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: JULY 2023	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SUPPLEMENTARY / SECOND 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 8 PAGES (Including this front page)

QUESTION 1 [15 X 2 = 30]

1. A numerical value used as a summary measure for a sample, such as sample mean, is known as a
   A. population parameter
   B. sample parameter
   C. sample statistic
   D. population mean
   E. None of the above answers is correct.

2. If a data set has an even number of observations, the median
   A. can not be determined
   B. is the average value of the two middle items
   C. must be equal to the mean
   D. is the average value of the two middle items when all items are arranged in ascending order
   E. None of the above answers is correct

3. The standard deviation of a sample of 100 observations equals 64. The variance of the sample equals
   A. 8
   B. 10
   C. 6400
   D. 4096
   E. None of the above answers is correct.

4. The variance of a sample of 81 observations equals 64. The standard deviation of the sample equals
   A. 0
   B. 4096
   C. 8
   D. 6,561
   E. None of the above answers is correct.

Case 1 : Consider the result of a fictional Stats final exam taken by 155 students, as given in the following relative frequency distribution:

Grade	Less than 50	50-59	60 - 69	70 - 79	80 - 89	90 - 100		
frequency	35	40	30	25	15	10		

5. Refer to Case 1 - How many students received at least a 70 in this exam?

A. 25

B. 50

C. 25

D. 30

E. 40

6. Refer to Case 1 - How many students received at most a 59 on this exam?

A. 10

B. 45

C. 75

D. 40

E. 66

Case 2 : The following data show the number of hours worked by 200 statistics students.

Number of Hours Frequency

HOURS	# Students
0 --- 9	40
10 ---- 19	50
20 ---- 29	70
30 ---- 39	40

7. Refer to Case 2. The class width for this distribution

A. 9

B. 10

C. 11

D. varies from class to class

E. None of the above answers is correct.

8. Refer to Case 2. The number of students working 19 hours or less

A. 40

B. 50

C. 90

D. can not be determined without the original data

E. None of the above answers is correct.

9. Refer to Case 2. The relative frequency of students working 9 hours or less

A. 0.2

B. 0.45

C. 40

D. can not be determined from the information given

E. None of the above answers is correct.

10. Refer to Case 2. The cumulative relative frequency for the class of 10 - 19

A. 90

B. 0.25

C. 0.45

D. can not be determined from the information given

E. None of the above answers is correct.

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

A. Nominal

B. Ordinal

C. Interval

D. Ratio

12. 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

13. What is the mean for the following scores: 2, 5, 4, 1, 8?

A. 3

B. 4

C. 5

D. 20

14. What is the median for the following scores: 2, 5, 4, 1, 8?

A. 3.5

B. 4

C. 4.5

D. 7

15. Which of the following sets of scores has the greatest variability (range)?

A. 2, 5, 8, 11

B. 13, 13, 13, 13

C. C. 20, 25, 26 ,27

D. D. 42, 43, 44, 45

QUESTION 2 [15]

The distance traveled (in kilometers) by a courier service motorcycle on 30 trips were recorded by the driver.

224	**219**	**221**	**227**	**220**	**217**	**217**	**232**	**222**	**226**
218	**213**	**223**	**230**	**210**	**213**	**218**	**222**	**234**	**216**
218	**223**	**215**	**219**	**228**	**225**	**225**	**220**	**217**	**215**

2.1) Use the data provided above to construct a frequency distribution table with 210 as the lower limit of your first class interval and a constant width of four (4) units for all intervals. (7)

2.2) Construct a histogram and a polygon of the relative frequency distribution, (8)

QUESTION 3 [16]

A marketing research survey shows that approximately 80% of car owners indicate that their next car purchase would be an electric propelled car. If 5 prospective buyers are interviewed, determine the probability that:

3.1) all 5 indicate that their next car will be an electric propelled car. (4)

3.2) At least three indicate that his or her next purchase will be an electric propelled car. (4)

3.3) no-one indicates that their next car will be an electric propelled car (4)

3.4) At most one indicates that his or her next purchase will be an electric propelled car. (4)

QUESTION 4 [30]

4.1) Pulse rates of adult men are approximately normally distributed with a mean of 70 and a standard deviation of 8. What is the probability of selecting a man with pulse rate of .....

4.1.1) 74.9 and higher (4)

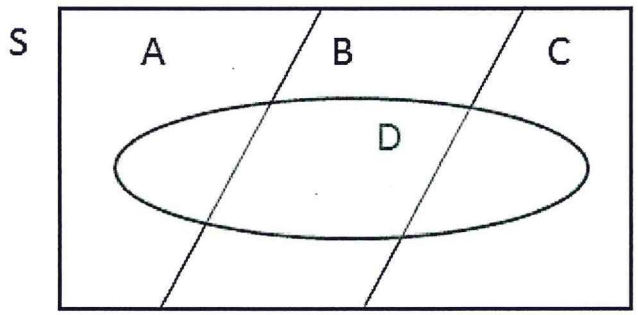
4.1.2) 64.1 and lower (4)

4.1.3) 82.3 and lower (4)

4.1.4) What is the probability that the pulse rate for a sample of **four** men will be between 66.8 and 72.7 (inclusive) (8)

4.2) Three airlines serve a small town. Airline A has 50% of all the scheduled flights, where-as airline B has 30% and airline C has the remaining 20% of all scheduled flights. Their on-time rates are 80%, 65% and 40% respectively. An airplane has just left.

Let A={airline A}, B={airline B}, C={airline C}, D={airline left on time}



4.2.1) What is the probability that the airplane has left on time? (6)

4.2.2) If an airplane left on time what is the probability that it belonged to airline A (4)

QUESTION 5 [9]

The Tuck-shop on campus has compiled the following information on the prices and quantities of snacks from 2017 to 2022

ITEM	P_b	P_i		Q_b	Q_i
	2017	2022		2017	2022
Toffees	1.85	3.75		75	110
Lollies	1.50	2.25		140	260
Chocolates	3.40	5.40		250	335

Use 2017 as the base period to determine and interpret the simple price indexes for these three items in 2022. (9)

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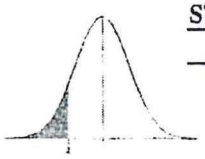
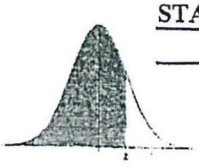
Standard Normal Distribution Tables



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

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

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

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

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

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

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

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

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

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

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