KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Marks Scored:

Level: B. E./B.Sc.
Year : II

Course : MATH 208
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : FEB 2 8 2018

SECTION "A"
[10 Q. × 1 =10 marks]

Fill in the blank(s) by the most appropriate word(s) or symbol(s).

1. _____ are used to present, describe, and understand variability.

2. The term _____ is composed of the set of all elementary units or simply units.

3. _____ is the representation or displaying the results of two variables, the bivariate equivalent of the dot plot.

4. _____ is a more useful summary of data than simple enumeration of data.

5. To construct a _____, we divide the each number into two parts, consisting of one or more leading digits and a remaining digits.

6. The mean or average of all the observation in a finite population is called _____

7. In the given data set 1, 2, 3, 4, and 5, if each item is subtracted by 3 then the resulting sum is equal to _____

8. _____ was motivated by real life situation and the study of games of chance.

9. The set of possible outcomes of an events _____

10. The standard deviation of n observations $x_1, x_2, \ldots \ \ldots \ \ldots x_n$ with their corresponding frequencies $f_1, f_2, \ldots \ \ldots \ \ldots f_n$ as = _____.

SECTION "B"
[10 Q. × 1 =10 marks]

Fill in the blank space(s) DO NOT TICK, by choosing the most appropriate answers among the given ones.

11. Which one of the given measures of central tendency is based on only the maximum repetition of observations _____
[a] quartiles [b] median [c] mode [d] mean

12. If each observation of the n given observation increased by two units, then their standard deviation_____
[a] remains the same
[b] is increased by two units of the original standard deviation
[c] is one-half of the original standard deviation
[d] is decreasing by two units of the original standard deviation

13. If p is the probability of success and n is the total number of any trials, for a binomial distribution, then its mean is _____

[a] $p(1-p)$ [b] np [c] $np(1-p)$ [d] $n(1-p)$

14. The coefficient of quartile deviation is _____

[a] $\frac{Q_2+Q_1}{Q_2-Q_1}$ [b] $\frac{Q_2-Q_1}{Q_2+Q_1}$ [c] $\frac{Q_3+Q_1}{Q_3-Q_1}$ [d] $\frac{Q_3-Q_1}{Q_3+Q_1}$

15. $If\ P(A) = 0.32, P(\bar{B}) = 0.38$ and$P(A \cap B) = 0.1$ then$P(B-A)$ _____

[a] 0.08 [b] 0.22 [c] 0.28 [d] 0.52

16. The confidence interval on the ratio of two sample variances of normal population involves _____

[a] $\chi^2 - distribution$ [b] $t - distribution$ [c] $F - distribution$ [d] $Z - distribution$

17. In a Poisson distribution is _____

[a] mean is greater than variance [b] mean is smaller than variance
[c] mean and variance are equal [d] mean and variance are not equal

18. The sample of 25 observations having the variance is 100, then the Standard error of mean is--- --- --- ---

[a] 2 [b] 4 [c] 10 [d] 25

19. Variation in the items produced in a factory may be due to _____

[a] chance factor [b] faulty process [c] common cause [d] random process

20. The upper control limit for the number of defectives present in a statistical process control is _____

[a] $\overline{p} + 3\sqrt{\frac{\overline{p}(1-\overline{p})}{n}}$ [b] $\overline{p} - 3\sqrt{\frac{\overline{p}(1-\overline{p})}{n}}$ [c] $\overline{p} + 3\sqrt{\frac{n}{\overline{p}(1-\overline{p})}}$ [d] $\overline{p} - 3\sqrt{\frac{n}{\overline{p}(1-\overline{p})}}$

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SECTION "C"
[3Q.× 7 = 21 marks]

1. What is the difference between standard deviation and Variance? When should we use the term standard deviation and variance? [3+4]

A communication channel is being monitored by recording the number of errors in a string of 1000 bits. Data for 20 of these strings are given here. (Read the data left to right, then down.):

1	1	6	1	3	0	0	1	0	1
5	2	0	1	1	1	2	1	2	3

a) Arrange this data into an ordered array.
b) Construct an ungrouped frequency distribution.
c) Compute Quartiles.
d) Compute coefficient of quartiles.

2. State the conditions under which a binomial distribution tends Normal distribution. Write down the probability mass function of Binomial distribution.
Six independent space missions to the moon are planned. The estimated probability of failure on each mission is 0.05. Enumerate the probability distribution of space missions planed to the moon. What is the probability that at least three of planned missions will be successful? [3+4]

OR

Define cumulative distribution function X is a continuous random variable is defined over the set of all real numbers. Write down its properties.
A robot positions 10 units in a chuck for machining as the chuck is indexed. If the robot positions the unit improperly, the unit falls away and the chuck position remains open, thus resulting in a cycle that produces fewer than 10 units. A study of the robot's past performance indicates that if X = number of open positions,

$$p(x) = \begin{cases} 0.62, & x = 0 \\ 0.20, & x = 1 \\ 0.18, & x = 2 \\ 0.0, & otherwise \end{cases}$$

a) Determine the mean of X
b) Find the variance.

3. A motorist found that the efficiency of her engine could be increased by adding lubricating oil to fuel. She experimented with different amounts of lubricating oil and the data are

Amount of lubricating oil (ml)	Efficiency (%)
0	60
25	70
50	75
75	81
100	84

a) Graph the line on a scatter diagram
b) Find the regression equation of efficiency in terms of Amount of lubricating oil (ml).
c) Predict efficiency of engine in terms of amount of lubricating oil (ml) when the amount of lubricating oil is 450 ml.

SECTION "D"
[6Q. × 4 = 24 marks]

4. A chemical engineer monitors water quality by measuring the amount of suspended solids in a sample of river water. Over 10 weekdays, she observed

14, 12, 21, 28, 30, 63, 29, 63, 55, 19

suspended solids (parts per million).
(a) Draw a dot diagram.
(b) Find the variance and standard variation.

5. A new computer virus can enter the system through the e-mail or through the internet. There is a 30 percent chance of receiving this virus through the e-mail. There is a forty percent chance of receiving this virus through the internet. Also the virus enters the system simultaneously through the e-mail and the internet with probability fifteen percent. What is the probability that the virus does enter the system at all?

6. Lifetime of certain hardware is a continuous random variable with density function

$$f(x) = \begin{cases} K - \frac{x}{50}, & for\ 0 \le x < 10\ years \\ 0, & for\ all\ others\ x \end{cases}$$

Find the following
a) K
b) What is the expected lifetime?

7. a. Find z if the probability that a random variable haying the standard normal distribution will take on a value

i. less than z is 0.9911;

ii. greater than z is 0.1093;

b. Assume Z has a standard normal distribution. Determine the following probabilities for the standard normal random variable Z:
i. $P(|Z| \ge 1.57)$
ii. $P(Z > 2.11)$

8. The following random samples are measurements of the heat producing capacity (in millions of calories per ton) of specimens of coal from two mines:

Mine 1: 8,260 8,130 8,350 8,070 8,340

Mine 2: 7,950 7,890 7,900 8,140 7,920, 7,840

Assuming that the populations sampled are normal and have the same variance. Test the null hypothesis $\mu_1 - \mu_2 = 0$ against the alternative hypothesis $\mu_1 - \mu_2 \neq 0$ at the 0.05 level of significance.

9. A *U* chart may be constructed for the printed circuit board defect data in table given below. Since each sample contains n=8 printed circuit boards, the values of *U* for each sample may be calculated as shown in the following display:

Sample Number		Number of Defectives	Sample Number		Number of Defectives
1	8	6	11	8	9
2	8	4	12	8	15
3	8	8	13	8	8
4	8	10	14	8	10
5	8	9	15	8	8
6	8	12	16	8	2
7	8	16	17	8	7
8	8	2	18	8	1
9	8	3	19	8	7
10	8	10	20	8	13

Determine the limits for the *U* charts and check to see if there are any out-of-control points.

SECTION "E"

[5Q. × 2 = 10 marks]

10. The mean of marks in Mathematics of 50 computer science students in a class was 82. The mean of marks of 30 boys was 79. Find out the mean marks of girls in the class.?

11. If X_1 has mean 18 and standard deviation 16 while X_2 has mean -8 and standard deviation 16 and the two are independent, find E $(2X_1-X_2-16)$.

12. Antivirus software reports that 4 folders out of 12 are infected. How many possibilities are there?

13. The one sample t statistic from a sample of n = 16 observations for the two sided test of for testing:

$H_0: \mu = 50$

versus

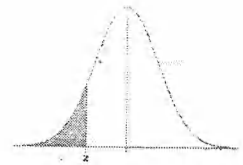
$H_1: \mu \neq 50$

has the value t =2.012. Decide whether it is significant or not at the 5% level of significance?

14. Construct a Histogram from the frequency distribution given below:

Weight	Frequency
91 – 100	5
101 – 110	18
111 – 120	26
121 – 130	3
131 - 140	5

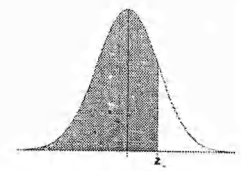
Standard Normal Cumulative Probability Table



Cumulative probabilities for NEGATIVE z-values are shown in the following table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-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

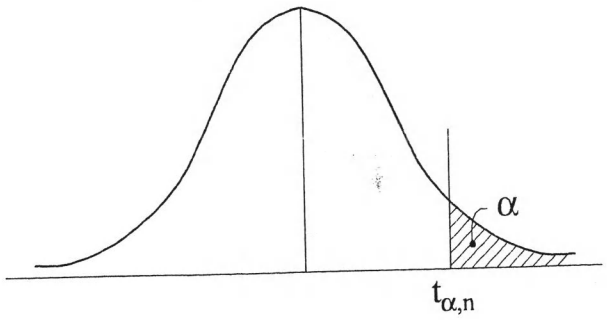
Standard Normal Cumulative Probability Table



Cumulative probabilities for POSITIVE z-values are shown in the following table:

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
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

STUDENT'S *t*-DISTRIBUTION



VALUES OF $t_{\alpha,n}$

df	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	*df*
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	1
2	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	2
3	0.765	0.978	1.350	1.638	2.353	3.182	4.541	5.841	3
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	4
5	**0.727**	**0.920**	**1.156**	**1.476**	**2.015**	**2.571**	**3.365**	**4.032**	**5**
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	6
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	7
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	8
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	9
10	**0.700**	**0.879**	**1.093**	**1.372**	**1.812**	**2.228**	**2.764**	**3.169**	**10**
11	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	11
12	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	12
13	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	13
14	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	14
15	**0.691**	**0.866**	**1.074**	**1.341**	**1.753**	**2.131**	**2.602**	**2.947**	**15**
16	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	16
17	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	17
18	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	18
19	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	19
20	**0.687**	**0.860**	**1.064**	**1.325**	**1.725**	**2.086**	**2.528**	**2.845**	**20**
21	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	21
22	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	22
23	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	23
24	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	24
25	**0.684**	**0.856**	**1.058**	**1.316**	**1.708**	**2.060**	**2.485**	**2.787**	**25**
26	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	26
27	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	27
28	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	28
29	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	29
30	**0.683**	**0.854**	**1.055**	**1.310**	**1.697**	**2.042**	**2.457**	**2.750**	**30**
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	∞