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2 SEM TDC STSH (CBCS) C 3 (N/O)

2026

(May/June)

STATISTICS

(Core)

Paper : C-3

(Probability and Probability Distribution)

Full Marks : 50 Old (55 for New Batch)

Pass Marks : 20 Old (22 for New Batch)

Time : 2 hours Old (3 hours for New Batch)

*The figures in the margin indicate full marks
for the questions.*

1. Choose the correct answer from the following alternatives : 1×5=5

(a) The outcome of tossing a coin is a

- (i) simple event
- (ii) mutually exclusive event
- (iii) complementary event
- (iv) compound event

- (b) Probability is expressed as
- (i) ratio
 - (ii) proportion
 - (iii) percentage
 - (iv) All of the above
- (c) If A is an event, the conditional probability of A given A is equal to
- (i) zero
 - (ii) one
 - (iii) infinite
 - (iv) indeterminate quantity
- (d) For binomial probability distribution
- (i) mean = variance
 - (ii) mean > variance
 - (iii) mean < variance
 - (iv) None of the above
- (e) The number of parameters of the normal distribution is
- (i) 1
 - (ii) 2
 - (iii) 3
 - (iv) 4

2. Answer the following questions in brief :

2×5=10

- (a) Write down the classical definition of probability.
- (b) Define a simple or elementary event.
- (c) Define marginal density function of a random variable X .
- (d) Obtain the moment generating function of Poisson distribution.
- (e) Prove that if X and Y are independent random variables, then $E(XY) = E(X).E(Y)$.

3. (a) State Bayes' theorem. In a bolt factory, machines A , B and C manufacture respectively 25%, 35% and 40% of the total. Of their output, 5%, 4% and 2% are defective bolts respectively. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machine A , B or C ? 2+4=6

Or

- (b) (i) State the addition theorem of probability. 3
- (ii) The probability that a man will live 10 more years is $\frac{1}{4}$ and the probability that his wife will live 10 more years is $\frac{1}{3}$. Find the probability that both will be alive in 10 years. 3

(4)

4. (a) Define discrete random variable. A random variable X has the following probability distribution :

$$f(x) = cx^2, 0 \leq x \leq 1$$
$$= 1, \text{ otherwise}$$

Find the value of the constant c and

$$P\left[\frac{1}{4} < X < \frac{3}{4}\right] \quad 3+5=8$$

Or

- (b) Two random variables X and Y have the following joint density function :

$$f(x, y) = 2 - x - y; 0 < x < 1, 0 \leq y \leq 1$$
$$= 0, \text{ otherwise}$$

Find (i) marginal probability distributions of X and Y , and (ii) conditional density functions of X/Y and Y/X . $4+4=8$

5. (a) Define mathematical expectation of a random variable. Show that the mathematical expectation of sum of two random variables is the sum of their individual expectations. Can it be extended? If yes, write the extension. $2+4+2=8$

Or

- (b) Define cumulant generating function. Show that the r th cumulant for the distribution

$$f(x) = ke^{-kx}; 0 < x < \infty, k \neq 0 \in R \text{ is}$$
$$\frac{1}{k^r} \cdot \frac{r-1}{r} \quad 3+5=8$$

(5)

6. (a) Define binomial distribution with parameters n and p . Obtain the moment generating function of the binomial distribution and hence or otherwise obtain the mean and variance. $1+3+2+2=8$

Or

- (b) Define exponential distribution. Derive the moment generating function of the distribution and find the mean and variance of exponential distribution. $1+3+2+2=8$

7. Under what conditions, does the binomial distribution tend to normal distribution? State some important properties of normal distribution. $2+3=5$

(Additional 5 marks for New batch)

8. What is standard normal variate? Write what you know about the mathematical form and shape of the probability curve of this variate. $2+3=5$

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