[n]{\frac{\text{Value at end of period}}{\text{Value at start of period}}} - 1.0$$

Sample mean grouped data

$$\overline{X} = \frac{\sum fx}{n}$$

Median of grouped data

$$\text{Median} = L + \frac{\frac{n}{2} - CF}{f}\ (\text{Class width})$$

Mean deviation

$$MD = \frac{\sum |\ X - \bar{X}\ |}{n}$$

Linear regression equation

$$Y = a + bX$$

Sample variance for raw data

$$S^2 = \frac{\sum (X - \bar{X})^2}{n - 1}$$

Sample variance, raw data computational form

$$S^2 = \frac{\sum X^2 - \frac{(\sum X)^2}{n}}{n - 1}$$

Sample standard deviation, raw data

$$S = \sqrt{\frac{\sum X^2 - \frac{(\sum X)^2}{n}}{n - 1}}$$

Sample standard deviation, grouped data

$$S = \sqrt{\frac{\sum fX^2 - \frac{(\sum fX)^2}{n}}{n - 1}}$$

Coefficient of variation

$$CV = \frac{S}{X}\ (100)$$

Location of percentile

$$L_p = (n + 1)\ \frac{P}{100}$$

Pearson ' s Correlation coefficient

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

Correlation test of hypothesis

$$t = \frac{r\sqrt{n - 2}}{\sqrt{1 - r^2}}$$

Population standard deviation for raw data

$$\sigma = \sqrt{\frac{\sum (X - \mu)^2}{N}}$$

Population variance for raw data

$$\sigma^2 = \frac{\sum (X - \mu)^2}{N}$$

Slope of regression line

$$b = \frac{n\ (\sum XY) - (\sum X)\ (\sum Y)}{n\ (\sum X^2) - (\sum X)^2}$$

Intercept of a regression line

$$a = \frac{\sum Y}{n} - b\left(\frac{\sum X}{n}\right)$$

The Range

$$\text{Range} = \text{highest} - \text{lowest}$$

APPENDIX B: ADDITIONAL FORMULAE

$$\text{Mode} = L + \left(\frac{d_1}{d_1 + d_2}\right) \times c$$

$$\text{position } Q_j = \frac{jn}{4} \qquad \text{value } Q_j = L + \frac{\left(\frac{jn}{4} - F\right) \times c}{f_{Q_j}}$$

$$\text{position } P_j = \frac{jn}{100} \qquad \text{value } P_j = L + \frac{\left(\frac{jn}{100} - F\right) \times c}{f_{P_j}}$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} \qquad P(x) = \frac{n!}{x!(n-x)!}\pi^x(1-\pi)^{n-x} \qquad \text{P (x)} = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$z = \frac{x - \mu}{\sigma} \qquad z_{calc} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \qquad t_{calc} = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$z_{calc} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \qquad t_{calc} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n-1)s_1^2 + (n-1)s_2^2}{n_1 + n_2 - 1}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} \qquad z_{calc} = \frac{p_A - p_B}{\sqrt{(p \times q)\left(\frac{1}{n_A} + \frac{1}{n_B}\right)}} \qquad p = \frac{n_A p_B + n_B p_A}{n_A + n_B} \qquad q = 1 - p$$

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

$$F_V = P_V(1 + in) \qquad F_V = P_V(1+i)^n \qquad r = (1+i)^m - 1 \qquad D = B(1-i)^n$$

$$P = \frac{A}{(1+i)^n} \qquad PV = \frac{P(1+i)^n}{(1+j)^n} \qquad IRR = \frac{N_1 I_2 - N_2 I_1}{N_1 - N_2}$$