KATHMANDU UNIVERSITY
End Semester Examination
March, 2025

Marks Scored:

Level : B.Sc.
Year : II

Course : MATH 208
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 20 MAR 2025

SECTION "A"
[10 Q. × 1 = 10 marks]

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

1. The percentage of standard deviation with respect to mean of data distribution is called its _____.

2. To construct a boxplot minimum value, first quartile, median, third quartile and _____ are needed.

3. If A and B are _____ events, then $P(A \cup B) = P(A) + P(B)$.

4. If $V(X) = 24$, then $V(X/2) =$ _____.

5. If $X \sim B(15, 0.4)$, then $P(X = 1) =$ _____.

6. A normal distribution having mean 0 and variance 1 is called _____.

7. Different statistical values such as mean, median, range, variance, etc. of sample observations are called _____.

8. The error that is committed in accepting the null hypothesis when, in fact, it is wrong is called _____ error.

9. In control charts, any sample points lying outside the 3σ limits is an indication of _____.

10. In regression analysis, difference between observed value and model predicted value is called _____.

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. For a positively skewed distribution _____ is greatest.
[mean; median; mode; standard deviation]

12. $P(A \cap A) =$ _____
[0; 1; $P(A)$; 0.5]

13. If X is random variable then $P(X \leq x)$ is a non-decreasing function of X. It is denoted by $F_X(x)$ and is called _____.
[probability mass function; probability density function;
probability distribution function; cumulative distribution function]

14. It is known that 3 requests enter into a server, on average, in 1 second. The probability distribution of number of requests entering into the server can be modeled by _____ distribution.
[binomial; Poisson normal chi-square]

15. If $X \sim N(12, 3^2)$, and $Y = X + 4$, then $Y \sim N($_____, _____$)$.
[$N(16,3)$; $N(16,3^2)$; $N(12,16)$; $N(16, 16)$]

16. If a sample of n units is selected randomly from a $N(\mu, \sigma^2)$ population, then $\frac{\sigma^2}{n}$ represents _____.
[variance of sample observations; variance of sample means;
standard deviation of sample means ; skewness of sample observations]

17. If $S^2$is the variance of a sample of size n drawn from $N(\mu, \sigma^2)$ population, then the statistic $\frac{(n-1)S^2}{\sigma^2}$ has _____ distribution.
[t-distribution; Z-distribution;
chisquare-distribution; F-distribution]

18. A researcher wants to know whether average marks of male and female candidates in KUCAT entrance test differ significantly. In fact, corresponding test is _____ tailed test.
[left; right; two; heavy]

19. The error caused by _____ is a factor of random cause of variation.
[faulty equipment; defective raw material;
un-experienced operator minor mistakes in operation]

20. In simple linear regression equation $y = 21.5 + 1.24x$, the predicted value of dependent variable for value 4.8 of independent variable is _____
[21.5 1.24 5.592 27.452]

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SECTION "C"
[3 Q. × 7 = 21 marks]

1. The following data represent the length of life, in weeks, of 50 UPS batteries: [2+1+3+1]

17	20	10	9	23	13	12	19	18	24
12	14	6	9	13	6	7	10	13	7
16	18	8	13	3	32	9	7	10	11
13	7	18	7	10	4	27	19	16	8
7	10	5	14	15	10	9	6	7	15

a. Construct a branched stem-and-leaf plot for above data with digits 0, 1, 2, 3 and 4 in leaf placed in stem indicated with 'f' and digits 5, 6, 7, 8 and 9 in leaf placed in stem indicated with 's'.
b. Use the stem-and-leaf plot in part (a) to construct a frequency distribution with class interval of 5 and then construct a histogram.
c. Use the frequency distribution in part (b) to calculate the mean and standard deviation.
d. The median of given data distribution is observed to be 10. Calculate Pearson's coefficient of skewness.

2. A researcher collected data on waiting time to visit a doctor at two different hospitals. He/she observed waiting time of 15 patients at Hospital-1 with following result in minutes- **61, 56, 50, 68, 39, 20, 57, 56, 38, 53, 47, 45, 40, 31, 57**. Similarly, the waiting times of 12 patients at Hospital 2 were observed in minutes as- **37, 60, 59, 26, 45, 24, 38, 31, 38, 44, 61, 27**. Assuming that the variances of waiting times in two hospitals, though unknown, are equal perform a test of hypothesis procedure to establish the belief that actual average waiting time of Hospital-1 is significantly greater. Also obtain 95% two-sided confidence interval for actual difference in mean waiting times at the two hospitals.

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.

P.T.O.

3. A survey was conducted to relate the time 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: [1+4+1+1]

Hours (x)	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Score(y)	57	64	59	68	74	76	79	83	85

a. Draw a scatterplot to show that performance score is linearly related to the time required for presentation.

b. Find the equation of regression line that will predict a student's score if we know how many hours the student studied.

c. If a student had studied 0.85 hours, what is the student's predicted score?

d. Find Pearson's correlation coefficient between study hour and score.

SECTION "D"

[6Q. × 4 = 24 marks]

4. Let X be continuous random variable with probability density function

$$f(x) = \frac{x^3}{4}$$

for an interval $0 < x < c$. What is the value of the constant c that makes $f(x)$ a valid probability density function?

5. An auto insurance company classifies in terms of risk categories A, B and C. The proportion of policies associated with A is 25%, while B and C comprise 55% and 20% respectively. Over a 6-month time period the accidents rates for categories A, B and C are 10%, 5% and 1% respectively. Find the proportion of policyholders that have accidents over the 6-month period. If a policyholder has an accident in the period, find probability that it is in risk category B.

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) Poisson approximation of binomial distribution.

7. Parts for a machine are acceptable within the tolerance limits of 20.5 to 20.6 mm. From previous tests it is known that the machine produces parts with $N(20.56, 0.02^2)$ distribution. Out of a batch of 1000 parts how many would be expected to be rejected?

8. A random sample of 10 workers is taken from a factory. The wages (in hundreds) per months of these workers are given below: 48, 50, 62, 75, 80, 60, 70, 56, 52, 77. Obtain 95% confidence interval for the variance of wages of all the workers of the factory.

9. Data on 30 days for number of late flights out of 240 takeoffs daily are presented below-

26	19	26	22	24	19	19	20	18	18
17	9	13	10	12	14	14	13	9	10
12	15	14	15	16	18	17	16	18	17

Construct p-chart for proportions of late flights and interpret the chart.

SECTION "E"

[5Q. × 2 = 10 marks]

10. The number of blocked intrusion attempts on each day after changing firewall setting are recorded for 16 days as- 53, 21, 32, 49, 45, 38, 44, 33, 32, 43, 53, 46, 36, 48, 39, 35, 37, 36, 39, 45. If the first, second and third quartiles of these numbers are evaluated to be 35.75, 39.00 and 45.25 respectively, draw a box plot of these values.

11. It is known that the number of heavy trucks arriving at a railway station follows the Poisson distribution. If the average number of truck arrivals during a specified period of an hour is 2, find the probabilities that during a given hour at least two trucks will arrive.

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

13. A box contains 8 balls. Three of them are red and the remaining 5 are blue. Two balls are drawn successively, at random and without replacement. Find the probability that, the first draw results in red, and the second draw results in blue.

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

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

Find $E(X)$, $E(X^2)$ and $V(X)$.