KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Mark 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 :

SECTION "A"
[10Q × 1 = 10 marks]

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

1. The formula for calculation of Pearson's coefficient of skewness is _____.

2. The probability of an event when the outcome of another event dependent on it is known as _____.

3. If $x_1, x_2, \ldots\ldots\ldots\ldots x_n$ are a values of a random variable X having probability mass function $p(x)$, then $E(X) =$ _____.

4. The mean value or the rate, denoted as λ is the parameter of _____ distribution.

5. If $X \sim N(45, 16)$ then $Z =$ _____ has standard normal distribution N(0, 1).

6. The skewness of a normal distribution is _____.

7. The standard error of mean $(\bar{X})$ of a sample of size n drawn from a normal population having variance σ^2 is _____.

8. A postulated statement about population parameter is called a _____.

9. We use _____ distribution to make inference on population mean in the case when the value of population variance is not known.

10. _____ is the term used to describe the degree of relationship between two variables.

SECTION "B"
[10Q. × 1 = 10 marks]

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

11. The expression $P\big((A - B) \cup (B - A)\big)$ describes the event of _____ _____.

a. occurrence of neither event A nor event B
b. occurrence of any one or both of the events A and B
c. occurrence of exactly one of the two events A and B
d. occurrence of event A only without B

12. If X is a continuous random variable, then a continuous function, denoted as $f(x)$ is called its _____ if $P\left(x - \frac{\Delta x}{2} \leq X \leq x + \frac{\Delta x}{2}\right) = f(x).\Delta x$.

a. probability mass function
b. probability density function
c. probability distribution function
d. cumulative distribution function

13. In which distribution are mean and variance always equal? _____

a. Binomial distribution
b. Poisson distribution
c. Hypergeometric distribution
d. Normal distribution

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

a. $N(0, \sigma^2)$ b. $N(\mu, 1)$ c. $N(0, 1)$ d. $N(1, \sigma^2)$

15. For $X \sim N(\mu, \sigma^2)$ distribution, $P(\mu - 2\sigma < X < \mu + 2\sigma) =$ _____.

a. 0.6826 b. 0.9547 c. 0.9976 d. 1

16. Total number of ways of selecting a sample of n, units from a population of size N by simple random sampling with replacement method is _____.

a. N^n b. ${}^{N}C_n$ c. ${}^{n}C_N$ d. n^N

17. To carry inference on variance of a normal population _____ distribution is used.

a. F b. Z c. t d. χ^2

18. In 'Test of hypothesis' studies, Type II error means error committed in _____.

a. rejecting null hypothesis when it is true
b. accepting alternative hypothesis when it is true
c. accepting null hypothesis when it is false
d. accepting null hypothesis when it is true

19. In simple linear regression model given by $y = \alpha + \beta x$, the value of β measures _____.

a. the value of 'y' when 'x' is nullified.
b. the change in value of 'x' for unit change in the value of 'y'
c. the change in value of 'y' for unit change in the value of 'x'
d. the value of 'x' when 'y' is nullified.

20. If the value of correlation coefficient between two variables is observed to be – 0.9, then it indicates _____

a. weak negative correlation
b. strong negative correlation
c. perfect negative correlation
d. no correlation

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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:

17	61	10	45	23	38	12	47	18	50
47	14	39	9	41	6	37	10	43	7
16	52	8	46	3	37	9	51	10	62
44	7	56	7	49	4	35	19	48	8
7	41	5	53	15	49	9	52	7	47

(a) Construct a stem-and-leaf plot for above data.
(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.
(c) Use the frequency distribution in part (b) to calculate the mean and standard deviation.

2. The length of wings of 9 randomly selected peacocks of same age at Koshi Tappu and 8 peacocks of same age at Bardia National Park are measured in centimeter as follows:

Koshi Tappu : 94 87 75 88 92 72 79 81 67
Bardia : 92 105 89 112 96 125 120 104

Conduct a test of hypothesis at 5% level of significance to determine whether the length of wings of peacocks in Bardia National Park is significantly longer. Assume that actual lengths of wings of peacocks in two national parks are normally distributed with same variances. Also construct 95% confidence interval for true difference in length of wings of peacocks at the two national parks.

OR

What is point estimation and internal estimation? Write down the properties of estimators.
A random sample of 10 people recorded the number of glasses of water they drank in a particular week. The results are as follows: 19 15 24 18 26 28 32 17 29 36
Find 95% confidence interval for the number of glasses of water drank in a particular week.

3. Data on the amount of protein generated in certain experiment reported over different time are presented below:

Time/ min. (x)	Amount of Protein/ gm. (y)
0	0.936
10	0.925
20	0.908
30	0.881
40	0.850
50	0.818

a. Draw a scatterplot to examine whether it is reasonable to model data linearly.
b. Construct simple linear regression model of form $y = \alpha + \beta x$ to above data.
c. Estimate the amount of protein generated in the time of 65 minutes.

SECTION "D"

[6Q. × 4 = 24 marks]

4. The probabilities of selection of 3 persons for the post of a principal in a newly started college are in the ratio 4 : 3: 2 (i.e., corresponding probabilities are 4/9, 3/9 and 2/9 respectively) . The probabilities that they will introduce co-education in the college are 0.2, 0.3 and 0.5, respectively. Find the probability that co-education is introduced in the college. If the co-education is introduced by the candidate selected for the post of principal, what is the probability that first candidate was selected?

5. The probability mass function of a discrete random variable X is given by

$$p(x) = \frac{2}{3}\left(\frac{1}{3}\right)^{x} ; x = 0,1,2,3,4$$

Find $E(X)$.

6. The chances of catching cold by workers working in an ice factory during winter are 25%. What is the probability that out of 5 workers 4 or more will catch cold?

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

8. At an airport, it is observed that on average 2 planes land in 5 minutes. Find probability that in the duration of 10 minutes randomly chosen on a day no plane lands.

OR

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 at most 1 defective unit in the sample by using hyper-geometric distribution?

9. Two independent random samples of sizes $n_1 = 18$ and $n_2 = 20$ are taken from normal populations. The sample means are $\bar{X}_1 = 200$ and $\bar{X}_2 = 190$. It is known that the population variances are $\sigma_1^2 = 15$ and $\sigma_2^2 = 12$. Find 95% two-sided confidence interval of difference in population means, i.e., $\mu_1 - \mu_2$.

SECTION "E"

[5Q. × 2 = 10 marks]

10. Write down the addition law of probability for multiply and not multiply exclusive events.

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

X	-2	-1	0	1	2
$p(x)$	1/10	2/10	4/10	2/10	1/10

Find $E(X^2)$.

12. If $X \sim N(12,9)$, find $P(9 \leq X \leq 13)$.

13. The study of a set of paired data on (X, Y) give following results: n = 10, $\sum x = 15$, $\sum y = 15$, $\sum x^2 = 55$, $\sum y^2 = 226$ and $\sum xy = 110$. Find correlation coefficient between X and Y.

14. Write a short note on Expectation of a random variable in continuous probability distribution.