QUALIFICATION : BACHELOR of SCIENCE IN APPLIED MATHEMATICS AND STATISTICS & BACHELOR of SCIENCE	
QUALIFICATION CODE: **07BSAM & 07BSOC**	LEVEL: **5**
COURSE: **INTRODUCTION TO APPLIED STATISTICS**	COURSE CODE: **IAS501S**
DATE: **JANUARY 2025**	SESSION: **1**
DURATION: **3 HOURS**	MARKS: **100**

SECOND OPPORTUNITY: EXAMINATION QUESTION PAPER

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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 6 pages including this front page

QUESTION 1   [10x2 = 20]

Write down the letter corresponding to your choice next to the question number

1.1. Any characteristic of a population distribution may properly be referred to as a
    a.) standard deviation.   b.) standard score.
    c.) raw score.   d.) standard error.
    e.) parameter.

1.2. Characteristics of a population are called _____, while those of a sample are termed _____.
    a.) statistics; measures   d.) statistics; parameters
    b.) parameters; statistics   e.) none of these
    c.) statistics; variables

1.3. A population is:
    a.) a number or measurement collected as a result of observation
    b.) a subset of a population
    c.) a characteristic of a population which is measurable
    d.) a complete set of individuals, objects, or measurements having some common observable characteristics
    e.) none of these

1.4 Your statistics class
    a.) is a representative sample of your college student body
    b.) is not a representative sample of your college student body
    c.) is not a sample of your college student body
    d.) none of the above

1.5. Inferential statistics
    a.) refers to the process of drawing inferences about the sample based on the characteristics of the population
    b.) is the same as descriptive statistics
    c.) refers to the statistical methods used to draw inferences about a population based
         on sample information
    d.) is the same as a census
    e.) none of the above answers is correct.

1.6. Which of the following is NOT a valid reason for selecting a sample instead of studying the whole population?
    a.) The cost of studying an entire population may be too high.
    b.) The population may be at least partially destroyed in the process of studying it.
    c.) Studying the entire population might be too time consuming.
    d.) It is very interesting to conduct sampling.

1.7. Suppose we sample by selecting every fifth invoice in a file after randomly obtaining a starting point. What type of sampling is this?

a.) simple random sampling
b.) cluster random sampling
c.) stratified random sampling
d.) systematic random sampling
e.) None of the above

1.8. The _____ sampling method typically will require a larger sample size than other methods; however, the close proximity of sample elements can be cost-effective.

a.) simple random
b.) cluster
c.) stratified
d.) systematic
e.) None of the above.

1.9. All possible samples of size n are selected from a population, and the mean of each sample is determined. The mean of the sample means is _____.

a.) Exactly the same as the population mean
b.) Larger than the population mean
c.) Smaller than the population mean
d.) Cannot be estimated in advance
e.) None of the above

1.10. The _____ tells us that the distribution of all possible sample means will be approximately normal for reasonably large sample sizes.

a.) Central Limit Theorem
b.) Mean Limit Theorem
c.) Combination Theorem
d.) Estimation Theorem
e.) None of the above is correct.

QUESTION 2   [18]

The data below represents the annual rainfall (mm) recorded over forty farms across Namibia in 2018,

250	600	553	295	210	389	400	625	850	723
157	423	300	239	487	535	762	532	672	678
522	435	628	456	239	863	764	433	677	245
342	296	456	586	349	421	568	825	924	598

2.1) Summarize the data in a frequency distribution with classes of equal width of 100 rand, starting at 100 - < 200 ; 200 - < 300 ; ext..   (4)

2.2) Compile a relative frequency distribution distribution (2)

2.3) Compile a Relative Cumulative "less-tan" and a Relative Cumulative "more-than frequency distribution (2 + 2)

2.4) Use the data obtained in 2.1 to draw a histogram and a polygon (5 + 3 = 8)

QUESTION 3 [19]

During one month, time records shows the following results for the number of production workers absent per day:

13	14	9	17	21	10	15	22	19	13
22	13	19	23	17	21	10	9	20	18

For the distribution above, calculate and interpret the:

3.1) Range (2)
3.2) Mode (1)
3.3) Median (3)
3.4) Arithmetic mean (3)
3.5) Variance (5)
3.6) Standard deviation (2)
3.7) Coefficient of variation (3)

QUESTION 4 [15]

The Office of The Bursar at The Namibia University of Science and Technology (NUST) revealed some information regarding method of payment for a group of 2022 students at different levels of study.

	Bursary	Loan	Self	Totals
Certificate	12	379	727	**1118**
Diploma	39	106	642	**787**
Degree	48	20	57	**95**
Totals	69	505	1426	**2000**

4.1) Find the probability of randomly selecting one student from this group who pays for him/herself? (2)

4.2) Find the probability of randomly selecting one student from this group who has a Diploma or a Degree? (4)

4.3) Find the probability of randomly selecting one student from this group who has a Bursary or Degree? (4)

4.4) What is the chance of randomly selecting one student with a degree, given that this student has a loan? (5)

QUESTION 5 [28]

5.1) In a multiple choice question, there are five different answers, of which only one is correct. The probability that a student will know the correct answer is 0.6. If a student does not know the answer, he guesses an answer at random.

5.1.1) What is the probability that the student gives the correct answer? (4)

5.1.2) If the student gives the correct answer, what is the probability that he guessed? (6)

5.2) A company's sales for the years 2014 to 2022 were as follows: (x N$ 10 000)

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sales	324	296	310	305	295	347	348	364	370

5,2.1) Plot the time series data (4)

5.2.2) 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 2012) (8)

5.2.3) Compute trend values for the years 2012 and 2025 (6)

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FORMULAE SHEET

$$\text{Mean } \bar{x} = \frac{\sum xf}{n} \;;\; \text{Mode} = L + \frac{c(f_m - f_{m-1})}{2 \times f_m - f_{m-1} - f_{m+1}} \;;\; \text{Median} = L + \frac{c(0.5n - CF)}{f_{me}}$$

$$\beta = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2} \;;\; \alpha = \frac{\sum y - \beta(\sum x)}{n}$$

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

$$Ip = \frac{\sum p_1}{\sum p0} \times 100\%$$

$$Var(x) = \frac{\sum X^2 - n(\bar{x})^2}{n-1} \;;\; Std\ Dev, s = \sqrt{Var(x)} \;;$$

$$CV = \frac{Std\ Dev}{\bar{x}} \times 100 \;;$$

Z - Table

The table shows cumulative probabilities for the standard normal curve.

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

Cumulative probabilities for POSITIVE z-values are shown below.

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	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998