Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering
End Sem Examination Dec-2023
CS3EA09 Graph Theory

Programme: B.Tech. Branch/Specialisation: CSE All

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. How many simple graphs are possible with 5 vertices & 4 edges? **1**
(a) C(5,4) (b) P(4,5) (c) C(10,4) (d) P(10,4)

ii. If we delete an edge in graph G then no. of components in graph G. **1**
(Here n is the no. of vertex & k is no. of components)
(a) n & k (b) n & k+1 (c) n & k-1 (d) n-1 & k+1

iii. A tree has…… no. of perfect matching. **1**
(a) n (equal to vertex) (b) At most n
(c) At least 1 (d) At most 1

iv. What is the minimum number of edges needed to generate the connectivity in a simple graph with 10 vertices? **1**
(a) 37 (b) 38 (c) 39 (d) 40

v. Which of the following shows the simplest non-planar graph? **1**
(a) |V|=5 & |E|=9 (b) |V|=6 & |E|=10
(c) |V|=5 & |E|=10 (d) |V|=6 & |E|=11

vi. What is the chromatic number of an n vertices simple connected graph which does not contain any odd length cycle? (where n≥2) **1**
(a) 2 (b) 3 (c) n (d) n-1

vii. How many ways can 10 persons be seated at a round table? **1**
(a) 5,040 (b) 36,28,800 (c) 40,320 (d) 3,62,880

viii. How many number of diagonals which can be drawn by joining the angular points of a hexagon **1**
(a) 10 (b) 15 (c) C(2,6) (d) P(6,2)

ix. The recurrence relation f(n)=f(n−1)+f(n−2) is used to find- **1**
(a) Even number (b) Odd number
(c) Prime number (d) None of these

P.T.O.

x. Partitioning of integer means- **1**

(a) Representing an integer as sum of positive and negative real numbers

(b) Representing an integer as sum of positive and negative integers

(c) Representing an integer as sum of positive integers

(d) Representing an integer as sum of positive real numbers

Q.2 i. Explain the difference between walks and paths with an example. **2**

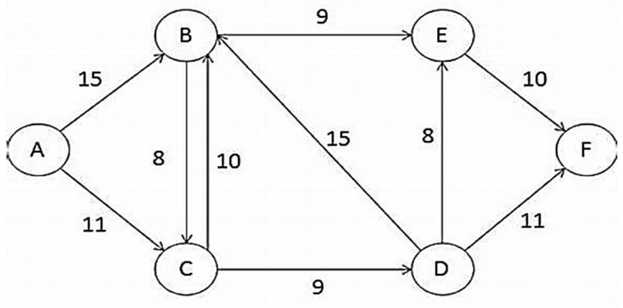
ii. Prove that the maximum number of edges in a simple graph with n vertices is n(n-1)/2. **3**

iii. What are the different properties of Euler graphs and Bipartite graphs. **5**

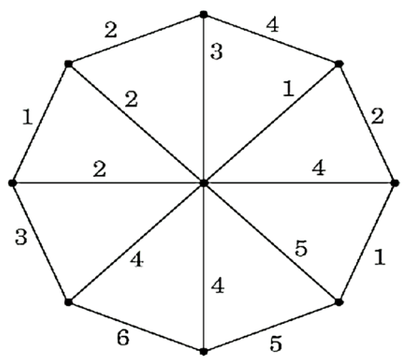
OR iv. What is a subgraph? Explain different types of subgraphs with examples. **5**

Q.3 i. Define combinational & geometric graphs. **2**

ii. In a given transport network, find the all cut-sets that separates source from sink & also find out the cut-set with minimum capacity & define maximum flow minimum-cut theorem. **8**



OR iii. Define spanning tree. Using Prim's algorithm to find the minimum spanning tree of the graph. find the weight of this minimum spanning tree. **8**



Q.4 i. What is a Greedy coloring algorithm? **3**

ii. Define chromatic number, chromatic partition & independent numbers. Prove that the chromatic polynomial equation for a complete graph is Pn(λ)=λ(λ-1)(λ-2)(λ-3)(λ-4)..... **7**

OR iii. What are the different types of diagraphs? Explain with an example. **7**

Q.5 i. Suppose we have 5 letters & 5 envelopes, one letter per envelope. How many ways can we place such that. **4**

(a) All are wrongly placed.

(b) At least one letter is correctly placed

(c) Only one letter is wrongly placed

(d) Define derangement with formula.

ii. Prove that C(n-1,r)+C(n-1,r-1)=C(n,r). **6**

OR iii. Use mathematical induction to prove that 2*7^n+3*5^n-5 is divisible by 24 for all n>0. **6**

Q.6 Attempt any two:

i. Define summations operator with an example. **5**

ii. Solve this recurrence relation (Given $a_0=3$ & $a_1=2$) **5**

$a_n-6a_{n-1}+8a_{n-2}=0$

iii. Explain first order & second order recurrence relation with example. **5**

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Marking Scheme
Graph Theory-CS3EA09(T)

Q.1	i)	(c) C(10,4)		**1**
	ii)	(b) n & k+1		**1**
	iii)	(d) At most 1		**1**
	iv)	(a) 37		**1**
	v)	(c) |V|=5 & |E|=10		**1**
	vi)	(a) 2		**1**
	vii)	(d) 3,62,880		**1**
	viii)	(b) 15		**1**
	ix)	(d) None of these (Fibonnaci numbers)		**1**
	x)	(c) representing an integer as sum of positive integers		**1**
Q.2	i.	Method-	1 mark	**2**
		Answer-	1 mark	
	ii.	Complete proof with steps	(As per explanation)	**3**
	iii.	Each define-1 mark		**5**
OR	iv.	Define-	1 mark	**5**
		Diagram	1 mark	
		Each type-	(1.5 mark *2)	
Q.3	i.	Each-1 mark	(1 Mark*2)	**2**
	ii.	Minimum cut-set capacity-	1 Marks	**8**
		Maximum flow minimum-cut theorem-	2 Marks	
		Solution steps with table-	5 Marks	
OR	iii.	Definition-	2 Marks	**8**
		solution steps-	5 Marks	
		Minimum spanning tree weight-	1 Mark	
Q.4	i.	Define Algorithm-3 marks		**3**
	ii.	Define chromatic number	1 Mark	**7**
		Define chromatic partition-	1 Mark	
		Define independent numbers	1 mark	
		Proof	4 Marks	
OR	iii.	Explain each graph with example-	(3.5 marks*2)	**7**
Q.5	i.	Each-1 mark	(1 Mark*4)	**4**
	ii.	Both side proof	(3 Marks*2)	**6**
OR	iii.	Complete solution steps	4 Marks	**6**
		Answer	2 Marks	
Q.6		Attempt any two:		
	i.	Define	2 Marks	**5**
		Solution steps	3 Marks	
	ii.	Solution steps	4 Marks	**5**
		Answer-	1 Mark	
	iii.	Each with example-	2.5 Marks	**5**

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