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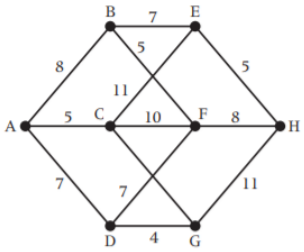
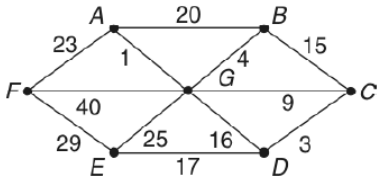
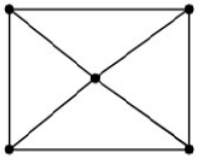
SCHOOL OF ADVANCED SCIENCES

Fall Semester 2024-2025

Final Assessment Test Model Paper

Programme Name & Branch: B. Tech.
Course Name & Code: Discrete Mathematics and Graph Theory & BMAT205L
Exam Duration: 3 hrs.
Maximum Marks: 100

1	Obtain the principal disjunctive normal form of the following statement: $$(p \to (q \wedge r)) \wedge (\sim p \to (\sim q \wedge \sim r))$$ and hence find the principal conjunctive normal form of the expression.	10	CO1	BL3
2	i) Verify the validity of the following argument: 1) Every living thing is a plant or an animal. 2) Arjun's dog is alive and it is not a plant. 3) All animals have hearts. 4) Therefore Arjun's dog has a heart. ii) Show that $$\forall x : (P(x) \vee Q(x)) \implies ((\forall x : P(x)) \vee (\exists x : Q(x)))$$ by using the indirect method of proof.	5+5	CO1	BL2
3	Let $a * b = a + b + ab$ for all $a, b \in G$. Then check that if the structure $(G, *)$ is a commutative group, when G is the set of real numbers.	10	CO2	BL3
4	If H_1, H_2 are two subgroups of a group G, then prove that $H_1 \cap H_2$ is a subgroup of G. Can we conclude that $H_1 \cup H_2$ is also a subgroup of G? Explain with an examples	10	CO2	BL1

5	Use generating function to solve the recurrence relation: $$a_{n+1} - 8a_n + 16a_{n-1} = 4n, \quad n \geq 1$$ given that $a_0 = 1, a_1 = 8$.	10	CO3	BL3
6	Show that every chain is a distributive lattice. Also discuss about the converse of this statement with justification. **(OR)** Expand the Boolean expression $(x_1 \bigoplus x_2)$ into an equivalent sum-of-products and product-of-sums canonical forms in terms of three variables x_1, x_2 and x_3.	10	CO4	BL1/BL2
7	Use Dijkstra algorithm to find the shortest path between A and H in the weighted graph shown in the figure. 	10	CO5	BL3
8	Prove that a given connected graph G is an Euler graph if and only if all vertices of G are of even degree.	10	CO5	BL1
9	Explain Kruskal algorithm, and then find the minimum spanning tree of the following graph by using the algorithm.  **(OR)** (a) Prove that a graph G is connected if and only if it has a spanning tree. (b) A tree T has $2k$ vertices of degree 1, $3k$ vertices of degree 2 and k vertices of degree 3. Determine the number of vertices and edges in T.	10	CO5	BL1/BL2
10	Find the chromatic number and chromatic polynomial of the following graph. 	10	CO5	BL3