No of Pages :3 **Course Code : 15XW21**

Roll No:
(To be filled in by the candidate)

PSGCOLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, MAY 2018

MSc - SOFTWARE SYSTEMS Semester: 2

15XW21 PROBABILITY AND STATISTICS

Duration : 3 Hours **Maximum Marks : 100**

INSTRUCTIONS:

1. Answer **ALL** questions. Each question carries 20 Marks.
2. Subdivision (a) carries 3 marks each, subdivision (b) carries 7 marks each and subdivision (c) carries 10 marks each.
3. Statistical table brought by the candidates shall be permitted.
4. Course Outcome :

Qn.1	CO1	Qn.2	CO2	Qn.3	CO3.	Qn.4	CO4	Qn.5	CO5

Table

1. a) In a certain experiment, whenever the event A occurs, then event B also occurs. Which one of the following statements is true and why?
If we know that A has not occurred, we can be sure that B has not occurred as well.
If we know that B has not occurred, we can be sure that A has not occurred as well.

b) i) A gambler has in his pocket a fair coin and a two-headed coin. He selects one of the coins at random and flips it. What is the probability that it comes up heads? [3]

ii) An individual uses the following gambling system at Las Vegas. He bets \$1 that the roulette wheel will come up red. If he wins, he quits. If he loses then he makes the same bet a second time only this time he bets \$2; and then regardless of the outcome, quits. Assuming that he has a probability of $1/2$ of winning each bet, what is the probability that he goes home a winner? [4]

c) i) There are three coins in a box. One is a two-headed coin, another is a fair coin, and the third is a biased coin that comes up heads 75 percent of the time. When one of the three coins is selected at random and flipped, it shows heads. What is the probability that it was the two-headed coin? [5]

ii) A mouse is inside a room, each of whose four walls has a door through which the mouse attempts to escape. Unluckily for the mouse, there is a trap at each of the doors and they work with probabilities 0.3, 0.2, 0.3 and 0.5 respectively. Suppose the mouse picks a door at random, What is the probability that the mouse will make good his escape? [5]

2. a) The time, in minutes, required for a student to walk from hostel to the class room is uniformly distributed between 20 and 25. If the student leaves hostel promptly at 8:08 a.m, what is the probability that the student will not be late for the class at 8:30 a.m.?

b) i) The time that a train from Milan to Rome is late is an exponential random variable X with parameter λ. Find $P\{X > E[X]\}$. [3]

ii) Assume that the number of messages input to a communication channel in an interval of duration $\boldsymbol{t}$ seconds is Poisson distributed with rate $\mathbf{0.3}\boldsymbol{t}$. What is the probability that

(i) at most 20 messages arrive in a 20-second interval?

(ii) exactly three messages arrive in a 10-second interval? [4]

c) i) The probability of hitting a target is $1/4$. If a person fires seven times, what is the probability of him hitting the target at least twice? How many times must he fire so that the probability of hitting the target at least once is greater than $2/3$? [4]

ii) Two fair dice are rolled and the absolute value of the difference of the outcomes is denoted by X. Obtain the probability distribution of X. Also find the variance of X. [6]

3. a) The breaking strength of a certain type of yarn produced by a certain vendor is normal with mean 95 and standard deviation 11. What is the probability that, in a random sample of size 10 from the stock of this vendor, the breaking strengths of at least two are over 100?

b) i) The average and standard deviation of lifetimes of light bulbs manufactured by a certain factory are, respectively, 800 hours and 50 hours. What can be said about the probability that a random light bulb lasts, at most, 700 hours? [3]

ii) Obtain the moment generating function of binomial random variable and hence find its mean and variance. [4]

c) The joint probability density function of random variables X and Y is given by $f(x,y) = \begin{cases} k(2x+3y), & 0 < x < 1,\ 0 < y < 2 \\ 0 & otherwise \end{cases}$. Determine the following:

(i) Determine the value of k;
(ii) Obtain the marginal density functions of X and Y;
(iii) Find the conditional density of Y given $X = 1/4$;
(iv) E(X) and E(XY).

4. a) Suppose that we want to test the null hypothesis that the drying time of a certain type of paint is decreased by a newly proposed method. Under what conditions we would commit a Type-1 error and under what conditions we would commit a Type-2 error?

b) i) Suppose you fail to reject a null hypothesis at a significance level of α=0.05. Would you also fail to reject it at a significance level of α=0.10? Why or why not? [3]

ii) A sample of 35 circuits has a mean resistance of 2.20 ohms. We know from past testing that the population standard deviation is 0.35 ohms. Determine a 95% confidence interval for the true mean resistance of the population. [4]

c) i) In 25 randomly selected hours of production, the mean and standard deviation of the number of acceptable units produced by an automatic machine are 1038 and 146. At 5% LOS, test the hypothesis that the mean number of units produced does not exceed 1000. [4]

ii) An experiment designed to study the relationship between hypertension and cigarette smoking yielded the data in Table.1. At 5% LOS, test the hypothesis that whether or not an individual has hypertension is independent of how much that person smokes. [6]

Table.1

	Non smoker	Moderate smoker	Heavy smoker
Hypertension	20	38	28
No hypertension	50	27	18

5. a) Suppose covariance of two random variables is zero. Can we conclude that the random variables are independent? Why or why not?

b) i) In design of experiments, what is Completely Randomized Design? [3]

ii) Explain the limitations, errors, and caveats of using correlation and regression analysis. [4]

c) i) In an experiment to see whether the amount of coverage of light-blue interior latex paint depends either on the brand of paint or on the brand of roller used, 1 gallon of each of four brands of paint was applied using each of three brands of roller, resulting in the data (number of square feet covered) in Table.2. State and test hypotheses appropriate for deciding whether paint brand has any effect on coverage at 5% LOS.

Table.2

	Roller 1	Roller 2	Roller 3
Paint 1	454	446	451
Paint 2	446	444	447
Paint 3	439	442	444
Paint 4	444	437	443

[OR]

ii) The tensile strength (y) of a certain synthetic fiber is thought to be related to the percentage of cotton in the fiber (x_1), and the drying time, minutes, of the fiber (x_2). A test of 10 pieces of fiber produced under different conditions yielded the results as in Table.3. (1) Fit a regression equation y on x_1 and x_2; (2) Estimate the tensile strength of a synthetic fiber having 21 percent cotton whose drying time is 3.6.

Table.3

x_1	13	15	14	18	19	20	22	17	16	18
x_2	2.1	2-3	2.2	2.5	3.2	2.4	3.4	4.1	4.0	4.3
y	213	220	216	225	235	218	239	243	233	240

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FD/RL