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Question Paper Code: 51033

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Third Semester

Computer Science and Engineering

15UMA322 – PROBABILITY STATISTICS AND QUEUING SYSTEMS

(Common to IT Branch)

(Regulation 2015)

(Statistical table may be permitted)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. If A and B are Independent $P(A)=\frac{1}{2}$ and $P(B)=\frac{1}{5}$, find $P(A \cap B)$.

   (a) $\frac{1}{100}$ (b) $\frac{1}{7}$ (c) $\frac{1}{10}$ (d) $\frac{6}{10}$

2. If X is a random variable then identify $E(ax+b)$.

   (a) $aE(X)+a$ (b) $E(X)+E(b)$ (c) $aE(X)$ (d) $aE(X)+b$

3. When $r=0$ the Lines of Regression are_____ to each other.

   (a) Parallel (b) Perfect (c) Perpendicular (d) Coincide

4. The correlation between price and demand of a commodity is an example of

   (a) Positive correlation (b) Negative correlation
   (c) Covariance (d) Regresion

5. The term Replication refers to

   (a) Randomisation (b) Repetation
   (c) Experimental Design (d) Local control

6. If $S_1^2 > S_2^2$ then generalize F

(a) $\frac{S_2^2}{S_1^2}$ (b) $\frac{S_1^2}{S_2^2}$ (c) $\frac{S_1}{S_2}$ (d) $\frac{S_2}{S_1}$

7. Transient state in Queueing system will be

(a) Independent of time (b) Depends on time
(c) Invariant in Time (d) None of these

8. Mean number of customers in the Non-empty Queues is

(a) W_S (b) L_S (c) L_W (d) W_L

9. The traffic equations are also known as

(a) Flow balance equation (b) Modified traffic Equation
(c) Steady State Equation (d) P-K Equation

10. Mean of Erlang distribution with parameter "λ" and "*K*" is

(a) $\frac{K}{\lambda^2}$ (b) $\frac{K}{\lambda}$ (c) $\frac{\lambda^2}{K}$ (d) $\frac{K^2}{\lambda}$

PART - B (5 x 2 = 10 Marks)

11. If the probability is 0.05 that a certain kind of measuring device will show excessive drift, what is the probability that the sixth of these measuring devices tested will be the first to show excessive drift?

12. Let *X* and *Y* be random variables having joint density function *f(x,y)*=$\begin{cases} \frac{3}{2}(x^2+y^2), 0 \le x \le 1 \\ 0, \quad otherwise \end{cases}$, formulate the value of *E(XY)*.

13. Write any two uses of Analysis of Variance.

14. If $\lambda=\frac{1}{13}$ and $\mu = \frac{1}{4}$ in a *(M/M/1):(x/FCFS)* model, then Predict the expected number of customers in the system.

15. What do you mean by *M/G/*1 Queue?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) If *P(X=x)*=$\begin{cases} Kx, & x = 1,2,3,4,5 \\ 0, & otherwise \end{cases}$, represents a probability mass function, Identify the value of *K*, *P(x* being a prime number*)* , $P\left\{\frac{1}{2} < x < \frac{5}{2} / x > 1\right\}$, Find the distribution function. (8)

(ii) Establish the Memory less property of exponential distribution. (8)

Or

(b) (i) The CDF of a continuous random variable X is given by $F(x) = \begin{cases} 0, x < 0 \\ x^2, 0 \le x < \frac{1}{2} \\ 1-\frac{3}{25}(3-x)^2, \frac{1}{2} \le x < 3 \\ 1, x \ge 3 \end{cases}$ find the pdf of X and evaluate $P(|x| \le 1)$ and $P(\frac{1}{3} < x < 4)$, using both pdf and CDF. (8)

(ii) Deduce MGF, mean, and variance of binomial distribution. (8)

17. (a) Determine the correlation coefficient between random variables X and Y whose joint p.d.f is $f(x,y) = \begin{cases} 2-x-y, 0 \le x \le 1; 0 \le y \le 1 \\ 0, \ otherwise \end{cases}$ (16)

Or

(b) (i) The two lines of regression are $8x - 10y + 66 = 0$, $40x - 18y - 214 = 0$. The variance of x is 9. Evaluate the mean values of x and y and the correlation coefficient between x and y. (8)

(ii) If X has p.d.f $f(x) = \frac{1}{\pi}, \frac{-\pi}{2} < x < \frac{\pi}{2}$, identifhy the p.d.f of $Y = tanx$. (8)

18. (a) The following table shows the lives in hours of four brands of electric lamps.

Brand A	1610	1610	1650	1680	1700	1720	1800	
Brand B	1580	1640	1640	1700	1750			
Brand C	1460	1550	1600	1620	1640	1660	1740	1820
Brand D	1510	1520	1530	1570	1600	1680		

Perform an analysis of variance to test the homogeneity of the mean lives of four brands of lamps. (16)

Or

(b) An experiment was designed to study the performance of 4 different detergents for cleaning fuel injectors. The following "*cleaness*" readings were obtained with specially designed equipment for 12 tanks of gas distributed over 3 different models of Engines.

	Engine 1	Engine 2	Engine 3
Detergent A	45	43	51
Detergent B	47	46	52
Detergent C	48	50	55
Detergent D	42	37	49

Looking on the detergents of treatments and the engines at blocks, obtain the appropriate anova table and test at 0.01 level of significance whether difference in detergents and engines? (16)

19. (a) Customers arrive at a watch repair shop according to Poisson process at a rate of one per every 10 minutes and the service time is an exponentially random variable with mean 8 min. (i) Find the average number of customers *Ls* in the shop. (ii) Find the average time a customer spends in the shop *Ws*. (iii) Find the average number of customers in the queue *Lq* (iv) What is the probability that the server is idle. (16)

Or

(b) A super market has two girls ringing up sales at the counters. If the service time for each customer is exponential with mean of 4 minutes and if the people arrive in a Poison fashion at the rate of 10/hr. (a) What is the probability of having to unit for the service. (b) What is the expected % idle time for each girl? (c) If a customer has to wait, what is the expected length of his waiting time? (16)

20. (a) Derive the Pollaczek-Khintchine formula. (16)

Or

(b) Write short notes on the following: (i) Queue networks, (ii) Series queues (iii) Open network (iv) Closed network. (16)

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