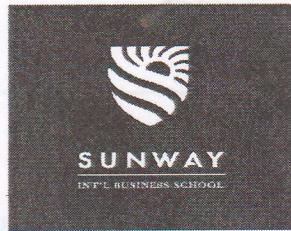


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**FINAL EXAMINATION
JUNE SEMESTER 2018**

**INTRODUCTION TO STATISTICS
(STAT 1000)**

(TIME : 3 HOURS)

MATRIC NO. :

IC. / PASSPORT NO. :

LECTURER : SHANTA RAYAMAJHI

GENERAL INSTRUCTIONS

1. This question booklet consists of 9 printed pages including this page.
2. Answer **ALL** questions for Section A in the **ANSWER BOOKLET**.
3. Answer **ANY TWO (2)** questions for Section B in the **ANSWER BOOKLET**.

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SECTION B**TIME: 3 HOURS****INSTRUCTIONS:****SECTION A****(60 MARKS)**

There are SIX (6) questions in this section. Answer ALL Questions in the Answer Booklet.

1. a) Define population, random sample and secondary data. (3 marks)
- b) State two weaknesses of mean as a measure of central location. (2 marks)
- c) Indicate whether the data set is a population or a sample.
 - i. A survey of 1353 American households found that 18% of the households own a computer. (1 mark)
 - ii. A survey of each elementary school children found that 28% of the children could be classified as obese. (1 mark)
- d) Identify the type of the variable for the following statement.
 - i. The years the summer Olympics were held in the United States. (1 mark)
 - ii. The ratings of a movie ranging from 'poor' to 'good' to 'excellent'. (1 mark)
 - iii. Hair color of women on a high school tennis team. (1 mark)
 - iv. The annual salaries for all lecturers in IUKL. (1 mark)

[CLO1:PLO2:C1]

2. In an experiment on the time taken (in minutes) by operators in putting labels on biscuit boxes is presented in the following table.

Time taken (in minutes)	No. of operators
0.055 – 0.065	5
0.065 – 0.075	7
0.075 – 0.085	14
0.085 – 0.095	23
0.095 – 0.105	11
0.105 – 0.115	5

- a) Calculate the mean of time taken by operators in the labelling process. (4 marks)
- b) Draw a "less than or equal" ogive and obtain the median of time. (6 marks)
- c) Determine the skewness of the distribution given that variance of time taken by operators is 0.0002. (3 marks)

[CLO1:PLO2:C3]

3. A and B are events in a sample space with probabilities, $P(A) = 0.2$, $P(\bar{B}) = 0.4$ and $P(A \cap B) = 0.1$.

Figure out $P(A \cup B)$, $P(B|A)$ and $P(A|(A \cup B))$. Hence, examine whether event A and event B are independent or not. (8 marks)
[CLO2:PLO1:C4]

4. A university has proposed that all students must take a course in ethics as requirement for graduation. 300 persons are interviewed about their opinion whether they are in favor or not of the proposal. In this group of 300 persons, 50 are lecturers, 100 are parents and 150 are students. Given that the persons interviewed are lecturers, parents and students, the probability of in favor of the proposal is 0.7, 0.8 and 0.6 respectively.

- a) Illustrate a tree diagram to represent above information. (3 marks)
- b) What is the probability that a randomly selected person from this group is in favor of the proposal? (2 marks)
- c) A randomly selected person from this group is found to be in favor of the proposal. What is the probability that the person is a student? (2 marks)

[CLO2:PLO1:C3]

5. A discrete random variable X has probability distribution given by the following table.

X	0	1	2	3	4
$P(X)$	0.03	0.1	0.17	0.25	0.45

Calculate $P(0 \leq X < 3)$, $V(X)$ and $E(X)$. (7 marks)
[CLO2:PLO1:C3]

6. a) A paper factory produces a type of high quality paper printing of certificates for IUKL. The size of thickness of the paper is normally distributed. If mean thickness of the paper is 1.09 mm and standard deviation is 0.03 mm, determine the probability that the thickness of the paper chosen randomly is less than 0.99 mm or more than 1.07 mm. (7 marks)
- b) A random variable X is normally distributed with mean 40 and variance 4. Obtain the value of k so that $P(X > k) = 0.25$. Hence, solve $P(38 < X < 44)$. (7 marks)

[CLO2:PLO1:C3]

SECTION B**(40 MARKS)**

There are THREE (3) questions in this section. Answer ANY TWO (2) questions in the Answer Booklet.

1. A local electric company is studying the relationship between company's profits and expenditure on R&D. Table below gives the yearly data of the relationship between R&D expenditure (in million RM) and company's profit (in million RM).

Expenditure	5	11	4	5	3	2
Profits	31	40	30	34	25	20

- a) Develop a fitted regression model to predict the company profits and state the type of relation between R&D expenditure and company's profits. (12 marks)
- b) Forecast the company's profit if R&D expenditure is RM 12 million. (2 marks)
- c) Briefly explain about the accuracy of the fitted regression model. (4 marks)
- d) Explain strengthens of correlation between R&D expenditure and company's profits. (2 marks)

[CLO3:PLO6:C5]

2. a) A manager of a fast food restaurant wishes to determine whether the population mean waiting time to place an order has changed in the past month from its previous population mean value of 4.5 minutes. From past experience, you can assume that the population is normally distributed, with a population standard deviation of 1.2 minutes. You select a sample of 25 orders during a one-hour period. The mean is 5.1 minutes. Determine whether there is evidence at the 0.05 level of significance that the population mean waiting time to place an order has changed in the past month from its previous population mean value of 4.5 minutes.

(6 marks)

- b) You and some friends have decided to test the validity of an advertisement by ABC pizza restaurant, which says it's average delivery time to the dormitories at most 17 minutes. While XYZ pizza restaurant claims that it's delivery time to the dormitories never exceed 18 minutes. Both restaurants are located across the street from your college campus. You collect the data by ordering 10 pizzas from each restaurant at different times. You recorded the delivery times (in minutes) of both restaurants as shown below.

ABC: 16.8, 11.7, 15.6, 16.7, 17.5, 18.1, 14.1, 21.8, 13.9, 20.8

XYZ: 22.0, 15.2, 18.7, 15.6, 20.8, 19.5, 17.0, 19.5, 16.5, 24.0

- i. Test at 5% level of significant that there is an increase in delivery time for the local pizza restaurant. (7 marks)
- ii. Test at 5% level of significant that there is no different in delivery time for the national pizza chain (7 marks)

[CLO3:PLO6:C6]

3. a) A study on college student's height was conducted. The result found that out of 40 students randomly selected, the height is 68.9 inches with the variance 2.7 inches. Construct a 95% confidence interval for mean height of all college's student. (5 marks)
- b) In an experiment to determine the content of salt in seawater was conducted. Five water samples were taken with the measurement of salt content is given as follows: 229, 255, 280, 203, 229. Construct a 90% confidence interval for mean salt content in the seawater. (8 marks)
- c) A college wants to know the average of yearly initial salary range for their graduates from Mechanical Engineering and Civil Engineering program. The study finding shown in the table below.

Sample	Mechanical	Civil
Size	59	30
Mean	32675	27675
Standard deviation	4430	4286

What is the margin of error for yearly mean salary for each program at 95% level of confidence? What conclusion do you reach?

(7 marks)

[CLO3:PLO6:C5]

*** END OF QUESTIONS ***

Student *t* Distribution

df	Tail probability, p											
	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

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FORMULAE

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

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

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

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

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

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

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

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

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

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

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

$$\bar{x} \pm z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

$$\bar{x} \pm z_{\alpha/2} \frac{s}{\sqrt{n}}$$

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

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

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

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

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

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

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

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

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

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

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