

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 COMPUTOR SCIENCE	
QUALIFICATION CODE: 07BACS, 07BCMS, 07BCCS, 07BCCY	LEVEL: 6
COURSE CODE: ASP610/611S	COURSE NAME: APPLIED STATISTICS AND PROBABILITY FOR IT
SESSION: JULY 2023	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 90

SUPPLEMENTARY / SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	MR. ROUX, AJ
MODERATOR:	MR. MWAHI, E

INSTRUCTIONS	
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.	

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 [12 X 2 = 24]

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. The sum of the percent frequencies for all classes will always equal
 - a. one
 - b. the number of classes
 - c. the number of items in the study
 - d. 100
 - e. None of the above answers is correct.

3. 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.

4. If a data set has an even number of observations, the median
 - a. cannot 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.

5. The value that has half of the observations above it and half the observations below it is called the
 - a. range
 - b. median
 - c. mean
 - d. mode
 - e. None of the above answers is correct.

6. In a sample of 800 students in a university, 160, or 20%, are Business majors. Based on the above information, the school's paper reported that "20% of all the students at the university are Business majors." This report is an example of
- a sample
 - a population
 - statistical inference
 - descriptive statistics
 - None of the above answers is correct.
7. A tabular summary of a set of data showing the fraction of the total number of items in several classes is a
- frequency distribution
 - relative frequency distribution
 - frequency
 - cumulative frequency distribution
 - None of the above answers is correct.
8. The variance of a sample of 81 observations equals 64. The standard deviation of the sample equals
- 0
 - 4096
 - 8
 - 6,561
 - None of the above answers is correct.
9. If the variance of a data set is correctly computed with the formula using $n - 1$ in the denominator, which of the following is true?
- the data set is a sample
 - the data set is a population
 - the data set could be either a sample or a population
 - the data set is from a census
 - None of the above answers is correct.
10. The measure of dispersion that is influenced by most by extreme values is
- the variance
 - the standard deviation
 - the range
 - the interquartile range
 - None of the above answers is correct.

11. The descriptive measure of dispersion that is based on the concept of a deviation about the mean is
- the range
 - the interquartile range
 - both a and b
 - the standard deviation
 - None of the above answers is correct.

12. Consider the result of a fictional Stat 100 final exam taken by 120 students, as given in the following relative frequency distribution:

Grade	Less than 50	50-59	60 - 69	70 - 79	80 - 89	90 - 100		
frequency	15 %	10 %	30 %	25 %	15 %	5 %		

How many students received at least a 70 on this exam?

- 54
- 45
- 25
- 30
- 66

QUESTION 2 [14]

The following is a frequency distribution summarizing data about a certain variable.

Class Interval	Frequency
10-20	4
20-30	12
30-40	40
40-50	41
50-60	27
60-70	13
70-80	9
80-90	4

Use the data provided to calculate the arithmetic mean, the median, and the mode from the frequency distribution. (4 + 5 + 5)

QUESTION 3 [8]

The Office of the Bursar at NUST claims that 40% of all student accounts are always settled (closed) within the first month of the semester, a claim that is denied by the Chief Accountant at Student Records. To prove the Bursar's claim wrong, the Chief Accountant at Student Records considered a random sample of 76 student accounts, and out of the 76 accounts 46 accounts were found to be settled within the first month. Test the appropriate hypothesis in this matter and interpret the results by using a 10% level of significance (8)

QUESTION 4 [16]

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

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) The probability that a driver must stop at any one traffic light coming to University is 0.2. There are 15 sets of traffic lights on the journey. What is the probability that a driver must stop at exactly 2 of the 15 sets of traffic lights? (5)

QUESTION 5 [16]

A company's sales for the years 2001 to 2009 were as follows: (x N\$ 10 000)

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sales	324	296	310	305	295	347	348	364	370

5.1) Construct a scatter plot (4)

5.2) Derive, by using the method of least squares, an equation of linear trend for the sales of the company. (Use sequential numbering with $x = 1$ in 2011) (8)

5.3) Compute trend values for the years 2009 and 2022 (4)

QUESTION 6 [12]

Given the following prices and quantities:

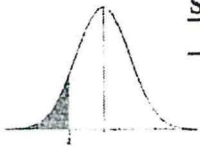
	Price (per kg)			Quantities produced		
	2012	2017	2022	2012	2017	2022
Milk	3.95	3.89	4.13	675	717	436
Cheese	61.50	62.20	59.70	117	115	115
Butter	34.80	35.40	38.90	77	74	82

- 6.1) Compute and interpret the Laspeyres price index number for the year 2022 with 2012 as base. (6)
- 6.2) Compute and interpret the Paasche's price index number for the year 2022 with 2012 as base. (6)

xx

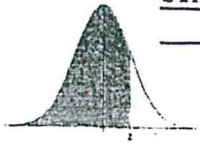


Standard Normal Distribution Tables



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

$$\bar{X}_w = \frac{w_1 X_1 + w_2 X_2 + \dots + w_n X_n}{w_1 + w_2 + \dots + w_n}$$

Geometric mean

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

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

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

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

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

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

Range = highest - lowest

APPENDIX B: ADDITIONAL FORMULAE

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

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

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

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$P(x) = \frac{n!}{x!(n-x)!} \pi^x (1-\pi)^{n-x}$$

$$P(x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$z = \frac{x - \mu}{\sigma}$$

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

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

$$z_{calc} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

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

$$z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$$

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

$$p = \frac{n_A p_B + n_B p_A}{n_A + n_B}$$

$$q = 1 - p$$

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

$$F_V = P_V(1+in)$$

$$F_V = P_V(1+i)^n$$

$$r = (1+i)^m - 1$$

$$D = B(1-i)^n$$

$$P = \frac{A}{(1+i)^n}$$

$$PV = \frac{P(1+i)^n}{(1+j)^n}$$

$$IRR = \frac{N_1 I_2 - N_2 I_1}{N_1 - N_2}$$