**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**

**Work Integrated Learning Programmes Division**

Cluster Programme - M. Tech in Data Science and Engineering

II Semester , 2020 – 21(July 2021)

Mid semester Examination (**Regular**)

Course No : DSECL ZC413

Course Title : Introduction to Statistical Methods

Nature of Exam. : Open Book (Online)

*Number of questions: 10*

*Number of Pages: 3*

Weightage : 30 Marks

Duration : 120 minutes

Date : 24th July 2021

Q.1.A survey conducted by an NGO shows that the people in a city were suffering with three diseases 70% were diabetic patient, 20% were cancer patients and 10% were HIV patients, the same survey also shows that 1% of diabetic patient were affected by COVID where as cancer and HIV patients affected were 2% and 5% respectively. **[3 Marks]**

1. What is the probability that a randomly selected person is COVID positive?
2. What is the probability that COVID patient suffering with diabetic also?
3. What is the probability that COVID patient suffering with cancer also?
4. What is the probability that COVID patient suffering with HIV also?

Q.2.In a national park, there is an average of four poaching activities per day, and the time between such activities has an exponential density function with an expected value of day. Find the probability that the time between two poaching activities will be more than day and less than day. **[3 Marks]**

Q3. The number of cars coming to a LPG gas station for gas during each-minute was recorded for an hour. In 25 intervals, there were 3 cars each coming to the station, in 15 intervals there were 5 cars each and in 20 intervals no car came. A 1-minute interval is to be selected at random and number of cars noted. **[3 Marks]**

Then X is a random variable taking on the values 0, 3 and 5.

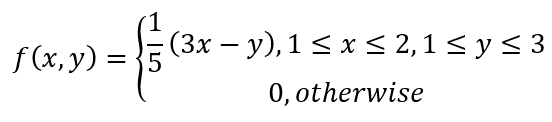
1. Write out a probability table for X.
2. Compute E(X)
3. Interpret E(X)

Q4. In answering a question in Work Integrated Learning Programme student test, a student either knows the answer or guesses. Let be the probability that he knows the answer and is the probability that he guesses. Assume that a student who guesses the answer will be correct with probability 1/5. What is the probability that a student knew answer to a question given that he answered it correctly? **[3 Marks]**

Q5. In a law enforcement office, a lie detector machine is installed. Based on past experiments, when tested on liars, it gave 91% correct detection. When non-liars were tested it correctly avoided detecting them as liars 87% of time. It is estimated that 13% of criminal lies during the detection process. Given a random criminal is tested and the detector tagged the person as a non-liar, what is the probability that the criminal not lied? **[3 Marks]**

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| Q6. A service station has both self-service and full-service islands. On each island, there is a single regular unleaded pump with two hoses. Let X denote the number of hoses being used on the self-service island at a particular time and let Y denote the number of hoses on the full-service island in use at that time. The joint probability mass function of X and Y is given below:   |  |  |  |  | | --- | --- | --- | --- | | X | Y | | | | 0 | 1 | 2 | | 0 | 0.10 | 0.04 | 0.02 | | 1 | 0.08 | 0.20 | 0.06 | | 2 | 0.06 | 0.14 | 0.30 |   (a) Find the marginal probability mass function of X and Y  (b) Give the verbal description the event (X≠0 and Y≠0) and compute the  probability of this event.  (c) Find P(X=1|Y=2) and P(Y=2|X=1) **[3 Marks]** |

Q7. The joint probability mass function of the two random variables (X, Y) is given by



(a) Find the marginal density functions of X and Y

(b) Find E(XY) **[3 Marks]**

Q8.A manufacturer of inkjet printers claims that 15% of their printers require repairs within the first year. If of a random sample of 12 printers, at least 3 require repairs within the first year, does this tend to refute or support the manufacturer’s claim? **[3 Marks]**

Q9. Mean and variance of marks of 100 students in a college are 40 and 16 respectively. If a sample of 50 students is randomly selected, what is the probability that the sample average will be more than 45? **[3 Marks]**

Q10. Let X be a random variable which follows Binomial Distribution with n = 400 and p = 0.01. Then find

1. P( X > 200)
2. P( X < 150)
3. P( 150 < X < 200)  **[3 Marks]**

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