

Jaypee University of Information Technology, Wagnaghat

Test-1 Examinations, September 2023

B.Tech - III Semester (CSE/IT)

Course Code/Credits: 18B11MA313/3
Course Title: Probability and Statistics
Course Instructors: RAD, BKP, SST

Max. Marks: 15

Max. Time: 1 Hour

Note: Answer all the questions. Describe random variables along with range where applicable.

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1. Answer the following questions: (3 Marks) [CO-1]

- (a) Given that E and F are events with $\mathbb{P}(E) = 0.6$, $\mathbb{P}(F) = 0.3$ and $\mathbb{P}(E \cap F) = 0.2$, find $\mathbb{P}(F|E)$.
- (b) Suppose that a is the probability that a leap year selected at random will have 53 Fridays and b is the probability that a non-leap year selected at random will have 53 Saturdays. What is $a + b$?

2. Bowl A contains 2 red chips; bowl B contains two white chips, and bowl C contains 1 red chip and 1 white chip. A chip is selected at random. (4 Marks) [CO-1]

- (a) What is the probability of selected chip being white?
- (b) If the selected chip is white, what is the probability that it was taken from bowl C?

3. The Department of Energy (DOE) puts projects out on bid and generally estimates what a reasonable bid should be. Call the estimate 'b'. The DOE has determined that the density function of $Y =$ winning bid is (4 Marks) [CO-2]

$$f_Y(y) = \begin{cases} \frac{5}{8b} & ; \frac{2b}{5} \leq y \leq 2b \\ 0 & ; \text{elsewhere} \end{cases}$$

- (a) Compute the *cumulative distribution function* $F_Y(y)$.
- (b) Use it to determine the probability $\mathbb{P}(Y < b)$ that the winning bid is less than the preliminary estimate 'b'.

4. You need to pay one dollar to buy an instant lottery ticket. In this instant lottery game, you have 10% chance to win 1 dollar, 5% chance to win 5 dollar, and you will get nothing in the remaining chance. (2 Marks) [CO-2]

- (a) Define the random variable X of interest.
- (b) Give the probability distribution table for X .
- (c) Determine the expected amount you win. Is this lottery game favourable to you?

5. Consider the *moment generating function* of a random variable X : (2 Marks) [CO-2]

$$\mathcal{M}_X(t) = \frac{1}{10}e^t + \frac{1}{5}e^{2t} + \frac{3}{10}e^{3t} + \frac{2}{5}e^{4t}.$$

What is $\mathbb{P}(2 < X < 6)$?

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