KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.Pharm
Year : I

Course : MATH 102
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 12 DEC 2024

SECTION "A"

[10Q. × 1 = 10 marks]

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

1. Half of the difference between third quartile and first quartile of data distribution is called _____.

2. If A and B are independent events then $P(A|B) =$ _____.

3. For a random variable X, P(X = 0) = 1/8, P(X = 1) = 3/8, P(X = 2) = 3/8 and P(X = 3) = 1/8, then E(X) has value _____.

4. If $X \sim B(15, 0.6)$ then its mean is _____.

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. _____ distribution is used to estimate mean of a normal population when population variance is not known and sample is small.

8. A computer manufacturer wants to establish that the average time to set up a new desktop computer is less than 2 hours. The alternative hypothesis of the corresponding test is H_1: _____.

9. The square root of variance of a sample statistic is called _____.

10. Regression analysis is used to _____ _____.

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. If A and B are any two events, then according to addition law of probability $P(A \cup B) =$ _____

[$P(A) \times P(B)$ $\quad$ $P(A) - P(B)$
$P(B) - P(A \cap B)$ $\quad$ $P(A) + P(B) - P(A \cap B)$]

12. If X is a discrete random variable then probability that it takes a particular value x, i.e. $P(X = x)$ is called _____.

[probability mass function $\quad$ probability density function
probability distribution function $\quad$ cumulative distribution function]

13. Mean and variance always equal in _____ distribution.

[binomial $\quad$ Poisson $\quad$ hypergeometric $\quad$ normal]

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

[$N(0, \sigma^2)$ $\quad$ $N(\mu, 1)$ $\quad$ $N(0, 1)$ $\quad$ $N(1, \sigma^2)$]

15. 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 $\quad$ Poisson $\quad$ normal $\quad$ chi-square]

16. If $X \sim N(\mu, \sigma^2)$ be a population and $X_1, X_2, \ldots\ldots\ldots, X_n$ be a random sample of size n drawn from the population then variance of sample mean $\bar{X}$ is given by _____

[σ^2 $\quad$ $\frac{\sigma^2}{n}$ $\quad$ $\frac{\sigma}{n}$ $\quad$ $\frac{\sigma}{\sqrt{n}}$]

17. The lower sided confidence interval for population mean when population variance is unknown and sample is small is given by _____

[$P\left(\mu \geq \bar{X} - Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}\right) = 1 - \alpha$ $\quad$ $P\left(\mu \geq \bar{X} + t_{\frac{\alpha}{2},\, n-1} \frac{S}{\sqrt{n}}\right) = 1 - \alpha$

$P\left(\mu \geq \bar{X} - t_{\frac{\alpha}{2},\, n-1} \frac{S}{\sqrt{n}}\right) = 1 - \alpha$ $\quad$ $P\left(\mu \leq \bar{X} + t_{\frac{\alpha}{2},\, n-1} \frac{S}{\sqrt{n}}\right) = 1 - \alpha$]

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

[rejecting null hypothesis when it is true $\quad$ accepting alternative hypothesis when it is true
accepting null hypothesis when it is false $\quad$ accepting null hypothesis when it is true]

19. In regression analysis, the X-variables are called _____ variables.

[dependent $\quad$ regressor $\quad$ response $\quad$ study variables]

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

[weak negative $\quad$ strong negative $\quad$ perfect negative $\quad$ no]

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SECTION "C"
[3Q × 7 = 21 marks]

1. State (i) addition law of probability (ii) multiplication law of probability for two events. When two events A and B are said to be independent? A consulting firm rents cars from three agencies, 20% from agency A, 20% from agency B and 60% from agency C. If 10% of the cars from A, 12% of the cars from B, and 14% of the cars from C have bad tires, what is the probability that (i) the firm will get a car with bad tires? (ii) a car with bad tires rented by the firm came from agency C? [1+1+1+2+2]

2. A coffee shop claims their large cup contains 16 ounces. A skeptical customer takes a random sample of 10 large cups of coffee and measures their contents in ounces with results-

20.0, 17.9, 20.6, 15.3, 16.8, 16.6, 18.2, 14.2, 19.2, 15.8

Obtain 95% confidence interval for true average content of coffee and carry t-test to determine if the mean volume differs from the claimed 16 ounces.

OR

Ten identical twins were enrolled in a study to measure the effect of home environment on certain social attitudes. An attitudinal survey of the selected twins was conducted before sending them to live with families of minority environment for a period of 1 year. At the end of the year, another attitudinal survey was administered. The table below gives scores of the children in attitudinal tests in home environment and in minority environment. Use paired t-test to observe whether living in the minority environment leads to higher scores on the attitudinal survey.

ID:	1	2	3	4	5	6	7	8	9	10
Home:	65	67	75	77	69	65	73	78	70	72
Minority:	83	85	72	76	78	80	72	81	70	78

Also construct 95% confidence interval for actual difference in scores of twins in home and in minority environment.

3. The cost of manufacturing a lot of a medicine depends on the lot size, as shown by the following sample data:

Cost (Rs.)	30	70	140	270	530	1010	2500	5020
Lot size	1	5	10	25	50	100	250	500

a. Draw a scatter plot to verify the assumption that the relationship is linear, letting lot size be x and cost y.
b. Fit a straight line of the form $y = a + bx$ to these data by the method of least square.
c. Use the fitted line in part (b) to estimate the cost when lot size is 750.
d. Find Pearson's correlation coefficient between cost and lot size. [1+4+1+1]

P.T.O.

SECTION "D"

[6Q × 4 = 24 marks]

4. Direct evidence of Newton's universal law of gravitation was provided from a renowned experiment by Henry Cavendish. In the experiment, masses of objects were determined by weighing, and the measured force of attraction was used to calculate the density of the earth. The values of the earth's density, in time order by row, are

5.36 5.29 5.58 5.65 5.57 5.53 5.62 5.29
5.44 5.34 5.79 5.10 5.27 5.39 5.42 5.47
5.63 5.34 5.46 5.30 5.75 5.68 5.85

a. Construct stem-and-leaf plot of above data.
b. Determine median and quartiles from the stem-and-leaf plot.

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

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

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

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. The scores of 5 students in an exam are as follows:

Student Name	A	B	C	D	E
Score	50	60	66	70	80

Find Z-values of these scores individually, using Z = (X - mean)/ s.d.

8. 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 on $\mu_1 - \mu_2$.

9. 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 using Poisson distribution.

SECTION "E"

[5Q × 2 = 10 marks]

10. Suppose X is a random variable with E(X) = 3 and V(X) = 5, find (i) E(2X – 7) and (ii) V(2X – 7).

11. There are 6 computer chips two of which are defective. If two chips are selected one-by-one without replacing, find probability of getting both defective chips.

12. Let $X \sim N(10, 9)$. Find $P(2 \leq X \leq 10)$.

13.

a. Use t-table to find (i) $t_{0.025,7}$ (ii) 'c' if $P(t_{10} \geq c) = 0.025$
b. Use z-table to find the value of (i) $Z_{0.95}$ (ii) $P(Z \geq 1.05)$.

14. The study of a set of 10 paired data on (X, Y) give following results: $\sum x = 15$, $\sum y = 30$, $\sum x^2 = 55$, $\sum y^2 = 226$ and $\sum xy = 110$. Find correlation coefficient between X and Y.