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MANIPAL INSTITUTE OF TECHNOLOGY  
MANIPAL UNIVERSITY, MANIPAL - 576 104

First Semester MCA Examination December- 2014

COMPUTATIONAL MATHEMATICS (MAT- 4150)

Time: 3 Hrs.

Max. Marks: 50



Note: a) Answer any FIVE full questions.

b) All questions carry equal marks.

1A. If A, B and C are the events of sample space which are not mutually exclusive then prove the following

i)  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

ii)  $P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$

1B. Show that the set  $B = \{2, 4, 6, 8 ; x \text{ mod } 10\}$  is an abelian group.

1C. Derive mean and standard deviation of binomial distribution.

(3 + 3+ 4)

2A. From 8 positive and 6 negative integers, 4 are chosen at random and are multiplied. What is the probability that the product is positive?

2B. Anon-empty set H of a group is a sub group of G if and only if

i) for any  $a, b \in H \Rightarrow a * b \in H$

ii) for any  $a \in H \Rightarrow a^{-1} \in H$

2 C. Find all the eigen values and the corresponding eigen vectors of the matrix

$$A = \begin{bmatrix} 2 & 2 & 0 \\ 2 & 5 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

(3+ 3 + 4)

3A. The life of a certain type of electrical lamps is normally distributed with mean 2040 hours and standard deviation 60 hours. In a consignment of 3000 lamps, how many would be expected to burn for i) more than 2150 hours ii) Less than 1950 hours iii) between 1920 hours and 2160 hours

3B. Define Ring. Verify the set of matrices of the form  $A = \begin{pmatrix} 0 & a \\ -a & 0 \end{pmatrix}$ , where 'a' is rational number is a ring with respect to addition and multiplication of matrices.

- 3C. State Baye's theorem. Three major parties A, B and C are contending for power in the election of the state. The chance of their winning the election is in the ratio 1:3:5. The parties A, B, C respectively have probability of banning the online lottery  $\frac{2}{3}$ ,  $\frac{1}{3}$ ,  $\frac{3}{5}$ . What is the probability that there will be a ban on the online lottery in the state? And what is the probability that the ban is from party C.

(3+ 3 + 4)

- 4A. Define the following  
 i) Complete graph & give an example of complete graph of 4 and 5 vertices.  
 ii) Linearly independent and linearly dependent vectors.  
 iii) Complete bipartite graph and give an example of  $K_{3,3}$  and  $K_{3,6}$

- 4B. Test for consistency and solve:  $x + 2y + 3z = 1$ ,  $2x + 3y + 8z = 2$ ,  $x + y + z = 3$

- 4C. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} Kx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$$

- i) Find the constant K ii) compute  $P(1 < x < 2)$  iii) Find the distribution function F(x)

(3+ 3 + 4)

- 5A. Define planar graph. If G is a simple graph with n vertices and k components then prove that G can have at most  $\frac{(n-k)(n-k+1)}{2}$  edges

- 5C. A fair coin is tossed three times the two random variables X and Y defined as follows, X = 0 or 1 according as head or tail occurs on the first toss. Y denote the total number of heads. Determine the following i) Marginal distributions of X and Y ii) Joint distributions of X and Y iii) E(x) and E(Y) iv) covariance of X and Y

(4 + 6)

- 6A. Reduce the quadratic form  $3x^2 - 2y^2 - z^2 + 12yz + 8zx - 4xy$  to the canonical form by an orthogonal reduction and indicate the nature, rank, index and signature of the canonical form.

- 6B. Define Eulerian circuit and Hamiltonian cycle. Give an example of i) Hamiltonian graph but not an Eulerian graph ii) Eulerian graph but not a Hamiltonian graph.

(7+ 3)

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