

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

DURATION: 3 HOURS

13 Jackson Kaujeua Street T: +264 61 207 2913 Private Bag 13388 Windhoek NAMIBIA

MARKS: 100

E: msas@nust.na W: www.nust.na

QUALIFICATION : BACHELOR of SCIENCE IN APPLIED MATHE BACHELOR of SCIENCE	MATICS AND STATISTICS &
QUALIFICATION CODE: 07BSAM & 07BSOC	LEVEL: 5
COURSE: INTRODUCTION TO APPLIED STATISTICS	COURSE CODE: IAS501S
DATE: NOVEMBER 2023	SESSION: 1

FIRST OPPORTUNITY: EXAMINATION QUESTION PAPER

EXAMINER: MR. ANDREW ROUX

MODERATOR:

DR. DISMAS NTIRAMPEBA

INSTRUCTIONS

- 1. Answer all questions on the separate answer sheet.
- 2. Please write neatly and legibly.
- 3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
- 4. No books, notes and other additional aids are allowed.
- 5. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS :

1. Non-Programmable Calculator

ATTACHEMENTS

- 1. Statistical Formulae Sheet
- 2. Standard Normal Probability Distribution Table
- 3. 1 x A4 Graph Sheet

This paper consists of 4 pages including this front page

QUESTION ONE [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.

А	С	Е	В	D	С	D	В	D	С	
D	В	D	Е	С	А	D	С	D	E	
D	С	А	В	D	С	В	Е	С	D	
В	С	D	С	D	С	Е	A	D	С	
С	В	D	D	В	D	С	E	В	A	

1.1) Construct the frequency distribution for the set of qualitative data in the table. (8)

1.2) Construct the relative frequency distribution for the data set. (2)

1.3) Construct the bar chart for the absolute frequency distribution for the data set. (5)

QUESTION TWO [25]

The data below shows scores in BBS611C for a random sample of 7 students in a class test.

86, 72, 23, 56, 62, 94, 48 Use the data provided to find the following:

2.1 The average so	ore			
a) 64	b) 62	c) 100	d) none of the provided	(2)
2.2 The modal score	res			
a) 86	b) no mode	c) 23	d) none of the provided	(2)
2.3 The median sco	ores			
a) 72	b) 62	c) no median	d) none of the provided	(3)
2.4 The range of th	e scores			
a) 72	b) 73	c) 38	d) none of the provided	(2)

2.5 The first quarti	le of the score	s		
a) 62	b) 48	c) 71	d) none of the provided	(3)
2.6 The third quart	tile of the score	es		
a) 88	b) 94	c) 62	d) none of the provided	(3)
2.7 The inter-quar	tile range for tl	he scores		
a) 0	b)38	c)17	d) none of the provided	(2)
2.8) The variance	for the scores			
a) 23.9	b) 15.25	c) 574.3	d) none of the provided	(3)
2.9) The Standard	Deviation in s	scores		
a) 25.75	b) 22.25	c) 125.50	d) none of the provided	(2)
2.10) The Coefficie	ent of Variatio	n		
a) 40.5	b) 38.0	c) 35.5	d) none of the provided	(3)

QUESTION THREE [15]

•

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

What is the probability that on any given day:

3.1)	No calls will be received	(3)
3.2)	At most two calls will be received	(6)
3.3)	At least four calls will be received	(6)

QUESTION FOUR [20]

The travelling speed for cars within townland areas normally distributed with a mean speed of 70 km/h and a standard deviation of 8 km/h. What is the probability that a car travelling within townland areas will drive at a speed of:-

4.1)	74.9 km/h (inclusive) and faster.	(5)
4.2)	64.1 km/h (inclusive) and slower	(5)
4.3)	Between 59.7 km/h and 82.3 km/h (both inclusive)	(5)

4.4) What is the probability that <u>nine</u> cars travelling within townland areas will drive at an average of 66.4 km/h (inclusive) and slower (5)

QUESTION FIVE [15]

Consider a random variable with the following distribution and find the following probabilities.

x	2	4	6	8	
<i>P(x)</i>	0.2	0.3	0.4	0.1	
5.1) P(x>	•6)				(1)
5.2). P(X :	= 8)				(1)
5.3) P(2	≤ X ≤ 6)				(1)
5.4) Find	Mean or Mathem	natical Expectation			(4)
5.5) Varia	ance, Var(x)				(6)
5.6) and	I the standard de	viation for the ranc	lom variable.		(2)

QUESTION SIX [10]

Given the following prices and quantities, use the data provided to compute and interpret:

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

- 6.1) Compute and interpret the Laspeyres price index number for the year 2022 with as 2012 base. [5]
- 6.2) Compute and interpret the Paasche's price index number for the year 2022 with 2017 as base. [5]

Statistical Formulae Sheet

$$\overline{x} = \frac{\sum x}{\sum f} \quad \text{; Median = L + } \frac{h(MedVal - F)}{f_m} \quad \text{; Mode= L+ (} \frac{\blacktriangle_1}{\blacktriangle_1 + \bigstar_2} \text{)c}$$
$$S^2 = \frac{\sum x^2 \frac{(\sum x)^2}{n}}{n-1}$$

 $P(X) = {}^{n}C_{x}p^{x}(1-p)^{n-x}$, where X = 0, 1, 2,, n

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

Y' = bx + a

10 508

 \sim

$$b = \frac{n\sum xy - \sum x\sum y}{n\sum x^2 - (\sum x)^2} \qquad \qquad \& \qquad a = \frac{\sum y - b\sum x}{n}$$

$$E(X) = \sum p(x_i) \bullet x_i \quad \& \quad Var(x) = \sum p(x) x^2 - u^2$$

$$Ip(L) = \frac{\sum P_i \times Q_b}{\sum P_b \times Q_b} \times 100 \quad \& \quad Iq(L) = \frac{\sum Q_i \times P_b}{\sum Q_b \times P_b} \times 100$$
$$Ip(P) = \quad \frac{\sum P_i \times Q_i}{\sum P_b \times Q_i} \times 100 \quad \& \quad Iq(P) = \frac{\sum Q_i \times P_i}{\sum Q_b \times P_i} \times 100$$

Z - Table

a, 8

The table shows cumulative probabilities for the standard normal curve.

Cumulative probabilities for NEGATIVE z-values are shown first. SCROLL	
DOWN to the 2 nd page for POSITIVE z	

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9995	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

Cumulative probabilities for POSITIVE z-values are shown below.

٠,٠