**Birla Institute of Technology and Science, Pilani.**

Second semester 2015-16

Course No. MATH F113

Course Name : Probability and Statistics,

Assignment-I

Chapter 1 to 4 (Lecture 1 to 20 as per handout)

**NOTE: Students are advised to solve all the questions given below, out of which one question may be asked in any of the examinations. (Don't submit to any of the Instructor)**

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Q1. A stockist has 20 items in a lot. Out of which 12 are non-defective and 8 are defective. A

customer selects 3 items from the lot. What is the probability that out of 3 items,

(a) Three items are non-defective. (b) Two are non-defective and one is defective.

Q2. In a certain town, males and females each form 50% of the population. It is known that 20% of the males and 5% of the females are unemployed. A research student studying the employment situation selects an unemployed person at random, what is the probability that the selected person is a

(a) male? (b) female?

Q3. In a lottery conducted to benefit a local charity, 8000 tickets are to be sold at Rs. 10 each. Out of 8000 tickets only one ticket win the prize of Rs. 24000. If you purchase two tickets, what is your expected net gain ?

Q4. Two tennis players A and B are scheduled to play a match. The winner is the first player to win three sets in a total that cannot exceed five sets. The event that player A wins any one set is independent of the event that he/she wins any other set. The probability that player A wins any one set is equal to 0.6. Let X be the total number of sets played in the match; i.e. X = 3, 4, 5. Prepare a table for probability density function of X and find the expected number of sets required to complete the match. Use moment generating functions to compute Var(X).

Q5. An Institute offers test series for clearing a certain competitive exam. To clear a single test a minimum of 90% marks is necessary and a student can take unlimited number of tests. Abel has 75% chance to clear a given test in a test series. To be successful in the test series the criteria set is clearing two tests. Assuming the tests are of identical difficulty level, how many tests should Abel give to attain a 99% or higher chance of clearing the test series?

Q6. If X follows Poisson distribution with parameter λ, show that Y = is a random variable with mean 0 and variance 1. Find the moment generating function of Y and show that it approaches  as λ → ∞.

Q7. A point is chosen at random on the line segment [0, 2]. What is probability that the chosen

point lies between 1 and 3/2 ?

Q8. The probability density function for a continuous random variable *X* is given as

.

Compute .

Q9. Suppose that a system contains a certain type of component whose time, in years, to failure is given by . The random variable is modeled nicely by the exponential distribution with mean time to failure . If 5 of these components are installed in different systems, what is the probability that at least 2 are still functioning at the end of 8 years?

Q10. In an industrial process the diameter of a ball bearing is an important component part. The buyer sets specifications on the diameter to be . The implication is that no part falling outside these specifications will be accepted. It is known that in the process the diameter of a ball bearing has a normal distribution with mean and standard deviation How many ball bearings will be scrapped out of 10000 manufactured ball bearings?

Q11. a) An unbiased die is rolled 600 times. Apply Chebyshev’s inequality to find the lower bound on the probability of obtaining the number of one's, strictly between 80 and 120.

b) An unbiased die is rolled 720 times. Find the upper bound for the probability that number one's occurs either less than 106 or more than 134 times, by using Chebyshev’s inequality.

Q12. The reliability of an electric component is the probability that the bulb chosen at random from production, will function under its designed conditions. A random sample of 1000 components is tested. Calculate the approximate probability of observing 25 or more are not working, assume that the reliability of a component is 0.98.

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