KATHMANDU UNIVERSITY
End Semester Examination
September 2024

Marks Scored:

Level : B.Sc./B.Tech.
Year : I

Course : MATH 102
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 05 SEP 2024

SECTION "A"
[10Q. × 1 = 10 marks]

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

1. For a symmetric distribution _____, _____ and _____ coincide.

2. If mean, mode and standard deviation of a set data are observed to be 45.6, 42.9 and 9.8 respectively, then the value of Pearson's Skewness of coefficient is _____.

3. The value of the sum of deviation taken from actual mean is _____.

4. For a random variable X, it has been calculated that $E(X^2) = 192$ and $E(X) = 9$. Here $V(X) =$ _____.

5. If $x's$ are values assumed by a discrete random variable X having probability mass function $p(x)$, then $E(X) =$ _____.

6. The average number of persons infected by a disease out of 40 persons selected randomly from a population, if 5% of population are known to be infected by the disease is _____.

7. A peculiar characteristic of Poisson distribution is that mean and variance are _____.

8. If $X \sim N(\mu, \sigma^2)$ then $X - \mu \sim$ _____.

9. Simple regression is the study of dependency of a variable with another variable, whereas, correlation is the study of _____ of a variable with another variable.

10. The variance of a sample of size 10 if $\sum X^2 = 172$ and $\sum X = 25$ is _____.

SECTION "B"

[10 Q. × 1 = 10 marks]

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

11. _____ is not a measure of variation or dispersion of data.
[mean range standard deviation mean deviation]

12. $P(A \cap A) =$ _____.
[0 1 $P(A)$ $1 - P(A)$]

13. In a group of 100 persons, 60 are graduates and 40 are employed and 20 are both. A person is randomly selected from the group and is known to be employed, then the probability of this selected person to be graduate is _____.
[$\frac{60}{100}$ $\frac{20}{100}$ $\frac{20}{40}$ $\frac{20}{60}$]

14. For a discrete random variable X, the probability that it takes a particular value 'x' is usually expressed as a function called _____ function.
[probability mass function probability density function
probability distribution function cumulative distribution function]

15. _____ distribution can be considered as the limiting form of binomial distribution $B(n,p)$ when (i) $n \to \infty$ (ii) $p \to 0$ and (iii) $n \times p$ is constant.
[normal Poisson chi-square t]

16. A researcher is interested in analyzing the concentration of haemoglobin in blood of human beings. He/she can achieve his objective by implementing _____ distribution.
[binomial Poisson normal chi-square]

17. The number of metastatic lymph nodes in cancer patients is found to depend on age. Here 'age' is _____ variable.
[dependent response regressive independent]

18. If $P(t_{12} \geq 1.78) = 0.05$, then it is expressed as _____.
[$t_{12,0.05} = 1.78$ $t_{1.78,12} = 0.05$ $t_{12,1.78} = 0.05$ $t_{0.05,12} = 1.78$]

19. Inference on difference in means of two normal populations when population variances are unknown and samples are less than 30 is carried with the help of _____ distribution.
[Chi-square Distribution t- Distribution F- Distribution Normal Distribution]

20. For a left tailed test on mean of a normal population, if the value of the test statistic is Z_0, then the null hypothesis will be rejected at 5% level of significance, if _____.
[$Z_0 \geq -Z_\alpha$ $Z_0 \leq -Z_{\alpha/2}$ $Z_0 \leq -Z_\alpha$ $Z_0 \geq -Z_{\alpha/2}$]

KATHMANDU UNIVERSITY
End Semester Examination
September 2024

Level : B.Sc./B.Tech.
Year : I
Time : 2 hrs. 30mins.

05 SEP 2024

Course : MATH 102
Semester : II
F. M. : 55

SECTION "C"
[3Q × 7 = 21 marks]

1. The following data represent the length of life, in seconds, of 50 fruit flies subject to a new spray in a controlled laboratory experiment:

65.2	87.7	78.3	115.2	87.5	124.0	88.6	100.3	63.4	93.3
78.3	91.1	75.6	94.2	106.3	89.9	127.3	87.6	68.1	86.7
76.9	90.8	100.5	98.9	112.8	92.7	69.5	91	67.8	93.4
116.1	90.1	121.9	88.3	75.5	87.9	100.8	90.9	112.5	96.1
68.3	91.8	127.1	90.4	111.8	93.0	67.3	89.9	79.2	89.6
67.5	88.4	72.5	91.2	118.6	94.4	129.4	91.8	111.1	90.4

a. Construct a stem-and-leaf plot for above data. [2]
b. Use the stem-and-leaf plot in part (a) to construct a frequency distribution with class interval of 10 and then construct a histogram. [1]
c. Use the frequency distribution in part (b) to calculate the mean and standard deviation. [2]
d. Use the frequency distribution in part (b) to calculate the median and use following expression to calculate Pearson's coefficient of skewness. [2]

$$S_k = \frac{3(Mean - Median)}{s.d.}$$

2. A survey was conducted to relate the time, in hours, required to deliver a proper presentation on a topic, to the performance of the student with the scores he/she receives. Following table shows the matched data:

Presentaion ID	Hours(x)	Score (y)	Presentaion ID	Hours(x)	Score (y)
1	0.50	57	8	2.25	83
2	0.75	64	9	2.50	85
3	1.00	59	10	2.75	86
4	1.25	68	11	3.00	88
5	1.50	74	12	3.25	89
6	1.75	76	13	3.50	90
7	2.00	79	14	3.75	94

a. Draw a scatterplot to show that performance score is linearly related to the time required for presentation.
b. Find the coefficient of correlation between performance score and time in hours.
c. Obtain the coefficient of determination. [1+5+1]

P.T.O.

3. Data on the amount of protein generated when experimented with two different enzymes A and B are presented below:

Enzyme A - 17.40, 10.79, 24.19, 8.94, 13.25, 15.67, 19.36, 9.93, 14.44

Enzyme B - 13.59, 15.60, 9.45, 6.22, 11.26, 13.79, 12.20

Assuming that sample observations are drawn from normal populations with equal variances perform a test of hypothesis procedure to determine whether amount of protein generated using 'Enzyme A' is significantly greater than that using 'Enzyme B' at 5% level of significance. Also construct 95% confidence interval for actual difference in mean of protein generated between the two enzymes.

OR

In certain food experiment to test the effectiveness of a baby food, 8 children were observed. Their weights, in pounds, before taking the food and after 2 weeks of experiment are as follows-

Children ID	1	2	3	4	5	6	7	8
Before	49	53	51	52	47	50	52	53
After	52	55	52	53	50	54	54	53

Carry paired t-test to examine whether the baby food has been effective in increasing weight at 0.05 level of significance. Also construct 95% confidence interval for actual difference in weights of babies before and after taking the food.

SECTION "D"

[6Q × 4 = 24 marks]

4. Two hundred patients who had either hip surgery or knee surgery were asked whether they were satisfied or dissatisfied regarding the result of their surgery. The following table summarizes their response-

Surgery	Satisfied	Dissatisfied
Knee	70	25
Hip	90	15

If one person from the 200 patients is selected at random, determine the probability that the person was satisfied GIVEN that the person had knee surgery.

5. It is known that the average height of cadets of a center follows normal distribution. A sample of 10 cadets of the center was taken and measured their heights (in inch) which are given below:

70, 72, 80, 82, 78, 80, 69, 79, 77, 70

From this data, estimate the 95% confidence limits for the average height of cadets of the particular center.

6. Pharmacy in a clinic has 20 revolizers of which 5 are defective. If 10 of these revolizers are selected at random, find the probability that there are exactly 2 defective units in the sample by using (i) binomial distribution (ii) hyper-geometric distribution.

7. Given following probability mass function of a random variable X-

$$p(x) = \frac{k}{x+3} \; ; x = 1,2,3,4$$

Find (i) value of 'k' (ii) mean of 'X'.

OR

In a certain population, 30% of the persons smoke, and 8% have a certain type of heart disease. Moreover, 12% of the persons who smoke have the heart disease. What percentage of the population smoke and have the heart disease?

8. If the probability that an individual suffers a bad reaction from an injection of a given serum is 0.001, determine the probability that out of 500 individuals i) exactly 3, ii) more than 2 individuals suffer from bad reaction by using Poisson distribution.

9. The length of human pregnancies from conception to birth is normally distributed with mean of 266 days and a standard deviation of 16 days. Out of 1000 pregnancies observations how many pregnancies will last between 240 and 270 days (i.e., between 8 and 9 months)?

SECTION "E"

[5Q × 2 = 10 marks]

10. Calculate standard deviation of following frequency distribution:

x	5	15	25	35	45
f	7	12	20	8	4

11. Let X be random variable with following probability distribution-

X	2	4	6
p(x)	2/7	3/7	2/7

Find $E(X^2)$.

12. Find $'c'$ if $P(-c < Z < c) = 0.98$.

13. For a left tailed test on mean of a normal population, the value of the test statistic will be rejected at 5% level of significance.

14. There are two boxes. First box contains 7 red and 5 white balls. Second box contains 6 red and 6 white balls. Two balls are drawn one from each box. The probability that both balls will be white.