

KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

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

Course : MATH 208
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date :

SECTION "A"

[10 Q × 1 = 10 marks]

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

1. In theory of testing of hypothesis, α is called.....
2. Given $\mu_0 = 125$, $\bar{X} = 130$, $s = 25$ and $n = 4$; if hypothesis has to be tested for mean, what test statistics is appropriate?.....
3. In an paired samples t-test with sample sizes $n_1 = 11$ and $n_2 = 11$, the value of tabulated t should be obtained for.....degrees of freedom
4. In analyzing the results of an experiment involving six unpaired samples, tabulated t should be obtained for.....degrees of freedom
5. The correlation coefficient between X and X is.....
6. In two rolls of a fair die, let A be the event that no fours, fives or sixes are rolled the $P(A)$ is
7. One of the normal equations for fitting the line $Y = a + bx$ is given by $\sum_{i=1}^n X_i Y_i = \dots\dots\dots$
8. On a multiple choice question with 5 possible answers to 10 questions, what is the probability that the student gets 8 or more correct answers just by guessing.....
9. If $f(x) = 1/10$, $x = 10$, then $E(X)$ is.....
10. Coefficient of variation of a random variable distributed as binomial with parameters n and p is.....

SECTION "B"

[10 Q. × 1 = 10 marks]

11. According to Chebyshev's theorem, if $\mu = 2$ and $\sigma = 0.5$ for a random variable Y, then $P(1 < Y < 3) \geq a$, where a is
a. 0.75 b. 0.80 c. 0.85 d. 0.90
12. The level of confidence is denoted by.....
a. α b. β c. $1 - \alpha$ d. $1 - \beta$

13. An average of $\lambda = 7$ particles hit a magnetic detection field per microsecond. What is the probability that at most 5 particles hit in one microsecond?
 a. 0.254 b. 0.273 c. 0.293 d. 0.301
14. A failing student is passed by an examiner, it is an example of.....
 a. Type-I error b. Type-II error
 c. Unbiased decision d. Difficult to tell
15. A passing student is failed by an examiner; it is an example of.....
 a. Type-I error b. Type-II error c. Best decision d. All of the these
16. The region where the null hypothesis is rejected is called.....
 a. Critical region b. Critical value
 c. Acceptance region d. Significant region
17. The method ofis the most systematic method of fitting a unique line of regression to the data
 a. Least squares b. least cubes c. square d. None of these
18. From the data given below, $\sum_{i=1}^5 x_i^2 =$
- | | | | | | |
|---|---|---|---|----|----|
| x | 0 | 1 | 2 | 3 | 4 |
| y | 1 | 0 | 3 | 10 | 21 |
- a. 12 b. 13 c. 14 d. 30
19. The area under the standard normal curve beyond the lines $z = \pm 1.96$ is.....
 a. 95% b. 90% c. 5% d. 10%
20. The cumulative probability distribution shows the probability.....
 a. that a random variable is less than or equal to a particular value.
 b. of two or more events occurring at once.
 c. of all possible events occurring.
 d. that a random variable takes on a particular value given that another event has happened.

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Semester : II
F. M. : 55

SECTION "C"

[3Q. \times 7 = 21 marks]

1. The loads (in kg) required to crack the specimens are as follows:

[4+1+2]

Ceramic Type	Loads (kg)
A	15, 30, 51, 20, 17, 19, 20, 32, 17, 15, 23, 19, 15, 18, 16, 22, 29, 15, 13, 15
B	27, 18, 28, 25, 55, 21, 18, 34, 23, 30, 20, 30, 31, 25, 28, 26, 17, 19, 16, 24, 19, 9, 31, 19, 27, 20, 43, 15
C	20, 16, 20, 36, 27, 35, 66, 15, 18, 24, 21, 30, 20, 24, 23, 21, 13, 21

- a. Construct comparative box plots for three samples
b. Comments on the features of the three samples from the box plot.
c. Find the mean and variance of the three samples and give comments on the center of gravity and spread of the data.
2. The concentration of a reactant is a random variable with probability density function [2+3+2]
 $f(x) = 1.2(x + x^2), 0 < x < 1$
a. Find the mean concentration.
b. Find the probability that the concentration is within ± 0.1 of the mean and sketch the graph and indicate the area corresponding to this probability.
c. Find the cumulative distribution function of the concentration.
3. The following table presents the shear strengths (in kN/mm) and weld diameters (in mm) for a sample of spot welds. [1+2+2+1+1]

Diameter (x)	Strength (y)
4.2	51
4.4	54
4.6	69
4.8	81
5.0	75
5.2	79
5.4	89
5.6	101
5.8	98
6.0	102

- a. Construct a scatter plot
b. Compute the least square line for predicting strength from diameter
c. Compute the fitted value and the residual for each point
d. If diameter increased by 0.3 mm, by how much would you predict the strength to increase
e. Predict the strength for a diameter of 5.5 mm.

SECTION "D"

[6Q. \times 4 = 24 marks]

4. The breaking strength of hockey stick shafts made of two different graphite – Kevlar composites yield the following results (in Newtons):

Composite A: 487.3 444.5 467.7 456.3 449.7 459.2 478.9 461.5 477.2
 Composite B: 488.5 501.2 475.3 467.2 462.5 499.7 470 469.5 481.5 485.2
 509.3 479.3 478.3 491.5

Find a 98% confidence interval for the difference between the mean breaking strengths of hockey stick shafts made of the two materials.

5. The table below gives the following information. [1+1+2]

Sample #1	Sample #2	Sample #3	Sample #4
$\bar{X} = 1.51$	$\bar{X} = 1.50$	$\bar{X} = 1.52$	$\bar{X} = 1.53$
$R = .03$	$R = .02$	$R = .04$	$R = .03$
$n = 5$	$n = 5$	$n = 5$	$n = 5$

- What are the values of UCL, CL and LCL of \bar{X} chart?
 - What are the values of UCL, CL and LCL of R chart?
 - Draw \bar{X} chart and R chart and test whether the mean and range are within the control limits.
6. A certain manufactured product is supposed to contain 23% potassium by weight. A sample of 10 specimens of this product had an average percentage of 23.2 with a standard deviation of 0.2. If the mean percentage is found to differ from 23, the manufacturing process will be recalibrated.
- State the appropriate null and alternative hypothesis
 - Should the process be recalibrated? Explain
7. Computer chips often contain surface imperfections. For a certain type of computer chip, the probability distribution of the number of defects X is presented in the following table. [2+1+1]

x	0	1	2	3	4
p(x)	0.4	0.3	0.15	0.10	0.05

- Find $P(X \leq 2)$
 - Find $P(X > 1)$
 - Find $E(X)$
8. The blood type distribution in a certain country is type A, 41%; type B, 9%; type AB, 4%; and type O, 46%. It is estimated during World War II, 4% of inductees with Type O were types as type A; 88% of those with type A were correctly typed; 4% with type B were typed as A; and 10% with type AB were typed as A. A soldier was wounded and brought to surgery. He was typed as having type A blood? What is the probability that his true blood type? [4]

9. Let X denote the lag time in a printing queue at a particular computer center. That is, X denotes the difference between the time that a program is placed in a queue and the time at which the printing begins. Assume that X is normally distributed with mean 15 minutes and variance 25. [1+2+1]
- Find the probability that a program will reach the printer within 3 minutes of arriving in the queue.
 - Would it be unusual for the program to stay in the queue between 10 and 20 minutes? Explain, based on the approximate probability of this occurring.
 - For what time difference it would top 10% of the probability?

SECTION "E"

[5Q. \times 2 = 10 marks]

10. If the normal equations for fitting the line $y = ax + b$ are $26 = 4a + 6b$ and $54 = 6a + 4b$, then write the equation of the line of regression obtained from the normal equations.
11. For the following data, find a normal equation for fitting a straight line $y = a + bx$

x	1	2
y	5	8

12. Assume measurements for Ph levels in soil follow exactly normal distribution with mean $\mu = 5$ and $\sigma = 1.4$. Determine percentage if Ph levels in the intervals 3.6 to 6.4
13. One hundred students took a test on which the mean score was 73 with a variance of 64. A grade of A was given to all who scored 85 or better. Approximately how many A's were there, assuming scores were normally distributed?
14. Classify the following the data on Nominal, Ordinal, Interval and Ratio scale. [4 \times 0.5 = 2]
- Fear of Crime
 - Temperature
 - Income
 - Gender



Just compare April 2011

TABLE 7.6 $K_z = F(C_s, T)$ FOR USE IN LOG-PEARSON TYPE III DISTRIBUTION

Coefficient of skew, C_s	Recurrence interval T in years						
	2	10	25	50	100	200	1000
3.0	-0.396	1.180	2.278	3.152	4.051	4.970	7.250
2.5	-0.360	1.250	2.262	3.048	3.845	4.652	6.600
2.2	-0.330	1.284	2.240	2.970	3.705	4.444	6.200
2.0	-0.307	1.302	2.219	2.912	3.605	4.298	5.910
1.8	-0.282	1.318	2.193	2.848	3.499	4.147	5.660
1.6	-0.254	1.329	2.163	2.780	3.388	3.990	5.390
1.4	-0.225	1.337	2.128	2.706	3.271	3.828	5.110
1.2	-0.195	1.340	2.087	2.626	3.149	3.661	4.820
1.0	-0.164	1.340	2.043	2.542	3.022	3.489	4.540
0.9	-0.148	1.339	2.018	2.498	2.957	3.401	4.395
0.8	-0.132	1.336	1.998	2.453	2.891	3.312	4.250
0.7	-0.116	1.333	1.967	2.407	2.824	3.223	4.105
0.6	-0.099	1.328	1.939	2.359	2.755	3.132	3.960
0.5	-0.083	1.323	1.910	2.311	2.686	3.041	3.815
0.4	-0.066	1.317	1.880	2.261	2.615	2.949	3.670
0.3	-0.050	1.309	1.849	2.211	2.544	2.856	3.525
0.2	-0.033	1.301	1.818	2.159	2.472	2.763	3.380
0.1	-0.017	1.292	1.785	2.107	2.400	2.670	3.235
0.0	0.000	1.282	1.751	2.054	2.326	2.576	3.090
-0.1	0.017	1.270	1.716	2.000	2.252	2.482	2.950
-0.2	0.033	1.258	1.680	1.945	2.178	2.388	2.810
-0.3	0.050	1.245	1.643	1.890	2.104	2.294	2.675
-0.4	0.066	1.231	1.606	1.834	2.029	2.201	2.540
-0.5	0.083	1.216	1.567	1.777	1.955	2.108	2.400
-0.6	0.099	1.200	1.528	1.720	1.880	2.016	2.275
-0.7	0.116	1.183	1.488	1.663	1.806	1.926	2.150
-0.8	0.132	1.166	1.448	1.606	1.733	1.837	2.035
-0.9	0.148	1.147	1.407	1.549	1.660	1.749	1.910
-1.0	0.164	1.128	1.366	1.492	1.588	1.664	1.880
-1.4	0.225	1.041	1.198	1.270	1.318	1.351	1.465
-1.8	0.282	0.945	1.035	1.069	1.087	1.097	1.130
-2.2	0.330	0.844	0.888	0.900	0.905	0.907	0.910
-3.0	0.396	0.660	0.666	0.666	0.667	0.667	0.668

[Note : $C_s = 0$ corresponds to log-normal distribution]

TABLE 7.3 REDUCED MEAN μ_n IN GUMBEL'S EXTREME VALUE DISTRIBUTION

N = sample size

N	0	1	2	3	4	5	6	7	8	9
10	0.4952	0.4996	0.5035	0.5070	0.5100	0.5128	0.5157	0.5181	0.5202	0.5220
20	0.5236	0.5252	0.5268	0.5283	0.5296	0.5309	0.5320	0.5332	0.5343	0.5353
30	0.5362	0.5371	0.5380	0.5388	0.5396	0.5402	0.5410	0.5418	0.5424	0.5430
40	0.5436	0.5442	0.5448	0.5453	0.5458	0.5463	0.5468	0.5473	0.5477	0.5481
50	0.5485	0.5489	0.5493	0.5497	0.5501	0.5504	0.5508	0.5511	0.5515	0.5518
60	0.5521	0.5524	0.5527	0.5530	0.5533	0.5535	0.5538	0.5540	0.5543	0.5545
70	0.5548	0.5550	0.5552	0.5555	0.5557	0.5559	0.5561	0.5563	0.5565	0.5567
80	0.5569	0.5570	0.5572	0.5574	0.5576	0.5578	0.5580	0.5581	0.5583	0.5585
90	0.5586	0.5587	0.5589	0.5591	0.5592	0.5593	0.5595	0.5596	0.5598	0.5599
100	0.5600									

TABLE 7.4 REDUCED STANDARD DEVIATION S_n IN GUMBEL'S EXTREME VALUE DISTRIBUTION

N = sample size

N	0	1	2	3	4	5	6	7	8	9
10	0.9496	0.9676	0.9833	0.9971	1.0095	1.0206	1.0316	1.0411	1.0493	1.0565
20	1.0628	1.0696	1.0754	1.0811	1.0864	1.0915	1.0961	1.1004	1.1047	1.1086
30	1.1124	1.1159	1.1193	1.1226	1.1255	1.1285	1.1313	1.1339	1.1363	1.1388
40	1.1413	1.1436	1.1458	1.1480	1.1499	1.1519	1.1538	1.1557	1.1574	1.1590
50	1.1607	1.1623	1.1638	1.1658	1.1667	1.1681	1.1696	1.1708	1.1721	1.1734
60	1.1747	1.1759	1.1770	1.1782	1.1793	1.1803	1.1814	1.1824	1.1834	1.1844
70	1.1854	1.1863	1.1873	1.1881	1.1890	1.1898	1.1906	1.1915	1.1923	1.1930
80	1.1938	1.1945	1.1953	1.1959	1.1967	1.1973	1.1980	1.1987	1.1994	1.2001
90	1.2007	1.2013	1.2020	1.2026	1.2032	1.2038	1.2044	1.2049	1.2055	1.2060
100	1.2065									