Master of Computer Applications
MCAC-103
(PG_CBCS_UPC : 2234 01103)
Mathematical Techniques for Computer Science Applications
Nov/Dec 2019
For Admissions in 2019

Time: Three Hours **Max. Marks: 70**

Q1 a) Define binomial distribution (2+5=7 marks)

b) Given that $f(x) = \frac{k}{2^x}$ is a probability distribution of random variable that can take on the values x=0,1,2,3 and 4, find k. Find CDF.

Q2 Derive the mean and variance of uniform distribution in the interval (a,b). (7 marks)

Q3 Find the value of k for the probability density f(x) given below and hence find its mean and variance where (7 marks)

$$f(x) = \begin{cases} kx^3 & 0 < x < 1 \\ 0 & otherwise \end{cases}$$

Q4 The amount of time that a surveillance camera will run without having to be reset is a random variable having the exponential distribution with the parameter 50 days. Find the probability that such a camera will (7 marks)

a) have to reset in less than 20 days
b) not have to be reset in at least 60 days

Q5 Find SVD for matrix $A = \begin{bmatrix} 3 & 0 \\ 4 & 5 \end{bmatrix}$ (7 marks)

Q6 What is Baye's Rule? A box contains three coins: two regular coins and one fake two-headed coin (P(H)=1) (7 marks)

a) You can pick a coin at random and toss it. What is the probability that it lands heads up?
b) You pick a coin at random and toss it, and get heads. What is the probability that it is the two headed coin?

Q7 The data given below represents the time t (in minutes) taken by a group of people to swim 500m (7 marks)

t	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40
frequency	0	10	16	24	20	20	14	20

a) Draw the relative frequency histogram for the given data
b) Find mean, median and mode for t
c) Design the Box plot for t
d) One measure of skewness is found using $\frac{3(mean - median)}{standard\ \ deviation}$. Evaluate this measure and describe the skewness of these data
e) Draw the Ogives for the given data

Q8 a) Prove Markov's Inequality. (3.5x2=7 marks)

b) Find the rank, nullspace and basis of nullspace for matrix

$$A = \begin{bmatrix} 1 & 2 & -1 & 4 \\ 2 & 4 & 3 & 5 \\ -1 & -2 & 6 & -7 \end{bmatrix}$$

Q9 What is Orthonormal matrix? Find cosΘ for $v = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$ and $w = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$. Check Schwarz and Triangle Inequality for v and w. (7 marks)

Q10 Are the column vectors of A linearly independent? Find rank, eigenvalues and eigenvectors of matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 0 & 0 \\ -2 & 2 & 1 \end{bmatrix}$ (7 marks)