(8 pages) **Reg. No. : .....**

**Code No. : 20382 E** **Sub. Code : CAST 11**

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2022.

First/Third Semester

Mathematics – Allied

STATISTICS

(For those who joined in July 2021 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. The value of $\mu_3'$ is ———

(a) $\mu_3 + 3\mu_2\mu_1' + \mu_1'^3$

(b) $\mu_3 - 3\mu_2\mu_1' + \mu_1'^3$

(c) $\mu_3 + 2\mu_2\mu_1' + \mu_1'^3$

(d) $\mu_3 - 2\mu_2\mu_1' + \mu_1'^3$

2. ——— is not affected by change of origin but affected by change of scale.

(a) arithmetic mean

(b) median

(c) moment

(d) mode

3. If $\sum(x-\bar{x})^2 = 60$, $\sum(y-\bar{y})^2 = 90$, $\sum(x-\bar{x})(y-\bar{y}) = 45$, then the correlation coefficient between the variables $x$ and $y$ is ———

(a) 0.6125 (b) 0.1265

(c) 0.5623 (d) 0.2516

4. If $X$ and $Y$ are uncorrelated, $\text{cov}(X,Y) =$ ———

(a) 0 (b) 1

(c) –1 (d) $\infty$

5. If $Q = 0$, then $Y =$ ———

(a) 1 (b) 0

(c) –1 (d) $-\infty$

6. For any given three attributes, the total number of positive class frequencies is ———

(a) $n^2$ (b) $n^3$

(c) $3^n$ (d) $2^n$

7. The value for $c$ for the probability density function $f(x) = \frac{x}{c}$, $x = 1, 2, 3, 4, 5$ is ———

(a) $\frac{1}{15}$ (b) 15

(c) $\frac{15}{2}$ (d) 1

8. If $X$ is the number on a die when it is thrown, $E(X) =$ ———

(a) $\frac{1}{6}$ (b) 1

(c) 7 (d) $\frac{7}{2}$

9. If the mean of a Poisson distribution is $\lambda$, standard deviation = ———

(a) $\lambda$ (b) $\lambda^2$

(c) $\sqrt{\lambda}$ (d) $\sqrt{\lambda^2 + \lambda}$



10. In a normal distribution, Q.D = ——— S.D.

(a) $\frac{4}{5}$ (b) $\frac{2}{3}$

(c) $\frac{3}{2}$ (d) $\frac{5}{4}$

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) In a frequency distribution, Bowley's coefficient of skewness is 0.6, sum of the upper and lower quartiles is 100, median is 38. Find the value of the upper quartile.

Or

(b) Fit a straight line to the following data :

| X | 1 | 2 | 3 | 4 | 6 | 8 |
|---|---|---|---|---|---|---|
| Y | 2.4 | 3 | 3.6 | 4 | 5 | 6 |

12. (a) Prove that $-1 \leq \gamma \leq 1$.

Or

(b) From the following table, find the rank correlation coefficient between the height and weight.

| Height (in cm) | 165 | 167 | 166 | 170 | 169 | 172 |
|---|---|---|---|---|---|---|
| Weight (in kg) | 61 | 60 | 63.5 | 63 | 61.5 | 64 |

13. (a) Is there any inconsistency in the data given below $N = 600$; $(A) = 300$; $(B) = 400$; $(AB) = 50$.

Or

(b) Show that the relation between Yule's coefficient $Q$ and the coefficient of colligation $Y$ is $Q = \frac{2Y}{1+Y^2}$.

14. (a) If $f(x) = \begin{cases} Ax & \text{for } 0 < x < 5 \\ A(10-x) & \text{for } 5 \le x < 10 \\ 0 & \text{otherwise} \end{cases}$, is the probability density function of a random variable $X$, find the value of $A$.

Or

(b) If the random variable $X$ has the following probability law $P(X = x) = q^{x-1} \cdot p$, $x = 1, 2, 3, \ldots$, find the moment generating function of $X$.

15. (a) If the mean of a normal distribution is 4 and the variance is 3, find its mode.

Or

(b) A book of 500 pages contains 500 mistakes. Find the probability that there are atleast four mistakes in a randomly selected page.



PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Calculate the first three central moments for the following data :

| $x$ | 3 | 6 | 10 | 15 | 20 | 23 | 24 |
|---|---|---|---|---|---|---|---|
| $f$ | 2 | 5 | 15 | 21 | 16 | 13 | 4 |

Or

(b) Fit a curve $y = ae^{bx}$ for the following data :

| $x$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| $y$ | 3 | 8 | 25 | 74 |

17. (a) Find the correlation coefficient from the following data :

| $x$ | 65 | 66 | 67 | 67 | 68 | 69 | 70 | 71 |
|---|---|---|---|---|---|---|---|---|
| $y$ | 67 | 68 | 65 | 68 | 72 | 72 | 69 | 71 |

Or

(b) Let $x, y$ be two variables with standard deviations $\sigma_x$ and $\sigma_y$ respectively. If $u = x + ky$, $v = x + \left(\frac{\sigma_x}{\sigma_y}\right) y$ and $\gamma_{uv} = 0$, find the value of $k$.

18. (a) If $(A)=50$, $(B)=60$, $(C)=80$, $(AB)=35$, $(AC)=45$ and $(BC)=42$, find the greatest and least value of $(ABC)$.

Or

(b) Show that for $n$ attributes $A_1, A_2, ..., A_n$, $(A_1 A_2 .... A_n) \geq (A_1)+(A_2)+....+(A_n)(n-1)N$.

19. (a) If $x$ and $y$ are two random variables, determine whether they are independent in the following cases.

(i) $f(x,y)=\begin{cases}8xy; 0<x<1, 0<y<x \\ 0 \quad otherwise\end{cases}$

(ii) $f(x,y)=\begin{cases}4xy; 0<x<1, 0<y<1 \\ 0 \quad otherwise\end{cases}$

Or

(b) State and prove the addition and multiplication theorems of expectation for continuous random variables.



20. (a) If $X$ is a Poisson variate such that $P(X=2)=9\ P(X=4)+90P(X=6)$, find the value of $\beta$.

Or

(b) For a normal distribution, prove that $\mu_{2n}=(2n-1)\sigma^2 \mu_{2n-2}$.