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

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

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, AUGUST / SEPTEMBER - 2016

MSc - SOFTWARE SYSTEMS Semester : 2

15XW21 PROBABILITY AND STATISTICS

Time : 3 Hours **Maximum Marks : 100**

INSTRUCTIONS:

1. Answer **ALL** questions from GROUP – I.
2. Answer any **FOUR** questions from GROUP – II.
3. Answer any **ONE** question from GROUP – III.
4. Ignore the box titled as **"Answers for Group III"** in the Main Answer Book.
5. **Statistical table shall be provided.**

GROUP - I **Marks : 10 x 3 = 30**

1. A telephone call from a certain person is received some time between 7.00AM to 9.10AM every day. Define a sample space for this phenomenon and describe the event that the call arrives within 15 minutes of the hour.
2. Classify the following random variable is discrete or continuous:
   (i) The annual number of sweepstakes winners from New York City.
   (ii) Closing price of a stock on the New York Stock Exchange
   (iii) Time required to drive from home to college on any given day.
   (iv) The amount of heat energy needed to raise the temperature of one pound of water by one degree F.
3. An absentminded person does not remember which of his 12 keys will open his office door. If he tries them at random and with replacement. What is the probability that he opens his office door after only three tries?
4. The lifetime of a TV tube (in years) is an exponential random variable with mean 10. If Jim bought his TV set 10 years ago, what is the probability that its tube will last another 10 years?
5. Why do decision makers often measure samples rather than populations?
6. Distinguish estimate and estimator with an example.
7. What types of errors are associated with hypothesis testing?
8. For the following situation, state appropriate null and alternative hypothesis: "A local hardware store owner wants to determine whether sales of garden supplies are better than usual after a spring promotion".
9. Suppose that X and Y are independent random variables, show that the correlation between them is zero.
10. Suppose that n random samples of water from a fresh water lake were taken and the calcium concentration were measured. A 95% confidence interval on the mean calcium

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

concentration is $0.49 \leq \mu \leq 0.82$. Would a 99%confidence interval calculated from the same sample be longer or shorter? Justify.

GROUP - II

Marks : 4 x 12.5 = 50

11. a) A box contains seven red and 13 blue balls. Two balls are selected at random and are discarded without their colors being seen. If a third ball is drawn randomly and observed to be red, what is the probability that both of the discarded balls were blue? (6.5)

    b) There are five boys and six girls in a class. For an oral exam, their teacher calls them one by one and randomly. (i) What is the probability that the boys and the girls alternate? (ii) What is the probability that the boys are called first? Compare the answers to parts (i) and (ii). (6)

12. a) A simple binary communication channel carries messages by using only two signals, say 0 and 1. We assume that, for a given binary channel, 40% of the time a 1 is transmitted; the probability that a transmitted 0 correctly received is 0.90 and the probability that a transmitted 1 correctly received is 0.95. Determine (i) the probability of a 1 being received (ii) given 1 is received, the probability that 1 was transmitted. (6.5)

    b) The distribution function of a random variable X is given by

$$F(x) = \begin{cases} 0 & if\ x < 2 \\ 1/2 & if\ -2 \leq x < 2 \\ 3/5 & if\ 2 \leq x < 4 \\ 8/9 & if\ 4 \leq x < 6 \\ 1 & if\ x > 6 \end{cases}$$

    Determine the probability mass function of X and sketch its graph. (6)

13. a) The discrete random variables *X* and *Y* have the joint PMF

$$P_{X,Y}(x,y) = \begin{cases} cxy, & x = 1,2,4\,;\, y = 1,3 \\ 0 & otherwise \end{cases}$$

    i) What is the value of the constant *c* and also find $P[Y < X], P[Y = X]$.

    ii) The marginal PMFs $P_X(x)$ and $P_Y(y)$. (6.5)

    b) What is the probability that the average of 200 random points from the interval (0, 1) is within 0.05 of the midpoint of the interval? (6)

14. a) Ellen Harris, an industrial engineer, was accumulating normal times for various tasks on a labor-intensive assembly process. This process included 300 separate job stations, each performing the same assembly tasks. She sampled seven stations and obtained the following assembly times for each station: 1.9, 2.5, 2.9, 1.3, 2.8 and 3.0 minutes.

    i) Calculate the mean assembly time and the corresponding standard deviation for the sample.

    ii) Estimate the population standard deviation.

    iii) Construct a 95 percent confidence interval for the mean assembly time. (6.5)

    b) A research study was conducted to examine the differences between older and younger adults on perceived life satisfaction. A pilot study was conducted to examine this hypothesis. Ten older adults (over the age of 70) and ten younger adults (between 20 and 30) were given a life satisfaction test (known to have high reliability and validity). Scores on the measure range from 0 to 60 with high scores indicative of high life satisfaction; low scores indicative of low life satisfaction. The data are presented below. Compute the appropriate t-test and F - test.

Older Adults : 45 38 52 48 25 39 51 46 55 46

Younger Adults: 34 22 15 27 37 41 24 19 26 36

i) Is there a significant difference between the two groups?

ii) Interpret your answer. (6)

15. a) Mechanical engineers, testing a new arc-welding technique, classified welds both with respect to appearance and an X-ray inspection.

		Appearance			
		Bad	Normal	Good	Total
X-ray	Bad	20	7	3	30
	Normal	13	51	16	80
	Good	7	12	21	40
	Total	40	70	40	150

Test for independence using α=0.05 and find the individual cell contributions to the χ^2 statistic. (6.5)

b) The central office of a large manufacturing company manages ten similar plants in different locations. The following data were obtained where x = percent of operating capacity being used at the plant and y= profits in hundreds of thousands of dollars at the same plant.

x	50	61	77	80	82	85	88	81	95	99
y	24	26	35	31	35	34	39	40	38	42

Fit corresponding linear regression equations for the data using least squares method. (6)

GROUP - III

Marks : 1 x 20 = 20

16 . X and Y are random variables with the joint probability density function

$$f_{X,Y}(x,y) = \begin{cases} \frac{cx^2}{2}, & -1 \le x \le 1;\ 0 \le y \le x^2 \\ 0 & otherwise \end{cases}$$

i) Find c.

ii) What is the marginal probability density function $f_X(x)$?

iii) What is the marginal probability density function $f_Y(y)$?

iv) Find E(X), E(Y), Var(X) and Var(Y).

17. To find the best arrangement of instruments on a control panel of an airplane, three different arrangements were tested by simulating an emergency condition and observing the reaction time required to correct the condition. The reaction time (in tenths of a second) of 28 pilots were as follows:

Arrangement 1: 14, 13, 9, 15, 11, 13, 14, 11

Arrangement 2: 10, 12, 9, 7, 11, 8, 12, 9, 10, 13, 9, 10

Arrangement 3: 11, 5, 9, 10, 6, 8, 8, 7

Test at the level of significance α=0.01 whether we can reject the null hypothesis that the differences among the arrangements have no effect.

/END/