QP CODE: 24019611

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# B.A/B.SC DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE EXAMINATIONS, MAY 2024

## Second Semester

## Complementary Course - ST2CMT02 - STATISTICS - PROBABILITY THEORY

(Common for B.A Sociology Model I, B.Sc Computer Applications Model III Triple Main, B.Sc Mathematics Model I, B.Sc Physics Model I)

2017 ADMISSION ONWARDS

DDC365EC

Time: 3 Hours Max. Marks : 80

### Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Define sample space. Write down the sample space associated with the random experiment of tossing a coin until a tail turns up.
2. Let sample space S = {1,2,3,4,5,6}. Let A = { $\phi$, S, {1,2}, {3,4,5,6} }, B = { $\phi$, S, {3,4,5,6}, {1,2,3} }. Examine whether A and B are sigma fields of events.
3. If P (A) = 0.2, P (B) = 0.3 and A and B are independent events, find P (A | B) and P(B | A).
4. State multiplication theorem of probability for three events.
5. Define random variable. Give an example.
6. Let the pmf of X be f(x) = $\frac{m^x}{x!}\ e^{-m}\ ;\ x = 0, 1, 2, \ldots$ Find the pmf of Y = $X^2$
7. Mention the properties of joint probability mass function of a pair of discrete random variables.
8. Define marginal distributions.
9. The coefficient of correlation between two variables x and y is 0.28. Their covariance is 7.6. If the variance of x is 9, then obtain the standard deviation of y .
10. Define Spearman's correlation coefficient.
11. Define scatter diagram.

12. Obtain x on y regression line if $\sum x = 35$, $\sum x^2 = 203$, $\sum y = 28$, $\sum y^2 = 140$ , $\sum xy = 168$ and n =10 .

(10×2=20)

## Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. A box contains 6 red, 4 white and 5 black balls. A person draws 4 balls from the box at random.Find the probability that among the balls drawn, there is at least one ball of each colour.

14. State and prove addition theorem on probability for two events and hence deduce it for three events.

15. Three identical boxes contain two balls each. One has both red, one has one red and one black, and the third has two black balls. A person chooses a box at random and takes out a ball. If the ball is red find the probability that the other ball in the box is also red.

16. Consider the random experiment of tossing two unbiased coins together and let X be the random variable denoting the number of heads obtained. Obtain the pmf and distribution function of X. Sketch them graphically.

17. Given the pdf $f(x) = e^{-x}$ ; $x > 0$ and 0 elsewhere, find the pdf of (1) $Y = X^3$ (2) $Y = 3X + 4$.

18. Two unbiased coins are tossed . Let X = 1 if the first coin shows head and X = 0 if it shows tail and let Y denotes the number of heads obtained. Obtain the joint probability mass function of (X, Y) .

19. Let the joint pdf be $f(x,y) = k\,x(1-y)$ ; $0 < x < 1$, $0 < y < 1$ and 0 elsewhere, is a joint pdf, then find k and $P\left(0 < x < \frac{1}{3},\ 0 < y < \frac{1}{3}\right)$ .

20. Prove that change of origin and scale does not affect correlation coefficient.

21. Obtain the angle between two regression lines.

(6×5=30)

## Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. 1) If A, B, C are pairwise independent and A is independent of B∪C, then show that A, B, C are mutually independent

    2) The probabilities that a husband and a wife will be alive 20 years from now is given by

0.8 and 0.9 respectively. Find the probabilities that in 20 years (a) both of them will be alive (b) neither of them will be alive (c) at least one will be alive.

23. Examine whether the following is a pdf.

$f(x) = \frac{x}{2}$ ; $0 < x < 1$

$= \frac{1}{2}$ ; $1 < x < 2$

$= \frac{1}{2}(3 - x)$ ; $2 < x < 3$

= 0 elsewhere

If yes, obtain its distribution function and $P(|X| < 1.5)$

24. Let the joint pdf be $f(x,y) = c(xy^2 + x^2 y)$ ; $0 < x < 1$, $0 < y < 1$ and 0 elsewhere. Obtain the conditional pdf of x given y and y given x. Examine whether X and Y are independent.

25. (1) Explain the fitting of the curve $y = a + bx + cx^2$

(2) Fit a curve $y = a + bx + cx^2$ to the following data

| x | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|---|
| y | 11 | 13 | 16 | 20 | 27 | 34 | 41 |

(2×15=30)