BTS–III(R/S)–01–23–1442 Reg. No. 2 0 2 2 [illegible] 9 7

B

B.Tech. Degree III Semester Regular/Supplementary Examination January 2023

CS/IT 19-202-0303 DISCRETE COMPUTATIONAL STRUCTURES

(2019 Scheme)

Time: 3 Hours Maximum Marks: 60

Course Outcome

On successful completion of the course, the students will be able to:

CO1: Use logical notation to define and reason mathematically about the fundamental data types and structures used in computer algorithms.

CO2: Summarise mathematical notations and concepts in discrete mathematics that is essential for computing.

CO3: Construct proofs using direct proof, proof by contraposition, proof by contradiction and proof by resolution and by mathematical induction.

CO4: Familiarise mathematical reasoning and proof strategies.

CO5: Identify and apply the counting principle.

CO6: Apply graph theory to solve real world problems.

CO7: Interpret the conceptual background needed to identify structures of algebraic nature and discover, prove and properties about them.

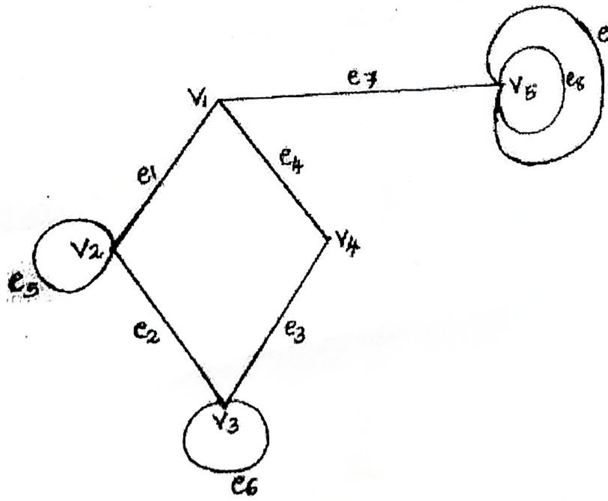
Bloom's Taxonomy Levels (BL): L1 – Remember, L2 – Understand, L3 – Apply, L4 –Analyze, L5 – Evaluate, L6 – Create

PO – Programme Outcome

PART A

(Answer *ALL* questions)

		(8 × 3 = 24)	Marks	BL	CO	PO
I.	(a)	Show that $((p \rightarrow q) \wedge (q \rightarrow r)) \rightarrow (p \rightarrow r)$ is a tautology.	3	L2	2	1,2,3,4, 8
	(b)	Consider f, g and h are functions on set of integers. $f(x) = x + 2$, $g(x) = x^2$ and $h(x) = 3x$. Find foh, hog and fogoh.	3	L1	4	1,2,2,3, 4,5, 8
	(c)	Write an algorithm to find the largest element in a finite sequence.	3	L2	1	1,2,3,4, 8
	(d)	What is the minimum number of students required in a class to be sure that atleast six will receive the same grade, if there is five possible grades A, B, C, D and E?	3	L1	5	1,2,3,8
	(e)	Find the adjacency and incidence matrix for the following graph.	3	L1	6	1,2,3,4, 8



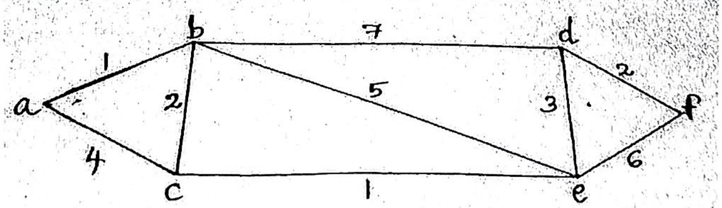
(P.T.O.)

			Marks	BL	CO	PO
	(f)	Convert the given expression into binary tree $a * b / c + e / f * g + k - x * y$.	3	L3	6	12,3,4,8
	(g)	Show that set N of natural numbers is a semigroup under the operation $x * y = max(x, y)$.	3	L1	7	12,3,4,8
	(h)	Define lattice and distributive lattice. Write an example for each.	3	L1	7	1,2,3,4, 8

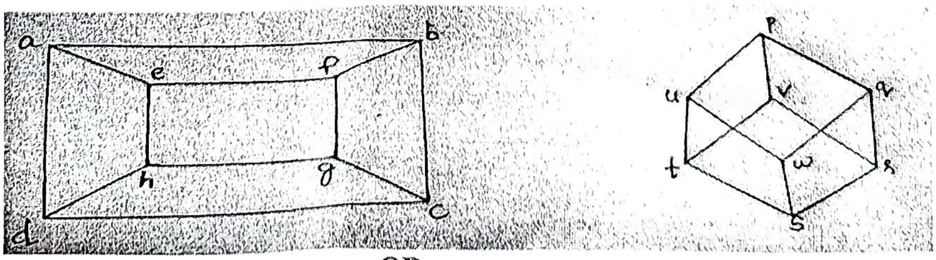
PART B

(4 × 12 = 48)

			Marks	BL	CO	PO
II.	(a)	Show that $n^3 + 2n$ is divisible by 3 for all $n \geq 1$ using mathematical induction.	6	L1	3	1,2,3,4, 5, 8
	(b)	Let $A = \{1, 2, 3, 4\}$ and R be a relation on A given by $R = \{(1,1), (1,3), (2,2), (2,4), (3,1), (3,3), (4,2), (4,4)\}$. Check whether R is reflexive, symmetric, transitive and antisymmetric	6	L4	4	1,2,3,4, 5,8
		OR				
III.	(a)	Use mathematical Induction to prove that $1 + 3 + 5 + \ldots\ldots + (2n-1) = n^2$ for all $n \geq 1$.	6	L1	3	1,2,3,4, 5,8
	(b)	Show that the following argument is valid. "If today is Tuesday, then I have a test in mathematics or English. If my English professor is sick, then I will not have a test in English. Today is Tuesday and my English professor is sick. Therefore I have a test in Mathematics".	6	L2	3	1,2,2,4, 5, 8
IV.	(a)	Solve the recurrence relation $2a_r - 5a_{r-1} + 2a_{r-2} = 0$ with initial conditions $a_0 = 0$ and $a_1 = 1$.	8	L3	5	1,2,3,8
	(b)	State Pigeon Hole principle. Show that among any 11 numbers there exist atleast two numbers with same unit digit.	4	L2	5	1,2,3, 8
		OR				
V.	(a)	Solve the recurrence relation $a_r - 4a_{r-1} + 4a_{r-2} = 0$ with initial conditions $a_0 = 1$ and $a_1 = 6$.	8	L3	5	1,2,3, 8
	(b)	Write a recursive algorithm to find the n^{th} Fibonacci number.	4	L2	1	1,2,3,4, 8
VI.	(a)	Write Dijkstra's algorithm. Find the shortest path from A to F using the above algorithm.	6	L1	6	1,2,3,4, 8



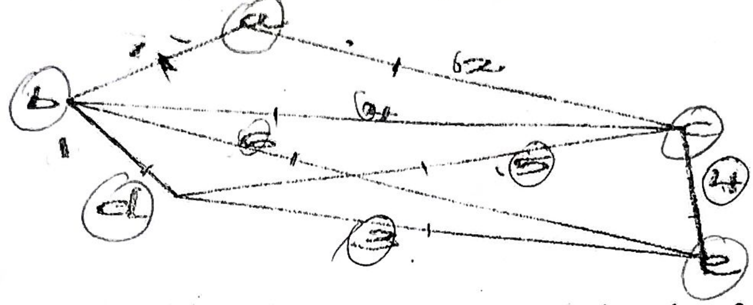
			Marks	BL	CO	PO
	(b)	Determine whether the following graphs are isomorphic or not.	6	L3	3	1,2,3,4, 5,8



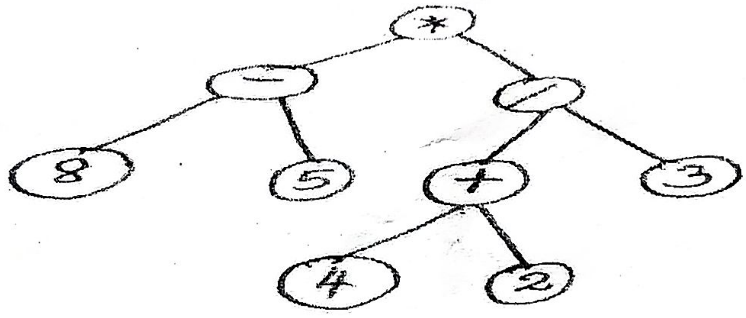
OR

(Continued)

			Marks	BL	CO	PO
VII.	(a)	State Kruskal's algorithm. Find minimum spanning tree of the below given graph using Kruskal's algorithm.	6	L1	1	1,2,3,4,8



	(b)	State and explain different tree traversal methods and perform different tree traversals for the given binary tree.	6	L2	6	1,2,3,4,8



VIII.	(a)	Consider the set $D_{50}=\{1, 2, 4, 5, 10, 20, 25, 50\}$ and partial ordering divisibility. Draw the Hasse Diagram and find upper bounds, lower bounds, infimum and supremum of the set $B=\{5, 10\}$.	8	L3	7	1,2,3,4,8
	(b)	Consider an algebraic system (G, *) where G is set of all non -zero real numbers and * is a binary operation defined by $a*b=(ab)/2$. Show that (G, *) is an abelian group.	4	L1	7	1,2,3,4,8

OR

IX.	(a)	Let A be the set of factors of a particular positive integer m and $\leq$ be the relation divides. Draw a Hasse Diagram for (i) m = 12 (ii) m = 45.	8	L3	7	1,2,3,4,8
	(b)	Define a semigroup. Consider an algebraic system (A, *) where $A=\{1, 3, 5, 7, \ldots\}$, the set of all positive odd integers and * is a binary multiplication operation. Determine whether (A, *) is a semigroup.	4	L1	7	1,2,3,4,8

Blooms's Taxonomy Levels

L1 – 39%, L2 – 22%, L3 – 34%, L4 – 5%.

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