Total number of printed pages-3

FYUG/Sem-2/ST-CE1

2026
(Regular)
Statistics (Core)
Paper Code : ST-CE-2114
Paper Name : Basic Probability Theory

Time : 2 hours ***Full Marks : 45***

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

1. Answer the following questions as directed : 1×4=4

   a) The probability of all possible outcomes of a random experiment is always equal to :

      i) infinity

      ii) zero

      iii) one

      iv) none of the above

      (Choose the incorrect optio

   b) If X and Y are two _____ variables then $E(XY)=E(X).E(Y)$.

      (Fill in the blank)

   c) Define the m.g.f of a random variable X.

   d) If the mean of a Poisson distribution is 4, then the variance is _____.

      i) 4

      ii) 5

      iii) 2

      iv) 8

      (Choose the correct option)

Contd..

2. Answer the following questions : $2\times3=6$

a) What is random experiment ?

b) If X is a Poisson Variate such that $P(x=1)=P(x=2)$ find $P(x=4)$.

c) If C is any constant, then prove that $Var(C)=0$

3. Answer *any three* of the following : $5\times3=15$

a) State and prove Chebyshev's inequality. $1+4=5$

b) Write all properties of a normal distribution.

c) State and prove addition theorem of mathematical expectation. $1+4=5$

d) Find mean and variance of Poisson distribution and comment on the results. $2+2+1=5$

e) State and prove Baye's theorem. 5

f) An urn contains *a* white and *b* black balls. *C* balls are drawn one by one with replacement. Find the expected number of white balls drawn. 5

4. Answer *any two* from the following : $10\times2=20$

a) i) Prove that the sum of two independent binomial variate is not a binomial variate. Under what condition binomial distribution possesses the additive property ? $2+1=3$

ii) It has been found that on an average the number of mistakes per page of a typist is 1.5. Find the probability that there are 3 or less mistakes. 2

iii) State De-Moivre Laplace and Lindeberg-Levy central limit theorems. 5

b) i) Define mutually exclusive and independent events. With $P(A)>0$, $P(B)>0$, can two mutually exclusive events A and

B be independent. Justify your answer. 1+1+3=5

ii) Find the probability of getting exactly two heads by tossing a coin thrice, given that the first toss has resulted in a head. 2

iii) Show that for any two random variables X and Y, $V[aX+bY]=a^2 V(X)+b^2 V(Y)+2ab\,Cov(X,Y)$. 3

c) i) If the p.d.f of a $r.v$ X is

$f(x)=Kx \; ; 1 \le x \le 2,$

Find the value of K, $E(X)$ and

$P\left[\frac{5}{4} \le X \le \frac{7}{4}\right]$ 1+2+2=5

ii) An unbiased coin is tossed for four times. Write the sample space of all possible outcomes. From the probability distribution X. (numbers of head), find expected number of head and variance of X. 5

d) i) The probability distribution of a random variable X is :

$f(x)=Kx^2\left(1-x^3\right) ; \; 0 \le x \le 1.$

Determine the constant K. Using this value of K, find its mean and variance. 1+2+2=5

ii) State and prove the additive property of moment generating function. 5

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