U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

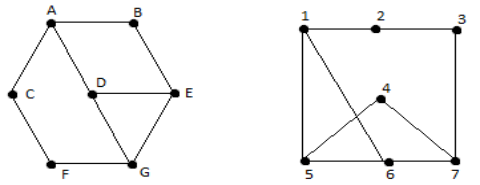
Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Machine Learning **Duration: 3 hrs.**
Course Code: 22MA3BSMML **Max Marks: 100**
Course: Mathematical Foundations for Machine Learning

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

				CO	*PO*	Marks
			UNIT - I			
1	a)		Solve the linear congruence $7x \equiv 2(\text{mod}37)$.	CO1	PO1	**06**
	b)		Apply Chinese remainder theorem to solve the linear congruences $x \equiv 3(\text{mod}5)$, $x \equiv 2(\text{mod}6)$, $x \equiv 4(\text{mod}7)$.	CO1	PO1	**07**
	c)		Generate the public and private keys to encrypt certain messages using primes 3 and 11.	CO1	PO1	**07**
			UNIT - II			
2	a)		Define complete graph, bipartite graph & complete bipartite graph with examples.	CO1	PO1	**06**
	b)		Verify whether the following graphs are isomorphic or not? 	CO1	PO1	**07**
	c)		Prove that a connected graph with n vertices has at least $(n-1)$ edges.	CO1	PO1	**07**
			OR			
3	a)		Define Simple graph, Regular graph, and Induced subgraphs with examples.	CO1	PO1	**06**
	b)		Write a graph and its adjacency matrix whose incidence matrix is given below. $A(G) = \begin{array}{c} \\ a \\ b \\ c \\ d \\ e \end{array} \begin{array}{c} \begin{array}{cccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$	CO1	PO1	**07**
	c)		Prove that a connected graph G has a Euler circuit if an only if all vertices of G are of even degree.	CO1	PO1	**07**

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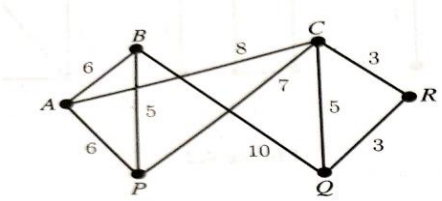
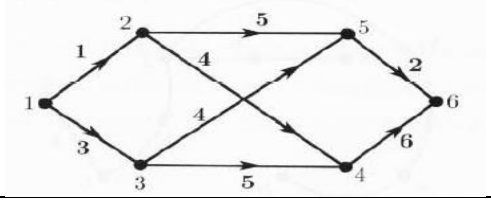
			UNIT - III			
	4	a)	Let $T_1 = (V_1, E_1)$ and $T_2 = (V_2, E_2)$ be two trees with $\|E_1\| = 19$ and $\|V_2\| = 3\|V_1\|$, then determine $\|V_1\|$, $\|V_2\|$ and $\|E_2\|$.	CO1	PO1	**06**
		b)	Apply Kruskal's algorithm to find the minimal spanning tree of the graph given below 	CO1	PO1	**07**
		c)	Apply Dijkstra's algorithm to find the shortest path and its weight from the vertex 1 to each of the other vertices in the directed graph given below 	CO1	PO1	**07**
			UNIT-IV			
	5	a)	Find the coefficient of (i). x^9y^3 in the expansion of $(2x - 3y)^{12}$, (ii). xyz^2 in the expansion of $(2x - y - z)^4$.	CO1	PO1	**06**
		b)	In a survey of 200 musicians, it was found that 40 wore gloves on the left hand and 39 wore gloves on the right hand. If 160 wore no gloves at all, how many wore a glove on only the right hand? Only the left hand? On both hands?	CO1	PO1	**07**
		c)	Define Catalan numbers and write first 6 Catalan numbers. Using the moves $R: (x, y) \to (x + 1, y)$ & $U: (x, y) \to (x, y + 1)$, find in how many ways one can go from (i). $(0, 0)$ to $(6, 6)$ and not rise above the line $y = x$? (ii). $(2, 1)$ to $(7, 6)$ and not rise above the line $y = x - 1$?	CO1	PO1	**07**
			UNIT - V			
	6	a)	Apply mathematical induction to prove that $(n^3 - n)$ is divisible by 3 $\forall n \in Z^+$.	CO1	PO1	**06**
		b)	Solve the recurrence relation $a_{n+1} = 4a_n$, $a_0 = 3$ for $n \geq 0$.	CO1	PO1	**07**
		c)	A bank pays a certain percentage of annual interest on deposits, compounding the interest once in 3 months. If a deposit doubles in 6 years and 6 months, what is the annual percentage of interest paid by the bank?	CO1	PO1	**07**
			OR			
	7	a)	Apply mathematical induction to show that $2^n > n^2$ $\forall n > 4 \in Z^+$.	CO1	PO1	**06**
		b)	Solve the recurrence relation $a_n + a_{n-1} - 6a_{n-2} = 0$, $a_0 = -1$, $a_1 = 8$ for $n \geq 2$.	CO1	PO1	**07**
		c)	By the method of generating functions, find the solution of the recurrence relation $a_{n+2} - 3a_{n+1} + 2a_n = 0$, $a_0 = 1$, $a_1 = 6$ for $n \geq 0$	CO1	PO1	**07**

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