NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science ; Bachelor of science in Applied Mathematics and Statistics	
QUALIFICATION CODE: 07BSOC; 07BSAM	**LEVEL:** 5
COURSE CODE: IAS501S	**COURSE NAME:** INTRODUCTION TO APPLIED STATISTICS
SESSION: NOVEMBER 2022	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER	Mr. A.J. ROUX
MODERATOR:	Dr. D. Ntirampeba

INSTRUCTIONS
1. Answer ALL the questions in the booklet provided.
2. Show clearly all the steps used in the calculations.
3. All written work must be done in blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

ATTACHMENTS

1. The Standard Normal (z) Probability Distribution Table
2. Graph Paper x 1

THIS QUESTION PAPER CONSISTS OF 4 PAGES (Including this front page)

QUESTION 1   [15]

1.1)   For each of the following random variables, indicate if the random variable is discrete or continuous

1.1.1) The weight of a new born baby   (1)
1.1.2) The number of stones in a basket   (1)
1.1.3) The distance I walk to campus.   (1)
1.1.4) The number of assignments submitted by mail   (1)
1.1.5) The height on a building   (1)

1.2)   In the section (1.2.1 to 1.2.5) below, you must give only the letter indicating the correct answer to the question:

1.2.1) Which of the following measures of central tendency can reliably be used when the dataset has outliers?

a) Mean   b) Median   c) Mode   d) All of the above   [2]

1.2.2) Event A and B are said to be collectively exhaustive in statistics if,

a) A and B are mutually exclusive

b) The union of A and B equals the sample space

c) The union of A and B is an empty set

d) The intersection of A and B is the same as the union   [2]

1.2.3) Which of the following is NOT a possible probability

a) $\frac{65}{100}$ b) 1.16   c) 0   d) All of the above   [2]

1.2.4) Which one of the following variables is not categorical?

a) Age of a person.   b) Gender of a person

c) Choice on a test item   d) Marital status of a person   [2]

1.2.5) If a doctor suspects that his patient has a 50% chance of surviving, the probability of surviving in this case is an example of:

a) Simple probability   b) Conditional probability

c) Subjective probability   d) None of the above   [2]

QUESTION 2   [25]

The table below shows scores (%) of 25 first year students in a Biology examination.

56	43	56	48	82	52	71	68	75	91	69	28	64	58
61	74	77	83	25	55	34	79	71	63	64			

2.1)   Display the data using an ordered stem-and-leaf plot.   [6]

2.2)   Comment on the distribution of the data   [2]

2.3)   Using classes 20 to less than 30, 30 to less than 40, and 40 to less than 50 ,
       ...., 90 to less than 100, construct an absolute and a relative frequency
       distribution table for the data.   [6]

2.4)   Compile a less than cumulative percentage frequency distribution   [3]

2.5)   Use the data obtained in Question 2.3 to draw a histogram and the frequency
       polygon on the same axis for the data   [8]

Question 3   [20]

A sample of 10 time periods (in days) that elapsed between the taking and delivery
of an order at a company:

75	97	71	65	84	65	84	27	43	50

For the distribution above, calculate the:

3.1)   Range   [2]
3.2)   Mode   [2]
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 [25]

4.1) The average cost of providing a particular service per person per day is a random variable having a normal distribution with average of N$100 and a standard deviation of N$22.

4.1.1) Calculate the probability that the cost of providing the service will be at least N$120 per day per person. [5]

4.1.2) Calculate the probability that the cost of providing the service will be at least N$60 per day per person. [5]

4.1.3) Calculate the probability that the cost of providing the service will be at most N$80 per day per person. [5]

4.2) A sample of students wrote examination in three subjects, Biology, Chemistry, and Physics. About 50% of the students wrote Biology, 30% of them wrote Chemistry, and the rest wrote Physics. There was a two percent chance of failing Biology, and also 2% chance of failing Chemistry while there was a three percent chance of failing Physics. For the purpose of quality control, all the student results are put in one container and one student is drawn.

4.2.1) Determine the probability of drawing a student who failed an examination. [7]

4.2.2) Determine the probability that the student who was drawn failed Biology. [3]

QUESTION 5 [15]

The table below shows the monthly salary for yellow collar workers (x N$ 1000) recorded during the last decade by the Namibia Yellow Collar Workers Union
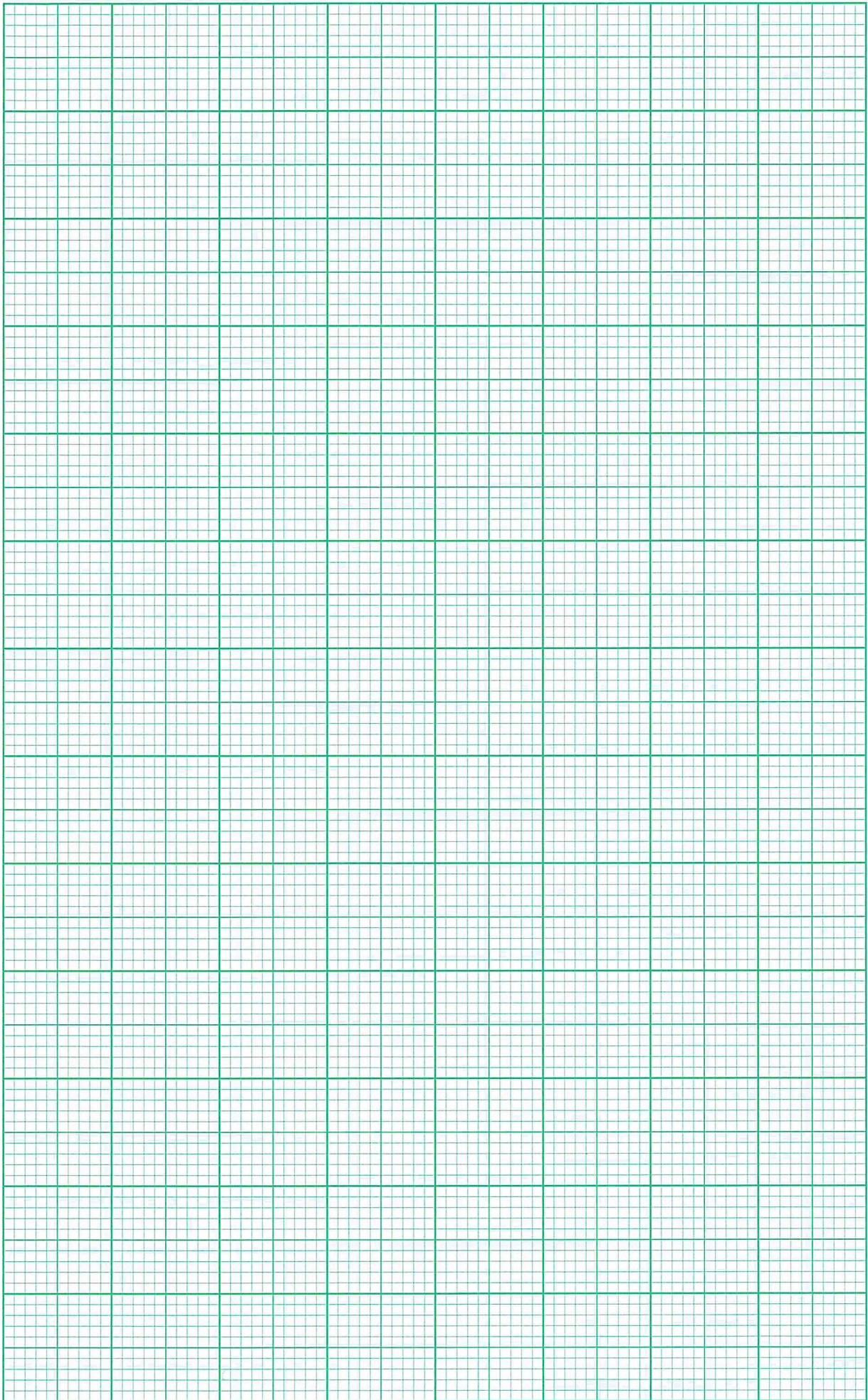
Year	2012	2013	2014	2015	2016	2017	2018	2091	2020	2021
Salary	3.0	4.2	4.8	3.7	3.4	4.3	5.6	4.3	3.8	4.1

5.1 Determine the least squares trend line equation, using the sequential coding method with 2012 = 1 . [9]

5.2 Use the trend line equation obtained in 5.1 to estimate monthly salaries for 2010 and 2025 [3 x 2 =6]
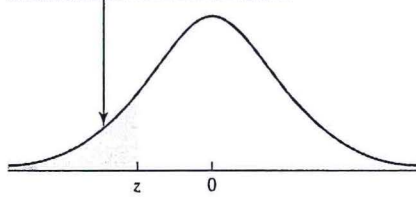
XXXXXXXXXX END OF QUESTION PAPER XXXXXXXXXXX

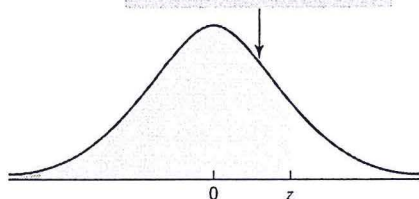e.g., for $z = -1.34$, refer to the -1.3 row and the 0.04 column to find the cumulative area, 0.0901.

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

Source: Cumulative standard normal probabilities generated by Minitab, then rounded to four decimal places.

e.g., for z = 1.34, refer to the 1.3 row and the 0.04 column to find the cumulative area, 0.9099.

The Standard Normal Distribution

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990