

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION MO/SP20\*\*)

CLASS: IMSC  
BRANCH: QEDS

SEMESTER:III  
SESSION:MO2022

SUBJECT: ED207 PROBABILITY - II

TIME: 03 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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Q.1(a) Let X, Y be two independent discrete random variables with pmf [5+5]

$$p(z) = \begin{cases} \frac{1}{2}, & \text{if } z = 0,1 \\ 0, & \text{otherwise.} \end{cases}$$

Find the distributions of X+Y and X-Y.

Q.2(a) Let X and Y be jointly bivariate normal random vector with  $\mu_x = 0$ ,  $\mu_y = -1$ ,  $\sigma_x^2 = 1$ ,  $\sigma_y^2 = 4$ , and  $\rho = -1/2$ . Find the distribution of X+Y and hence calculate  $P[X+Y > 0]$ . [5+5]

Q.3(a) Find the mean and variance of the distribution with pdf given by [8]

$$f(x) = \begin{cases} 1 - |1 - x|, & 0 < x < 2 \\ 0, & \text{otherwise} \end{cases}$$

Q.3(b) State Monotone Convergence Theorem for a sequence of random variables. [2]

Q.4(a) State Central Limit Theorem. [2]

Q.4(b) Analysis of computer travel shows that the number of passengers per car, X, is a discrete random variable with independent, identical distributions, such that  $E(X) = 1.2$  and  $\text{Var}(X) = 1.0$ . Estimate the probability that in a sample of 100 cars, the total number of passengers is 140 or fewer. [8]

Q.5 Calculate the MGF of the random variable with the density function given by [5+2+3]  
 $f(x) = ae^{-ax}$ ,  $x, a > 0$ . Hence, obtain the mean and variance of the distribution.

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