1895

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, MAY - 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 permitted.

 $\overline{\text{GROUP - I}} \qquad \text{Marks : } 10 \text{ x } 3 = 30$

- 1. Seven different books on a shelf are in a random order. If three of these seven books are a three volume dictionary, describe the event that these volumes stand in increasing order side by side (i.e, volume I precedes volume II and volume II precedes volume III). Define a sample space for this experiment.
- 2. Assuming neither A nor B has zero probability, examine the following.
 - (i) If A and B are mutually exclusive, will they be independent?
 - (ii) If A and B are independent, will they be mutually exclusive?
- 3. Express the statement, "Waiting time for a call is independent of how long we have been waiting" in mathematical notation by using probability concept.
- 4. On average, there are three misprints in every 10 pages of a particular book. If every chapter of the book contains 35 pages, what is the probability that chapters 1 and 5 have 10 misprints each?
- 5. Let R be the bounded region between y = x and $y = x^2$. A random point (X, Y) is selected from R. Find the joint probability density function of X and Y.
- 6. Differentiate estimate and estimator with an example.
- 7. Identify the null hypothesis and alternative hypothesis in the following situation: "Health Electronics, Inc., a manufacturer of pacemaker batteries, specifies that the life of each battery is greater than or equal to 28 months. If scheduling for replacement surgery for the batteries is to be based on this claim".
- 8. Suppose that we want to test the null hypothesis that an antipollution device for cars is effective. Explain under what conditions we would commit a Type I error and under what conditions we would commit a Type II error.
- 9. A random sample of size 25 from a normal population has the mean 47.5 and the standard deviation 8.4. Does this information tend to support or refuse the claim that the mean of the population is 42.1?
- 10. Identify the corresponding statistical tests used for the following scenarios:
 - i) Comparing the means of two small samples from populations with unknown variances.
 - ii) Value of a single population mean based on large samples.
 - ii) Comparing three are more population proportions.

1895

No of Pages : 3 Course Code : 15XW21

GROUP - II Marks : $4 \times 12.5 = 50$

11. a) A laboratory blood test is 95 percent effective in detecting a certain disease when it is, in fact present. However the test also yields a "false positive" result for 1 percent of the healthy persons tested (That is, if a healthy person is tested, then, with probability 0.01, the test result will imply he has the disease.) If 0.5 percent of the population actually has the disease, what is the probability that a person has the disease given that his test result is positive? (6.5)

- b) Suppose that an aircraft engine will fail in flight with probability 1-p independently of the plane's other engines. Also suppose that a plane can complete the journey successfully if at least half of its engines do not fail. Is it true that a four-engine plane is always preferable to a two-engine Plane? Explain. (6)
- 12. a) The grades for a certain exam are normally distributed with mean 67 and variance 64. What percent of students get A (≥90), B (80 90), C (70 80), D (60 70) and F (<60)? (6.5)
 - b) Let X be a discrete random variable with probability density function $p(i) = 2\left(\frac{1}{4}\right)^i$, i = 1, 2, 3, ... Find $M_X(t)$ and E(X). (6)
- 13. a) Let the joint probability mass function of discrete random variables X any Y be given

by
$$P(x, y) = \begin{cases} \frac{1}{25}(x^2 + y^2), & \text{if } x = 1, 2, \ y = 0, 1, 2 \\ 0, & \text{elsewhere}. \end{cases}$$

Find P(X>Y), P(X+Y<2), P(X+Y=2), P(X=2/Y=1) and E(X/Y=1). (6.5)

- b) If 20 random points are selected independently, from the interval (0, 1), what is the approximate probability that the sum of these numbers is at least eight? (6)
- 14. a) When a sample of 70 retail executives was surveyed regarding the poor November performance of the retail industry, 66 percent believed that decreased sales were due to unseasonably warm temperatures, resulting in consumers delaying purchase of cold-weather items. Find the upper and lower confidence limits for this proportion, given 95 percent confidence level. (6.5)
 - b) As part of an industrial training program, some trainees are instructed by Method A, which is straight teaching-machine instruction, and some are instructed by method B, which also involves the personal attention of an instructor. If random samples of size 10 are taken from large groups of trainees instructed by each of these two methods, and the scores which they obtained in an appropriate achievement test are

use the 0.05 level of significance to test the claim that Method B is more effective. Assume that the populations sampled can be approximated closely with normal distributions having the same variance (6)

15. a) Tests of fidelity and selectivity of 190 radio receivers produced the results shown in the following table:

3		Fic	Fidelity						
	a	Low	Average	High					
Selectivity	Low	6	5 12	32					
	Average	33	61	18					
CH	High	13	15	0					

Use 0.01 level of significance to test whether there is a relationship between fidelity and selectivity. (6.5)

No of Pages: 3

b) The following show the improvement (gain in reading speed) of eight students in a speed-reading program, and the number of weeks they have been in the program:

No. of weeks	3	5	2	8	6	9	3	4
Speed gain (words per minute)	86	118	49	193	164	232	73	109

Fit a straight line by the method of least squares.

(6)

GROUP - III

Marks: $1 \times 20 = 20$

Course Code: 15XW21

16. The joint probability density function of X and Y is given by

$$f(x, y) = \begin{cases} ce^{-x} & \text{if } x > 0, |y| < x \\ 0, & \text{elsewhere.} \end{cases}$$

- (i) Determine the constant c. (ii) Find $f_{X/Y}((x/y))$ and $f_{Y/X}((y/x))$ (iii) Calculate E(Y/X=x) and var(Y/X=x)
- 17. a) The following is the distribution of the daily number of power failures reported in western city on 300 days:

No. of power failures	0	1	2	3	4	5	6	7	8	9	
No. of days	9	43	64	62	42	36	22	14	6	2	

Test at the 0.05 level of significance whether the daily number of power failures in this city is a random variable having the Poisson distribution with $\lambda = 3.2$. (10)

b) As part of the investigation of the collapse of the roof of a building, a testing laboratory is given all the available bolts that connected the steel structure at three different positions on the roof. The forces required to shear each of these bolts are as follows:

Position 1: 90 32 79 98 83 91

Position 2: 105 89 93 104 89 95 86

Position 3: 83 89 80 94

Perform an analysis of variance to test at the 0.05 level of significance whether the differences among the sample means at the three positions are significant. (10)

/END/

FD/RL