**No of Pages : 3** **Course Code : 12XT23 / 12XW21**

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

**PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004**

**SEMESTER EXAMINATIONS, AUGUST / SEPTEMBER - 2015**

**MSc – TCS / SOFTWARE SYSTEMS Semester : 2**

**12XT23 / 12XW21 PROBABILITY AND STATISTICS**

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

**INSTRUCTIONS:**

1. Answer **ALL** questions from PART-A and Answer any **FOUR** questions from PART-B. Question under PART – C is compulsory.
2. Statistical tables may be permitted.

**PART - A** **Marks : 10 x 3 = 30**

1. If P(A)+P(B)+P(C)=1, then the events A, B and C are exclusive? Justify your answer with an example.
2. One of the five elevators in a building starts with seven passengers and stops at nine floors. Assuming that it is equally likely that a passenger gets off at any of these nine floors, find the probability that at least two of these passengers will get off at the same floor.
3. Airline A has commuter flight every 45 minutes from San Francisco airport to Fresno. A passenger who wants to take one of these flights arrives at the airport at a random time. Suppose that X is the waiting time for this passenger; find the distribution function of X. Assume that seats are always available for these flights.
4. A box contains 10 disks of radii 1,2,3,… and 10, respectively. What is the expected value of the area of disk selected at random from this box?
5. Comment the statement: *Statistical independence of X and Y is sufficient to guarantee that they are uncorrelated.*
6. Three balls are drawn at random without replacement from a box containing 2 white, 3 red and 4 black balls. If X denotes the number of white balls drawn and Y denotes the number of red balls drawn, find the joint probability distribution of (X,Y)
7. Suppose that we want to test the null hypothesis that an antipollution device for cars in effective. State under what conditions we would commit a Type I error and under what conditions we would commit a Type –II error.
8. Under what conditions the point estimator $T_n = T(x_1, x_2,\ldots x_n)$ is consistent and Unbiased? Give an example
9. Find the maximum likelihood estimate of the parameter $\lambda$ of the exponential $f(x) = \lambda e^{-\lambda x}; x > 0$ using a sample of size 'n'.
10. In one sample of 8 observations, the sum of squares of the deviations of the sample values from the sample mean is 84.4 and in the other sample of 10 observations, it was 102.6. Test whether this difference is significant at 5 % level.

**No of Pages : 3** **Course Code : 12XT23 / 12XW21**

**PART - B** **Marks : 4 x 12.5 = 50**

11. a) A laboratory blood test is 95 % effective in detecting a certain disease when it is, in fact, present. However, the test also yields a "false positive" result for 1% 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% of the population actually has the disease, what is probability that a person has the disease given that his test result is positive?

b) The demand for meat at a grocery store during any week is approximately normally distributed with a mean demand of 5000 kgs and a standard deviation of 300 kgs.

i) If the store has 5300 kgs of meat, what is the probability that it is overstocked?

ii) How much meat should the store have in stock per week so as not to run short more than 10 percent of the time?

12. a) Let Y be a point selected at random from the interval (0,1). Then another point X is chosen at random from the interval (0,Y). Find the probability density function of X.

b) Let X and Y be continuous random variables with joint probability density function $f(x,y) = \begin{cases} e^{-y} & if\ y > 0, 0 < x < 1 \\ 0 & elsewhere \end{cases}$ . Find $E[X\,|Y = 2]$.

13. a) A bomber flies directly above a railway track. Assume that if a large bomb falls within 40 feet of the track, the track will be sufficiently damaged and that the traffic will be disrupted. Let X denote the perpendicular distance from the track that a bomb falls. Assume that $f_X(x) = \frac{100 - x}{5000} \quad 0 \le x \le 100$

i. Find the probability that the bomb will disrupt the traffic

ii. If the plane can carry three large bombs and uses all the three, what is the probability that the traffic will be disrupted?

b) A manufacturer of sprinkler systems used for fire protection in office buildings claims that true average system activation temperature is $130^0$ F. A sample of n=9 systems, when tested yields a sample average activation of $131.08^0$F. If the distribution of activation times is normal with standard deviation $1.5^0$ F, does the data contradict the manufacturer's claim at significance level $\alpha$=1%.

14. a) A sample of ten new bike helmets manufactured by a certain company is obtained. Upon testing, it is found that the first, third and tenth helmets are flawed, whereas the others are not. Let p=Pr(flawed helmet). Find maximum likelihood estimate of 'p'.

b) The theory predicts the proportion of beans in the four groups A,B,C, and D should be 9:3:3:1. In an experiment among 1600 beans, the numbers in the four groups were 882, 313, 287 and 118. Test whether the experimental results support the theory.

**No of Pages : 3** **Course Code : 12XT23 / 12XW21**

15. Four machines A,B,C and D are used to produce a certain kind of cotton fabrics. Samples of 4 with each unit as 100 square meters are selected from the outputs of the machines at random and the number of flaws in each 100 square meters are counted with the following result:

| A | B | C | D |
|---|---|---|---|
| 8 | 6 | 14 | 20 |
| 9 | 8 | 12 | 22 |
| 11 | 10 | 18 | 25 |
| 12 | 4 | 9 | 23 |

Obtain the appropriate analysis of variance table and test at 0.01 level of significance whether there are differences in machines.

**PART - C** **Marks : 1 x 20 = 20**

16. Prior to submitting a quotation for a construction project, companies prepare a detailed analysis of the estimated labour and materials costs required to complete the project. A company which employs three project cost assessors, wished to compare the mean values of these assessors' cost estimates. This was done by requiring each assessor to estimate independently the costs of the same four construction projects. These costs, in lakhss are shown in the following table:

| | Assessor A | Assessor B | Assessor C |
|---|---|---|---|
| Project 1 | 46 | 49 | 44 |
| Project 2 | 62 | 63 | 59 |
| Project 3 | 50 | 54 | 54 |
| Project 4 | 66 | 68 | 63 |

Perform a two factor analysis of variance on these data to test, at the 5% significance level, that there is no difference between assessors' mean cost estimates.

17. A hardware manufacturing company appoints four marketing persons A, B, C, D and observes their sales in 3 months January, May and August. The figures (in hundreds) are given below

| | Marketing Persons | | | |
|---|---|---|---|---|
| Months | A | B | C | D |
| January | 36 | 36 | 21 | 35 |
| May | 28 | 29 | 31 | 32 |
| August | 26 | 28 | 29 | 29 |

Obtain the appropriate analysis of variance table and test at 0.01 level of significance whether there are differences in marketing persons.

**/END/**

**FD/RL**