**A** **Reg. No. :** | | | | | | | | | | |

# Question Paper Code: 53022

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Third Semester

Computer Science Engineering

15UMA322 - PROBABILITY, STATISTICS AND QUEUEING SYSTEMS

(Common to Information Technology branch)

(Regulation 2015)

(Statistical tables are may be permitted)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Method in which previously calculated probabilities are revised with new probabilities is classified as CO1- R

   (a) Addition theorem (b) Multiplication theorem
   (c) Revised theorem (d) Baye's theorem

2. If a random variable X has a moment generating function $M_X(t)$, then a random variable Y = a X + b has the moment generating function CO1- R

   (a) $e^{a t} M_X(bt)$ (b) $e^{b t} M_X(at)$ (c) $e^{b t} M_Y(at)$ (d) $e^{a t} M_Y(bt)$

3. Which of the following is not a possible value of the correlation co efficient? CO2- R

   (a) Negative 0.9 (b) Zero (c) Positive 1.5 (d) Negative 0.05

4. The formula for the correlation coefficient is CO2- R

   (a) $(1 - R^2) * SD(X)$ (b) $\frac{\text{cov } ariance\ (X,Y)}{SD(X) * SD(Y)}$ (c) $\sqrt{1-R^2} * SD(Y)$ (d) $\sqrt{1-R^2} * SD(Y)$

5. How many dependent variables must you have for an ANOVA to be conducted? CO3- R

(a) only 1 continuous variable (b) 2 nominal variables

(c) 3 ordinal variables (d) 3 ratio variables

6. The ANOVA test is based on which assumptions? CO3- R

I. the sample are randomly selected
II. the population variances are all equal to some common variance
III. the populations are normally distributed
IV. the populations are statistically significant

(a) II and III only (b) I, II, and III only (c) I and III only (d) I and II only

7. Define queue discipline CO4- R

(a) Degree to which members of the queue renege

(b) Sequence in which members of the queue arrived

(c) Degree to which members of the queue are orderly and quiet

(d) Sequence in which members of the queue are serviced

8. Identify from the following the necessary condition for the system to be in steady state CO4- R

(a) $\lambda = \mu$ (b) $\lambda < \mu$ (c) $\lambda > \mu$ (d) $\lambda = 0$

9. Network of M/M/m queues CO5- R

(a) Jackson (b) Product form networks

(c) BCMP (d) Denning and Buzen

10. Closed queueing networks CO5- R

(a) Have a source (b) Have a sink

(c) Do not have source (d) Do not have source or sink

PART – B (5 x 2= 10 Marks)

11. Find the density function of (X + 2Y), if X and Y are independent random variables having N (1, 2) and N (2, 2). CO1- App

12. State any two properties of correlation. CO2- R

13. List any two differences between RBD and LSD. CO3- R

14. State Pollaczek - Khinchine formula CO4- R

15. List the three classification of queueing network. CO5- R

PART – C (5 x 16= 80Marks)

16. (a) (ii) The interactive computer system at Ghu Glue has 20 communication lines to the central computer system. The lines operate independently and the probability that any particular line is in use is 0.6. What is the probability that 10 or more lines are in use. CO1- App (8)

(ii) Obtain the moment generating function and mean of geometric distribution. CO1- App (8)

Or

(b) (i) In a certain binary communication channel, the probability a transmitted zero is received as zero is 0.95 and the probability that a transmitted one is received as a one is 0.90. Assuming that the probability a zero is transmitted is 0.4. Find CO1- App (8)

(a) probability a one is received

(b) probability a one was transmitted given a one was received.

(ii) State and prove the memory less property of exponential distribution. CO1- App (8)

17. (a) The joint probability density function of a two-dimensional random variable (X,Y) is given by CO2- U (16)

$f(x, y) = x y^2 + \frac{x^2}{8}, \quad 0 \le x \le 2, 0 \le y \le 1.$

Compute

(a) $P ( Y < 1/2 / X > 1)$

(b) $P ( X + Y \le 1)$

Or

(b) Obtain the equation of the lines of regression from the following data: CO2- U (16)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X : | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Y : | 9 | 8 | 10 | 12 | 11 | 13 | 14 |

18. (a) The following data represent the number of units of production per day turned out by different workers using 4 different types of machines — CO3- Ana — (16)

| | | Machine type | | | |
|---|---|---|---|---|---|
| | | A | B | C | D |
| | 1 | 44 | 38 | 47 | 36 |
| | 2 | 46 | 40 | 52 | 43 |
| Workers | 3 | 34 | 36 | 44 | 32 |
| | 4 | 43 | 38 | 46 | 33 |
| | 5 | 38 | 42 | 49 | 39 |

(a) Test whether the five men differ with respect to mean Productivity.

(b) Test whether the mean productivity is the same for the four different machine types.

Or

(b) Set up the analysis of variance for the following results of a Latin Square Design. (Use $\alpha = 0.01$) level of significance. — CO3- Ana — (16)

| | | | |
|---|---|---|---|
| A12 | C19 | B10 | D8 |
| C18 | B12 | D6 | A7 |
| B22 | D10 | A5 | C21 |
| D12 | A7 | C27 | B17 |

19. (a) Customers arrive at a watch repair shop according to a Poisson process at a rate of one per every 10 minutes, and the service time is an exponential random variable with mean 8 minutes. — CO4- App — (16)

(a) Find the average number of customers $L_s$ in the shop.

(b) Find the average time a customer spends in the shop $W_s$.

(c) Find the average number of customers in a queue $L_q$.

(d) What is the probability that the server is idle?

Or

(b) A group of engineers has 2 terminals available to aid their calculations. The average computing job requires 20 minutes of terminal time and each engineer requires some computation one in an hour. Assume that these are distributed according to an exponential distribution. If there are 6 engineers in the group, find the expected number of engineers waiting to use the terminals in the computing center. CO4- App (16)

20. (a) Derive P-K formula. CO5- App (16)

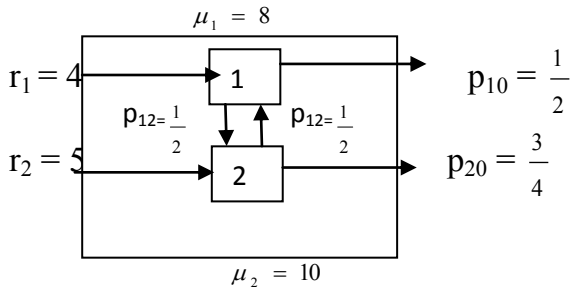
Or

(b) Consider a system of two servers where customers from outside the system arrive at server 1 at a Poisson rate 4 and at server 2 at a Poisson rate 5. The service rates for server 1 and 2 are 8 and 10 respectively. A customer upon completion of service at server 1 is likely to go to server 2 or leave the system; where as a departure from server 2 will go 25 percent of the time to server 1 and will depart the system otherwise. Determine CO5- App (16)

(i) the limiting probabilities.

(ii) average number of customers in the system.

(iii) average time a customer spends in the system.



**53022**