CONFIDENTIAL

Infrastructure University Kuala Lumpur

SUNWAY INT'L BUSINESS SCHOOL

FINAL EXAMINATION
JUNE SEMESTER 2019

INTRODUCTION TO STATISTICS
(STAT 1000)

(TIME : 3 HOURS)

MATRIC NO. : | | | | | | | | | |

IC. / PASSPORT NO. : | | | | | | | | | | | | | | |

LECTURER : SHANTA RAYAMAJHI BASNET

GENERAL INSTRUCTIONS

1. This question booklet consists of 8 printed pages including this page.
2. Answer **ALL** questions for Section A in the **ANSWER BOOKLET**.
3. Answer only **ONE (1)** question for Section B in the **ANSWER BOOKLET**.
4. Please do not tie the answer booklet with the question booklet together.
5. **PLEASE DO NOT TURN THIS PAGE AND START THE EXAM UNTIL YOU ARE TOLD TO DO SO.**

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INSTRUCTIONS: **TIME: *3 HOURS***

SECTION A (80 MARKS)

There are FIVE (5) questions in this section. Answer ALL Questions in the Answer Booklet.

1. a) What are the two main criteria of a discrete variable? Give two examples of a discrete variable. (4 marks)

   b) Categorical data can be further classified into nominal and ordinal data. Briefly explain nominal data and ordinal data by giving a suitable example. (6 marks)
   (CLO1:PLO1:C2)

2. Each morning for a month, the owner of a mini zoo recorded how long it took to feed the animals. The results for May 2019 were as shown:

Time (min)	16 – 25	26 – 30	31 – 45	46 – 50	51 – 55	56 – 60
No. of mornings	5	6	10	7	2	1

   a) Explain the condition need to be considered when constructing a histogram manually. Hence, display a table containing the necessary values needed to construct charts below. (7 marks)

   b) Construct a histogram and estimate the mode of the feeding time. (7 marks)

   c) Construct an ogive and estimate the median of the feeding time. (6 marks)
   (CLO1:PLO1:C3)

3. In a trial of tossing an unbiased ordinary coin, let the event of obtaining a 'head' be a successful event with a probability p. This trial is repeated 4 times with a random variable X representing the number of successes.

   a) Draw a tree diagram representing above experiment and list down all 16 possible outcomes from the experiment. (9 marks)

   b) Determine the possible values of x. Hence, set up a probability distribution table for X. (5 marks)

   c) Calculate $E(X)$. (2 marks)

   d) Calculate $P(X \leq 2)$ and $P(X > 2)$. (4 marks)
   (CLO2:PLO2:C3)

4. The amount of time taken by a student to commute daily from his house to his school is normally distributed with mean 30 minutes and standard deviation of 15 minutes.

a) If the school starts at 7.30 a.m., and the student leaves his house at 7.15 a.m., what is the probability that he will be late to school? (4 marks)

b) What is the probability that he will take between 40 to 50 minutes to reach the school? (6 marks)

(CLO2:PLO4:C3)

5. The records of patients at a children's hospital are maintained by a physician who wants to know the relationship between the ages and heights of boys who are patients. The data for seven randomly selected boys is shown in the following table.

Age to the nearest year	13	11	11	6	9	7	10
Height in inches	62	56	58	46	51	50	54

a) Find the fitted linear regression line for the boys' patient at the children's hospital. (14 marks)

b) Estimate the height of a boy patient who is 12 years old. (2 marks)

c) Find coefficient of correlation from above data and interpret your answer. (4 marks)

(CLO3:PLO6:C3)

SECTION B **(20 MARKS)**

There are TWO (2) questions in this section. Answer ANY ONE (1) question in the Answer Booklet.

1. a) In an air pollution study, an experimental station obtained a mean of 2.36 μg of suspended benzene-soluble organic matter per cubic meter with a standard deviation of 0.48 μg from 10 random samples.

   i. What is the margin of error in the interval estimate within 99% confidence level? (2 marks)
   ii. Construct a 99% confidence interval for the mean of the population. (4 marks)
   iii. What sample size will reduce the margin of error to ≤ 0.03? (2 marks)
   iv. What will be the effect on margin of error and the confidence interval width if the confidence level reduced to 95%? (7 marks)

   b) A random sample of 50 cans of peach halves has a mean weight of 16.1 oz. and a variance of 0.16 oz., construct a 90% confidence interval for μ. (5 marks)
   (CLO3:PLO6:C3)

2. The average running time of a certain variety of rechargeable flashlight battery is known to be 8.5 hours. A change in the production method for this battery has been proposed, and a sample of 60 batteries produced by the new method has mean running time of 8.62 hours and a standard deviation of 0.55 hour. Using 0.05 level of significance:

   a) Briefly explain how to determine the test statistic in conducting a hypothesis testing for the population mean. (3 marks)

   b) If $H_1: \mu \neq 8.5$, what conclusion do you reach? (7 marks)

   c) A chemical engineer examines the data and makes the inferences that the change in production was made for the purpose of improving the battery running time. He claims that $H_1: \mu > 8.5$. What conclusion does he reach? (5 marks)

   d) A second chemical engineer notes that the production method change might have been made for reasons such as reducing cost or increasing the number of times that the battery can be recharged. She claims that the major concern must be that the running time has not significantly worsened and that $H_1: \mu < 8.5$. What conclusion does she reach? (5 marks)
   (CLO3:PLO6:C3)

***** END OF QUESTIONS *****

Student *t* Distribution

	Tail probability, p											
df	**0.25**	**0.2**	**0.15**	**0.1**	**0.05**	**0.025**	**0.02**	**0.01**	**0.005**	**0.003**	**0.001**	**0.0005**
1	1	1.376	1.963	3.078	6.314	12.71	15.89	31.82	63.66	127.3	318.3	636.6
2	0.816	1.061	1.386	1.886	2.92	4.303	4.849	6.965	9.925	14.09	22.33	31.6
3	0.765	0.978	1.25	1.638	2.353	3.182	3.482	4.541	5.841	7.453	10.21	12.92
4	0.741	0.941	1.19	1.533	2.132	2.776	2.999	3.747	4.604	5.598	7.173	8.61
5	0.727	0.92	1.156	1.476	2.015	2.571	2.757	3.365	4.032	4.773	5.893	6.869
6	0.718	0.906	1.134	1.44	1.943	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.706	0.889	1.108	1.397	1.86	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.703	0.883	1.1	1.383	1.833	2.262	2.398	2.821	3.25	3.69	4.297	4.781
10	0.7	0.879	1.093	1.372	1.812	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.697	0.876	1.088	1.363	1.796	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.303	2.681	3.055	3.428	3.93	4.318
13	0.694	0.87	1.079	1.35	1.771	2.16	2.282	2.65	3.012	3.372	3.852	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.264	2.624	2.977	3.326	3.787	4.14
15	0.691	0.866	1.074	1.341	1.753	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.69	0.865	1.071	1.337	1.746	2.12	2.235	2.583	2.921	3.252	3.686	4.015
17	0.689	0.863	1.069	1.333	1.74	2.11	2.224	2.567	2.898	3.222	3.646	3.965
18	0.688	0.862	1.067	1.33	1.734	2.101	2.214	2.552	2.878	3.197	3.611	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.687	0.86	1.064	1.325	1.725	2.086	2.197	2.528	2.845	3.153	3.552	3.85
21	0.686	0.859	1.063	1.323	1.721	2.08	2.189	2.518	2.831	3.135	3.527	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.685	0.858	1.06	1.319	1.714	2.069	2.177	2.5	2.807	3.104	3.485	3.768
24	0.685	0.857	1.059	1.318	1.711	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.684	0.856	1.058	1.316	1.708	2.06	2.167	2.485	2.787	3.078	3.45	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.158	2.473	2.771	3.057	3.421	3.69
28	0.683	0.855	1.056	1.313	1.701	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.15	2.462	2.756	3.038	3.396	3.659
30	0.683	0.854	1.055	1.31	1.697	2.042	2.147	2.457	2.75	3.03	3.385	3.646
40	0.681	0.851	1.05	1.303	1.684	2.021	2.123	2.423	2.704	2.971	3.307	3.551
50	0.679	0.849	1.047	1.299	1.676	2.009	2.109	2.403	2.678	2.937	3.261	3.496
60	0.679	0.848	1.045	1.296	1.671	2	2.099	2.39	2.66	2.915	3.232	3.46
80	0.678	0.846	1.043	1.292	1.664	1.99	2.088	2.374	2.639	2.887	3.195	3.416
100	0.677	0.845	1.042	1.29	1.66	1.984	2.081	2.364	2.626	2.871	3.174	3.39
1000	0.675	0.842	1.037	1.282	1.646	1.962	2.056	2.33	2.581	2.813	3.098	3.3
∞	0.674	0.841	1.036	1.282	1.645	1.96	2.054	2.326	2.576	2.807	3.091	3.291

Z Scores

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0.5000	0.504	0.5080	0.512	0.516	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	0.591	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	0.648	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	0.937	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
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

Negative Z Scores

z	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.0
-3.4	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
-3.3	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005
-3.2	0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007
-3.1	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010
-3.0	0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013
-2.9	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019
-2.8	0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026
-2.7	0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035
-2.6	0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047
-2.5	0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062
-2.4	0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082
-2.3	0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107
-2.2	0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139
-2.1	0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179
-2.0	0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228
-1.9	0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287
-1.8	0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359
-1.7	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
-1.6	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
-1.5	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
-1.4	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
-1.3	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968
-1.2	0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151
-1.1	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
-1.0	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
-0.9	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
-0.8	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
-0.7	0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420
-0.6	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743
-0.5	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085
-0.4	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
-0.3	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
-0.2	0.3829	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
-0.1	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
-0.0	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000

FORMULAE

$$s = \sqrt{\frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]}$$

$$\bar{x} = \frac{\sum x}{n}$$

$$CV = \frac{s}{\bar{x}} \times 100$$

$$PCS = \frac{3(\bar{x} - \tilde{x})}{s}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

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

$$V(X) = E(X^2) - E(X)^2$$

$$E(X) = \sum xp(x)$$

$$P(X) = {}^{n}C_x p^x q^{n-x}$$

$$P(X) = e^{-\mu}\left(\frac{\mu^x}{x!}\right)$$

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

$$\bar{x} \pm z\alpha_{/2}\frac{\sigma}{\sqrt{n}}$$

$$\bar{x} \pm z\alpha_{/2}\frac{s}{\sqrt{n}}$$

$$\bar{x} \pm t\alpha_{/2,n-1}\frac{s}{\sqrt{n}}$$

$$Z = \frac{\bar{x} - \mu_{\bar{x}}}{\frac{\sigma}{\sqrt{n}}}$$

$$t = \frac{\bar{x} - \mu_{\bar{x}}}{\frac{s}{\sqrt{n}}}$$

$$S_{xx} = \sum x^2 - \frac{(\sum x)^2}{n}$$

$$S_{yy} = \sum y^2 - \frac{(\sum y)^2}{n}$$

$$S_{xy} = \sum xy - \frac{\sum x \sum y}{n}$$

$$\hat{\beta}_1 = \frac{S_{xy}}{S_{xx}}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1\bar{x}$$

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$$

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}}$$

$$r^2 = \frac{S_{xy}{}^2}{S_{xx}S_{yy}}$$