

SCHOOL OF ADVANCED SCIENCES

Fall Semester 2024-2025

Continuous Assessment Test – I

Programme Name & Branch: B.Tech & CSE

Slot: C1+TC1+TCC1

Course Name & code: Discrete Mathematics and Graph Theory & BMAT205L

Class Number (s): VL2024250102537, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, ,2547, 2548, 2549, 2552, 2553, 2554, 2555, 2558

Faculty Name (s): MANIMARAN A, NALLIAH M, PARTHIBAN A, MURUGAN V, EZILMARAN D, H NIRANJAN, ANKUSH CHANDA, DEEPA, MC SARAVANARAJAN, AMRIT DAS, SUMIT, B VENKATESWARLU, VIJAYAKUMAR V, JUHI BAROI, JAGATHESWARI S, PRAVEEN

Exam Duration: 90 Min.

Maximum Marks: 50

General instruction(s): Answer *ALL* the following questions.

Q.No.	Question	Max Marks
1.	Find the PDNF and PCNF of $(p \wedge q) \vee (p \wedge r) \vee (q \wedge r)$. (i) By using Truth table (ii) without using truth table.	10
ANS	PDNF: $(p \wedge q \wedge r) \vee (p \wedge q \wedge \neg r) \vee (p \wedge \neg q \wedge r) \vee (\neg p \wedge q \wedge r)$ PCNF: $(\neg p \vee q \vee r) \wedge (p \vee \neg q \vee r) \wedge (p \vee q \vee \neg r) \wedge (p \vee q \vee r)$	
2.	(i) Prove the following “All flowers are plants. Sunflower is a flower”. “Therefore, Sunflower is a plant”. (5M)	10
ANS	$P(x)$ is “ x is a plant” a is a constant symbol (Sunflower) $F(x)$ is “ x is a flower” The argument is $(\forall x)[F(x) \rightarrow P(x)] \wedge F(a) \rightarrow P(a)$ The proof sequence is as follows: 1. $(\forall x)[F(x) \rightarrow P(x)]$ hyp 2. $F(a)$ hyp 3. $F(a) \rightarrow P(a)$ 1, ui 4. $P(a)$ 2, 3, mp	
	(ii) Show that the following statement is valid. All men are mortal Socrates is a man Therefore, Socrates is a mortal. (5M)	
ANS	$H(x)$: x is a man. $M(x)$: x is a mortal S : Socrates $\forall(x)(H(x) \rightarrow M(x)) \wedge H(S) \Rightarrow M(S)$	

3.	<p>“If I eat spicy food, then I have strange dreams”. “I have strange dreams, if there is thunder while I sleep”. “I did not have strange dreams”. What relevant conclusion can be drawn from the above premises? Construct an argument to obtain your conclusion.</p>	10
ANS	<p>I did not eat spicy food or there was no thunder.</p> <ul style="list-style-type: none"> • The relevant conclusions are: “I did not eat spicy food” and “There is no thunder while I sleep”. • Let the primitive statements be: <ul style="list-style-type: none"> ▪ s, ‘I eat spicy foods’ ▪ d, ‘I have strange dreams’ ▪ t, ‘There is thunder while I sleep’ • Then the premises are translated as: $s \rightarrow d$, $t \rightarrow d$, and $\neg d$. • And the conclusions: $\neg s$, $\neg t$. • Steps Reason <ul style="list-style-type: none"> 1. $s \rightarrow d$ premise 2. $\neg d$ premise 3. $\neg s$ Modus Tollens to Steps 1 and 2 4. $t \rightarrow d$ premise 5. $\neg t$ Modus Tollens to Steps 4 and 2. 	
4.	<p>Prove that for any commutative monoid $(M, *)$, the set of idempotent elements of M forms a submonoid.</p>	10
ANS	<p><u>Proof:</u></p> <p>Let S be the set of idempotent elements of M, where $S \subseteq M$.</p> <p>Since $e * e = e$, e is an idempotent element of M and hence $e \in S$.</p> <p>Let $a, b \in S$.</p> <p>Then $a * a = a$ and $b * b = b$.</p> <p>Now $(a * b) * (a * b) = a * (b * a) * b$ $= a * (a * b) * b$ (since M is commutative) $= (a * a) * (b * b)$ $= a * b$</p> <p>Hence $a * b$ is also an idempotent element.</p> <p>$\therefore a * b \in S$ and $(S, *)$ is a submonoid.</p>	

5.	<p>Check whether the set $\{5, 15, 25, 35\}$ is a group or not with respect to multiplication module 40.</p> <p>(i) Form the Cayley's table (ii) Find the order of the group (iii) Find the identity element of the group (iv) Find the order of each element in a group. (v) Find the inverse of each element in a group.</p>	10																									
ANS	<p>Group</p> <p>(i)</p> <table border="1"> <tr> <td>X_{40}</td> <td>5</td> <td>15</td> <td>25</td> <td>35</td> </tr> <tr> <td>5</td> <td>25</td> <td>35</td> <td>5</td> <td>15</td> </tr> <tr> <td>15</td> <td>35</td> <td>25</td> <td>15</td> <td>5</td> </tr> <tr> <td>25</td> <td>5</td> <td>15</td> <td>25</td> <td>35</td> </tr> <tr> <td>35</td> <td>15</td> <td>5</td> <td>35</td> <td>25</td> </tr> </table> <p>(ii) order of the group is 4 (iii) identity element of the group is [25] (iv) $O[5]=2, O[15]=2, O[25]=2, O[35]=2$ (v) inverse of [5] is [5], inverse of [15] is [15], inverse of [25] is [25], inverse of [35] is [35].</p>	X_{40}	5	15	25	35	5	25	35	5	15	15	35	25	15	5	25	5	15	25	35	35	15	5	35	25	
X_{40}	5	15	25	35																							
5	25	35	5	15																							
15	35	25	15	5																							
25	5	15	25	35																							
35	15	5	35	25																							

NOTE*: Please refer below to the BL – Bloom's Taxonomy Levels and mention the respective level in the questions.

Bloom's Taxonomy Levels	Category
BL1	Remembering
BL2	Understanding
BL3	Applying
BL4	Analyzing
BL5	Evaluating
BL6	Creating