

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Winter 2018

Course: B. Tech in Computer Science and Engg

Subject Name: Discrete Mathematics

Date: 03/12/2018

Max Marks: 60

Instructions to the Students:

1. Solve ANY FIVE questions out of the following.
2. Use of non-programmable scientific calculators is allowed.
3. Assume suitable data wherever necessary and mention it clearly.

Marks

Q. 1 Solve Any Three of the following.

- A) Let p and q be the propositions “Swimming at the New Jersey shore is allowed” and “Sharks have been spotted near the shore” respectively. Express each of these compound propositions as an English sentence.

a) $\neg q$ b) $p \rightarrow \neg q$ c) $p \leftrightarrow \neg q$ d) $\neg p \vee q$

- B) Explain with example, notations used and mathematical expression to describe the following terms.

i) Membership ii) Subset iii) Equality of two sets iv) Union

- C) Use mathematical induction to show that $1+5+9+\dots+(4n-3)=n(2n-1)$, $\forall n \geq 1, n \in \mathbb{Z}$

- D) Explain Universal quantifiers and Existential quantifiers with example. What is De Morgan’s law for quantifiers?

Q. 2 Solve the following.

- A) Check whether the relation R defined in the set $\{1, 2, 3, 4, 5, 6\}$ is

$R = \{(a, b) : b = a+1\}$ is reflexive, symmetric or transitive. Justify your answer. Find the relation Matrix.

- B) Explain surjective, injective, bijective and inverse function each with example.

Q. 3 Solve Any three of the following.

- A) Explain the pigeonhole principle with example.

- B) Find how many symbol codes can be formed if the first two symbols are letters and the next three are digits but no symbol is repeated?

- C) What is the expansion of $(3x + y)^4$?

- D) Determine the sequence $\{a_n\}$ where $a_n = 3n$ for every non-negative integer, n is a solution of the recurrence relation $a_n = 2a_{n-1} - a_{n-2}$ for $n = 2, 3, 4, \dots$

Q. 4 Solve the following.

- A) Define Euler graph and Hamiltonian Graph.

i) For a given graph G :

- Find a Hamiltonian path that begins at A and ends at E.
- Find a Hamiltonian circuit that starts at A and ends with the pair of vertices E, A.
- Find a Hamiltonian path that begins at F and ends at G.

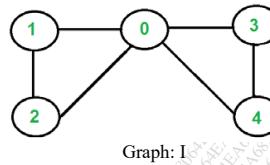
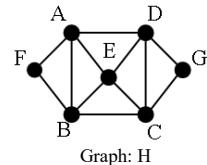
ii) For a given graph I find Eulerian path and Eulerian cycle.

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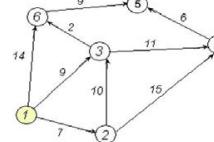
Sem: III

Subject Code: BTCOC302

Duration: 3 Hrs.



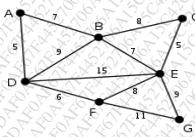
- B) Find the shortest path in the given graph using Dijkstra shortest path algorithm.



Q. 5 Solve Any three of the following.

- A) Show that a tree with n vertices has $n-1$ edges.

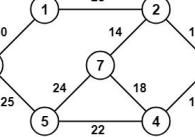
- B) Find minimum spanning tree for the given graph using Prim's algorithm?



- C) Define the following terms with reference to tree with example.

i) Level and Height of a tree ii) M-ary Tree iii) Eccentricity of a vertex

- D) Construct the minimum spanning tree (MST) for the given graph using Kruskal's Algorithm.



Q. 6 Solve the following.

- A) Define the following terms.

i) Algebraic Structures ii) Semi Groups iii) Monoids iv) Ring
v) Field vi) Group

- B) For each of the following, determine whether the binary operation * is commutative or associative?

- N is the set of natural numbers and $a * b = a + b + 2$ for $a, b \in N$
- On N where $a * b = \min(a, b+2)$
- On R where $a * b = a^b$

*** End ***

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**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD -402 103
Winter Semester Examination – Dec.- 2019**

Branch: Computer Science
Subject: - Discrete Mathematics (BTCOC302)
Date: - 12/12/2019

Sem.: III
Marks: 60
Time:- 3 Hr.

Instructions to the Students

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriate assume it and should mention it clearly

(Marks)

- Q.1. a) Let $A = \{ 4,5,7,8,10 \}$, $B = \{ 4,5,9 \}$ and $C = \{ 1,4,6,9 \}$. Then verify that,

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$
 (6)
b) Show that $(n^3 + 2n)$ is divisible by 3, for all $n \geq 1$, by method of induction. (6)
- Q.2. a) Find transitive closure of relation R defined on set $A = \{ 1, 2, 3, 4 \}$ defined as:

$$R = \{(1,2), (1,3), (1,4), (2,1), (2,3), (3,4), (3,2), (4,2), (4,3)\}$$
 (6)
- b) Let set $A = \{ 1, 2, 3 \}$, $B = \{ a, b, c \}$ & $C = \{ x, y, z \}$.
Consider following relations R & S from A to B and B to C respectively.

$$R = \{ (1,b), (2,a), (2,c) \} \text{ & } S = \{ (a,y), (b,x), (c,y), (c,z) \}$$

(i) Find composition relation $R \circ S$.
(ii) Write matrices M_R , M_S & $M_{R \circ S}$ of relations R, S & $R \circ S$.
(iii) Find product of M_R , $M_S = M_P$
Compare and comment on contents of $M_{R \circ S}$ & M_P . (6)

- Q.3. a) Define discrete numeric function.
Also state rules for product and sum of two numeric functions a and b.

Find sum of two numeric functions defined as:

$$a_r = \begin{cases} 0 & 0 \leq r \leq 2 \\ 2^{-r} + 5 & r \geq 3 \end{cases}$$

and

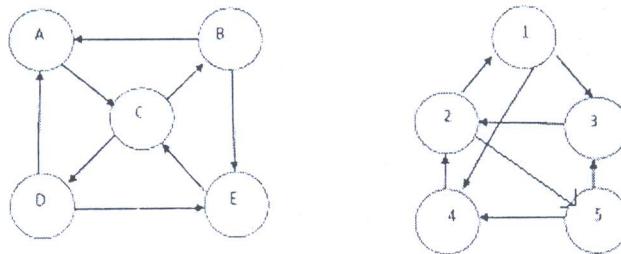
$$b_r = \begin{cases} 3-2^r & 0 \leq r \leq 1 \\ r+2 & r \geq 2 \end{cases}$$
(6)

- b) (i) How many different strings of length six can be generated using either three uppercase alphabets followed by three digits or four uppercase alphabets followed by two digits.
(6)

Q.4. a) (i) Show that the maximum number of edges in a simple graph having n vertices is $n * (n-1) / 2$. (6)

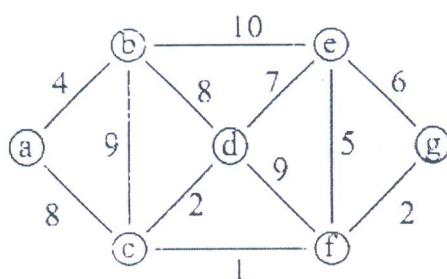
b) (i) Show that following graphs are isomorphic. Also give correspondence between edges and vertices of two graphs.

(6)



Q.5. a) Show the steps of constructing a binary Search tree for following sequence of data items. Also write steps to search an element “25” in the resultant tree.

b) Find minimum spanning tree for the graph given below using Prim's algorithm



(6)

Q.6. a) Define following terms

- (1) Abelian Group
 - (2) Monoid
 - (3) Ring

(6)

b) Let $A = \{0, 1, 2, 3\}$ & $\langle A, * \rangle$ be an algebraic system,
 where $\forall a, b \in A$ and $a * b = (a + b) \bmod 4$. Find $\forall a \in A, a^2, a^3, a^4$. (6)

----- ***Paper End*** -----

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Summer 2019

Course: B. Tech in CE/ CS / CS&E

Semester: III

Subject Name: Discrete Mathematics

Subject Code: BTCOC302

Max. Marks: 60

Date: 29 / 05 / 2019

Duration: 3 Hrs.

Instructions to the Students:

1. Solve ANY FIVE questions out of the following.
2. The level question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly.

(Level/ Marks
CO)

Q.1 Solve Any Three of the following.

- A) Among integers 1 to 1000,
- i. How many of them are not divisible by 3 nor by 5 nor by 7?
 - ii. How many are not divisible by 5 or 7 but divisible by 3?
- B) Among integers 1 to 300,
- i. How many of them are not divisible by 3 nor by 5 nor by 7?
 - ii. How many of them are divisible by 3 but not by 5, nor by 7?
- C) i. Obtain the Conjunctive Normal Form of $(p \wedge q) \vee (\neg p \wedge q \wedge r)$
ii. Obtain the Disjunctive Normal Form of $\neg(p \rightarrow (q \wedge r))$
- D) Transcribe the following into logical notation. Let the universe of discourse be the real numbers.
- i. For any value of x , x^2 is non-negative.
 - ii. For every value of x , there is some value of y such that $x \cdot y = 1$.
 - iii. There are positive values of x and y such that $x \cdot y > 0$.
 - iv. There is a value of x such that if y is positive, then $x + y$ is negative.

Application 4

Application 4

understand 4

understand 4

Q.2 Solve Any Two of the following.

- A) $X = \{2, 3, 6, 12, 24, 36\}$ R on $X = \{(x, y) \in R, x \text{ divides } y\}$
 (a) Construct Hasse diagram.
 (b) Find maximal and minimal element?
 (c) Is poset a lattice? Justify.
- B) Given $A = \{1, 2, 3, 4\}$ and $B = \{x, y, z\}$. Let R be the following relation from A to B :
 $R = \{(1, x), (2, x), (3, x), (4, x), (1, y), (2, y), (3, y), (4, y), (1, z), (2, z), (3, z)\}$

Synthesis 6

understand 6

$$R = \{(1, y), (1, z), (3, y), (4, x), (4, z)\}$$

- (a) Determine the matrix of the relation.
- (b) Find the inverse relation R^{-1} of R.
- (c) Determine the domain and range of R.

- C) Given: $A = \{1, 2, 3, 4\}$. Consider the following relation in A:

$$R = \{(1, 1), (2, 2), (2, 3), (3, 2), (4, 2), (4, 4)\}$$

- (a) Draw its directed graph.
- (b) Is R (i) reflexive, (ii) symmetric, (iii) transitive, or (iv) antisymmetric?
- (c) Find $R^2 = R \circ R$.

Q.3 Solve the following.

- A) Consider the second-order homogeneous recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with the initial conditions $a_0 = 2$, and $a_1 = 7$,
- (a) Find the next three terms of the sequence.
 - (b) Find the general solution.
 - (c) Find the unique solution with the given initial conditions.
- B) Solve the following recurrence

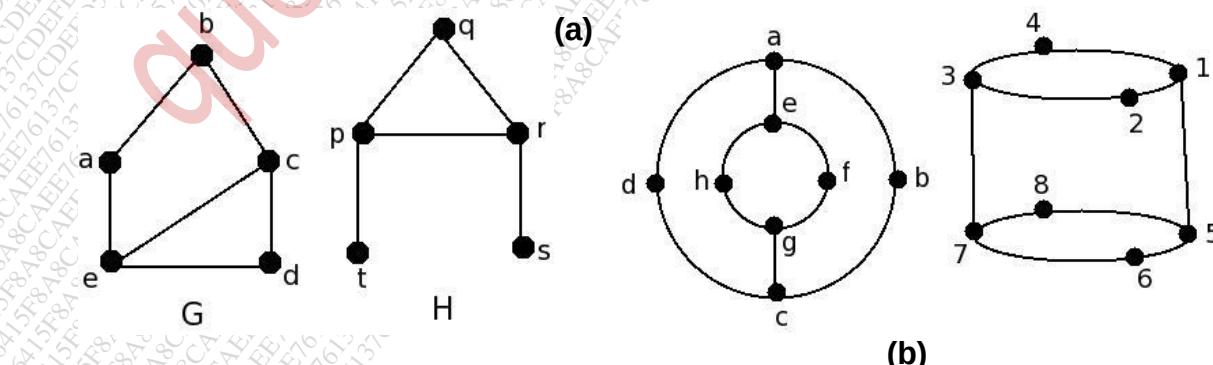
$$t_n = 6t_{n-1} - 11t_{n-2} + 6t_{n-3}$$

with initial conditions

$$t_0 = 1, t_1 = 5, \text{ and } t_2 = 15$$

Q.4 Solve Any Two of the following.

- A) Define the isomorphic graph. Are the following graphs shown in fig. (a) and (b) isomorphic? Understand 6



- B) (a) Draw the graph $K_{2,5}$.

Understand 6

(b) Define the following terms:

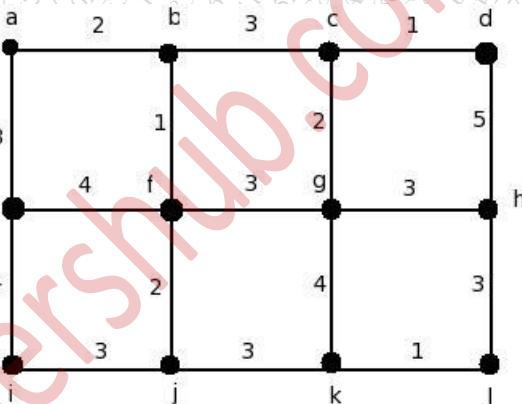
- (i) Planar Graph (ii) Bipartite Graph (iii) Complete graph

(c) Draw the 2-regular graph with 5 vertices.

- C) Write the Euler's Formula. Prove that in planar graph G with p vertices and q edges, where
 $p \geq 3$ then $q \geq 3p - 6$. Knowledge 6

Q.5 Solve the following.

- A) Use Prim's algorithm to find a minimum spanning tree in the graph shown in Figure given below.



Understand 6

- B) Construct a Binary Search Tree by inserting the following sequence of numbers:

10, 12, 5, 4, 20, 8, 7, 15, 13.

Application 6

Also Find Preorder, Inorder and Postorder traversals of Binary Search Tree.

Q.6 Solve the following.

- A) Define the following terminology:

Knowledge 6

- (i) Identity Element (ii) Monoid (iii) Group (iv) Algebraic System
 (v) Ring (vi) Inverse Element

- B) Consider the group $G = \{1, 2, 3, 4, 5, 6\}$ under multiplication modulo 7. Understand 6

- (a) Find the multiplication table of G.
 (b) Find the $2^{-1}, 3^{-1}, 6^{-1}$.
 (c) Find the orders and subgroups generated by 2 and 3.

*** End ***

Dr. Babasaheb Ambedkar Technological University Lonere-Raigad
Semester Examination: November 2010
Class: B. Tech. Computer Engineering Semester: III

Subject: Discrete Mathematics (DM)

Maximum Marks: 50

Time: 3 hours
Instructions :

1. Attempt ANY ONE question from each group, and ONE from the remaining.
2. Assume suitable data wherever necessary and mention it clearly.
3. Use rough space at the end of answer sheet.
4. Assume suitable data if necessary by specifying it
5. Each question carries 10 marks.

GROUP - I

Que. 1 Solve the following

a) Suppose A, B, and C represent three bus routes though a suburb of your favorite city. Let A, B, and C also be sets whose elements are the bus stops for the corresponding bus route. Suppose A has 25 stops, B has 30 stops and C has 40 stops. Suppose further that A and B share (have in common) 6 stops, A and C share 5 stops, and B and C share 4 stops. Lastly, suppose that A, B, and C share 2 stops. Answer each of the following questions.

- i) How many distinct stops are on the three bus routes?
- ii) How many stops for A are not stops for both B and C?

b) Prove the following:

- i) $\text{power}(A \cap B) = \text{power}(A) \cap \text{power}(B)$
- ii) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

Que. 2 Attempt the following

a) Prove the following in the context of GCD

$$\gcd(a, b) = \gcd(b, a) = \gcd(a, -b)$$

b) The *fatherOf* function from *People* to *People* is neither injective nor surjective. Why?

GROUP - II

Que. 3 Use induction to prove each of the following equations.

- i) $1 + 5 + 9 + \dots + (4n+1) = (n+1)(2n+1)$
- ii) $2 + 6 + 12 + \dots + (n^2 - n) = (n(n^2 - 1))/3$

Que. 4 Verify each of the following equivalences by writing an equivalence proof as tautology

- i) $(A \vee B) \wedge \neg A \rightarrow B$
- ii) $(A \rightarrow B) \wedge \neg B \rightarrow \neg A$

GROUP - III

Que. 5 Solve the following

a) Let $B(x)$ mean x is bird, let $W(x)$ mean x is a worm, and let $E(x, y)$ mean x eats y . Find an English sentence to describe the following statement

$$\forall x \forall y (B(x) \wedge W(y) \rightarrow E(x, y))$$

b) Formalize the each of the following statements, where $B(x)$ means x is a bird, $W(x)$ means x is a worm, and $E(x, y)$ means x eats y

- i) Only birds eat worms
- ii) Birds only eat worms

END OF QUESTION PAPER

- Que. 6 Transform each of the following into formalized for and give a formal proof of the same
- i) "All computer science majors are people. Some computer science majors are logical thinkers. Therefore, some people are logical thinkers".
 - ii) "Some freshmen like all sophomores. No freshman likes any junior. Therefore, no sophomore is a junior."
 - iii) Answer the following
- Que. 7
- a) Write and explain Kruskal's algorithm to find the minimum spanning tree with suitable example
- b) What is chromatic number of a graph? Write an algorithm to color a given graph G.
- Que. 8 Solve the following
- a) Suppose repetitions are not permitted (i) how many three-digit numbers can be formed from the six digits 2, 3, 5, 6, 7 and 9 (ii) How many of these numbers are less than 400 chosen from seven men and five women?
- b) In how many ways can a committee considering of three men and two women be formed from the six digits 2, 3, 5, 6, 7 and 9 (iii) How many of these numbers are less than 400 chosen from seven men and five women?

B. Tech. Course in Information Technology

06 MAY 2017

Subject: Discrete Mathematics

Date:

Time: 10:00 AM – 1:00 PM

Max. Marks: 50

Note: i) Attempt any five Questions from Q. 1 to Q. 7. Each Question carry 10 marks.
ii) Necessary data is given in the respective questions. If such data is not given, it means that the knowledge of that data is a part of examination.
iii) If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

Q. 1

- a) Construct the truth table for $[(p \rightarrow q) \wedge \sim q] \rightarrow \sim p$. [5]
- b) Which of these sentences are propositions? What are the truth values of those that are propositions?
a) New Delhi is the capital of India. b) Panajim is the capital of Goa.
c) $2 + 3 = 5$. d) $5 + 7 = 10$. e) $x + 2 = 11$.

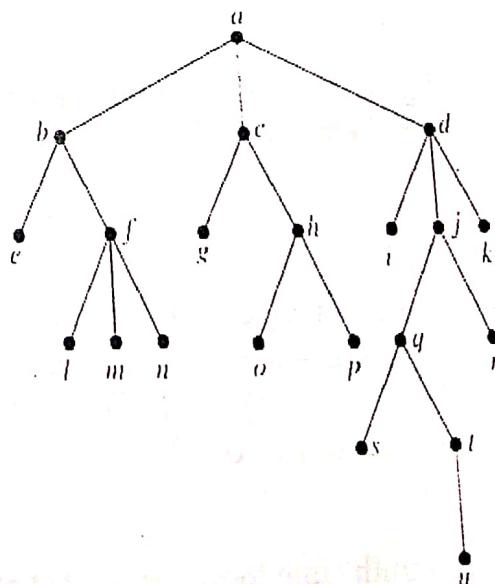
Q. 2

- a) Define the following terminologies:
(i) SET (ii) TREE
(iv) UNIVERSAL SET (v) PRODUCT SET [5]

(iii) GRAPH

- b) Answer these questions about the rooted tree illustrated.

- Which vertex is the root?
- Which vertices are leaves?
- Which vertex is the parent of h?
- Which vertices are children of j?
- Which vertices are internal?



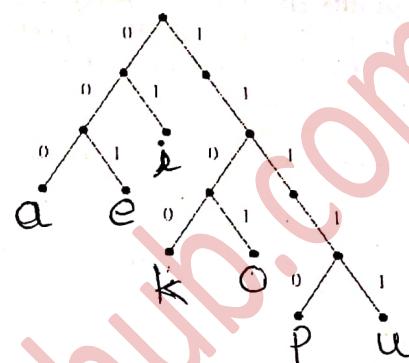
Q. 3

- a) Draw the Venn diagrams for each of these combinations of the sets A, B, and C. [5]

 - $(A \cup B) \cap (A \cup C)$
 - $A \cap B \cap C$

b)

- a) What are the codes for *a*, *e*, *i*, *k*, and *u* if the coding scheme is represented by this tree? [5]



b)

- i) $A \cup B$ ii) $A \cap B$ iii) $A - B$ iv) $B - A$.

Q.5

- a) In the survey of 140 people who reading SAKAL and LOKAMT newspapers, it was found that 60 read SAKAL, 45 read LOKMAT, 20 read both SAKAL and LOKAMAT. Find [5]
 (i) number of people read at least one paper
 (ii) read exactly one news paper.

b) Let f and g be the functions from the set of integers to the set of integers defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$. Find $f \circ g$ and $g \circ f$? [5]

Q. 6

- a) Consider the set \mathbb{Q} of rational numbers, and let $*$ be the operation on \mathbb{Q} defined by $a * b = a + b - ab$. Find:

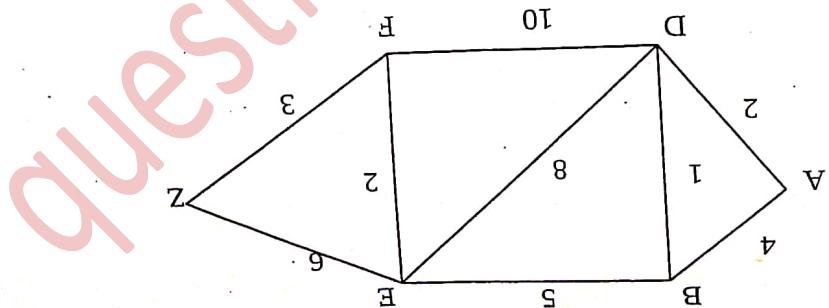
(i) $3 * 4$ (ii) $2 * (-5)$ (iii) $7 * (\frac{1}{2})$

(iv) Is $(\mathbb{Q}, *)$ a semigroup?

b) Construct a truth table for $((p \rightarrow q) \rightarrow r) \rightarrow s$. [5]

Q. 7

a) Apply Dijkstra's algorithm to find the shortest path between vertices A to Z in the figure shown below. [5]



[5]

b) Determine whether $(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$ is a tautology. [5]

Dr. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Winter Examinations 2022

Course: B. Tech.

Branch : Computer Science & Engineering

Semester : III

Subject Code & Name: BTCOC302 _ Discrete Mathematics

Max Marks: 60

Date: 11/03/2023

Duration: 3 Hr.

Instructions to the Students:

1. All the questions are compulsory.
2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
3. Use of non-programmable scientific calculators is allowed.
4. Assume suitable data wherever necessary and mention it clearly

(BTLevel)	Ma
	rks

Q. 1 Solve Any Two of the following.

A) Among the integers 1 to 1000:

- 1) How many of them are not divisible by 3, or by 5, or by 7?
- 2) How many are not divisible by 5 and 7 but divisible by 3.

B) Prove that $1 + 2 + 2^2 + \dots + 2^n = 2^{n+1} - 1$, where n is a nonnegative integer by using mathematical induction

C) Let $S(x)$ be the predicate “ x is a student,” $F(x)$ the predicate “ x is a faculty member,” and $A(x, y)$ the predicate “ x has asked y a question,” where the domain consists of all people associated with your school. Use quantifiers to express each of these statements.

- I. Lois has asked Professor Michaels a question.
- II. Every student has asked Professor Gross a question.
- III. Every faculty member has either asked Professor Miller a question or been asked a question by Professor Miller.
- IV. Some student has not asked any faculty member a question.
- V. There is a faculty member who has never been asked a question by a student
- VI. There is a faculty member who has asked every other faculty member a question

12	
Apply	6

Understand	6
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Understand	6
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Q.2 Solve Any Two of the following.

12

A) Let $A = \{p, q, r\}$. Show $(P(A), \subseteq)$ is a poset and draw its Hasse diagram.

Apply	6
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B) How many permutations of the letters a, b, c, d, e, f, g contain neither the pattern *bge* nor *eaf*?

Apply	6
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C) Determine whether each of these functions is one-to-one, onto, both or not a function. Justify your answer

Apply	6
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p, a, q, r

1) from $\{a, b, c, d\}$ to itself

i. $f(a) = b, f(b) = a, f(c) = c, f(d) = d$

ii. $f(a) = b, f(b) = b, f(c) = d, f(d) = c$

2) from Z to Z

i. $f(n) = n+1$

ii. $f(n) = n3$

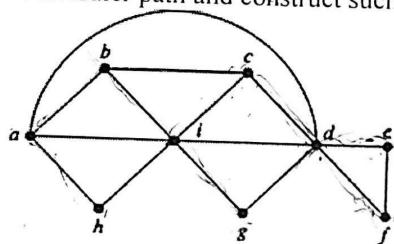
Q. 3 Solve Any two of the following.

12

- A) Determine whether the given graph has an Euler circuit. Construct such a circuit when one exists. If no Euler circuit exists, determine whether the graph has an Euler path and construct such a path if one exists.

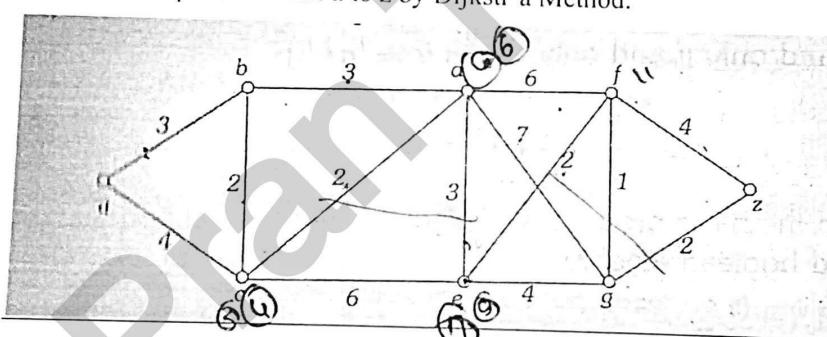
Apply

6



- B) Find shortest path between a to z by Dijkstr'a Method.

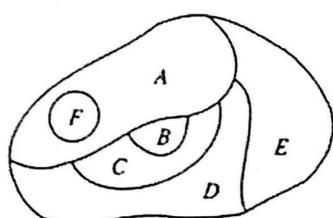
Understand 6



- C) For the following maps

Apply 6

- 1) Draw the planar graph
- 2) Color the vertices of graph.
- 3) Find the chromatic number

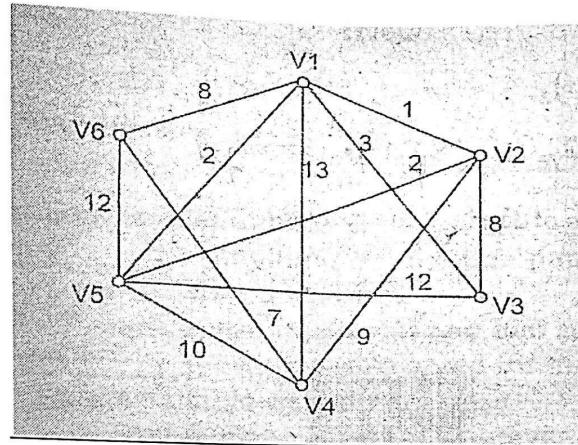


Q.4 Solve Any Two of the following.

12

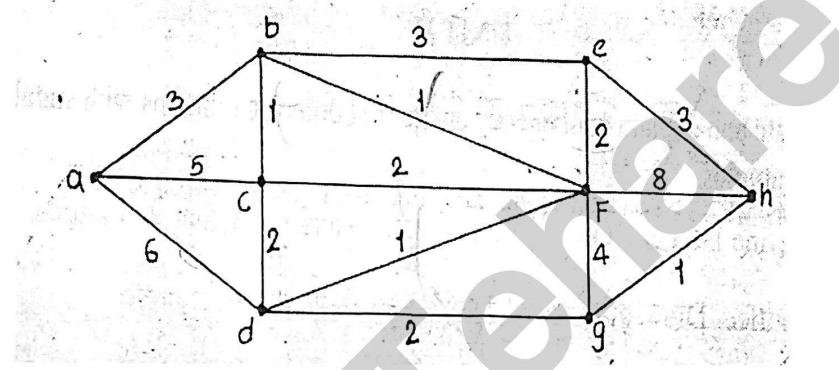
- A) Find Minimum spanning tree for following graph by using Kruskal's algorithm.

Apply 6



- B) Find Minimum spanning tree for following graph by Prim's Algorithm.

Apply 6



- C) Define Rooted tree, Balanced Tree and Binary search tree. Explain with example Understa nd 6

Q. 5 Solve Any two of the following.

- A) Define Semigroup, Monoid and Group. Explain with example Rememb er 6

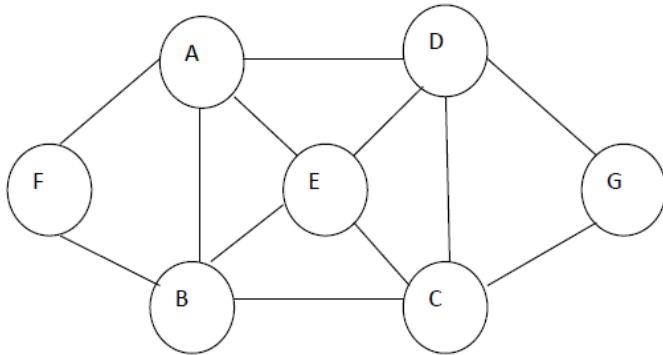
- B) Let (G, \oplus) is an algebraic system where $G = \{1101, 0000, 1001, 0100\}$ prove that (G, \oplus) is a group. Apply 6

- C) Define Ring . Prove that An algebraic system $(Z, +, \cdot)$ is a ring, where $+$ is addition and \cdot means multiplication operation. i.e. $a + b$ as the sum of a and b in Z , and $a \cdot b$ as the product of a and b in Z . Apply 6

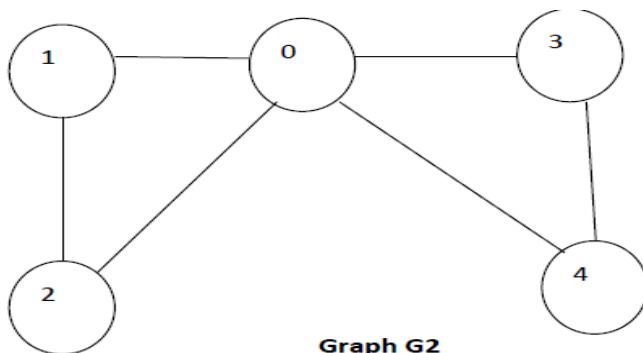
*** End ***

	DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE Supplementary Examination – Summer 2022 Course: B. Tech. Branch: Computer Science and Engineering Semester: III Subject Code & Name: BTCOC302_Discrete Mathematics		
	Max Marks: 60	Date:	
		Duration: 3 Hr.	
	Instructions to the Students: 1. All the questions are compulsory. 2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question. 3. Use of non-programmable scientific calculators is allowed. 4. Assume suitable data wherever necessary and mention it clearly.		
		(Level/CO)	
Q. 1	Solve Any Two of the following.		
A)	Explain with example, notation used and mathematical pression to describe following terms 1)Membership 2) Subset 3) Equality of two sets	(L1/CO1)	06
B)	Constructor a truth table for each of these compound propositions and identify type of compound statements a. $(p \wedge q) \rightarrow (p \vee q)$ b. $(q \rightarrow \neg p) \leftrightarrow (p \leftrightarrow q)$	(L3/CO1)	06
C)	Test the validity of following statement: If there is strike by student, then exam will be postponed. Exam was not postponed. Therefore, there were no strikes by students	(L3/CO1)	06
Q.2	Solve Any Two of the following.		
A)	Let $A = \{1,2,3,4,6,8,12\}$ and R be the partial order on A defined by aRb if a divides b. Determine the relational matrix for R. Construct directed graph G on A. Draw Hasse diagram of Poset (A, R).	(L1/CO2)	06
B)	State Pigeon hole principle. If five colors are used to paint 26 doors show that at least Six doors will have the same door	(L3/CO2)	06
C)	Let $f(x) = 2x+3$, $g(x) = 3x+4$, $h(x) = 4x$ for $x \in R$, where R is set of real numbers. Find gof , fog , foh and hof .	(L1/CO2)	06
Q. 3	Solve Any One of the following.		
A)	Show that the maximum number of edges in a simple graph having n vertices is $n*(n-1)/2$.	(L1/CO3)	06
B)	Define Euler graph and Hamiltonian graph 1) For a given graph G_1 a) Find a Hamiltonian path that begins at A and ends at E. b) Find a Hamiltonian circuit that starts at A and ends with the pair of vertices E, A	(L1/CO3)	06

- c) Find a Hamiltonian path that begins at F and ends at G.
 2) For a given graph G2 find Eulerian path and Eulerian cycle

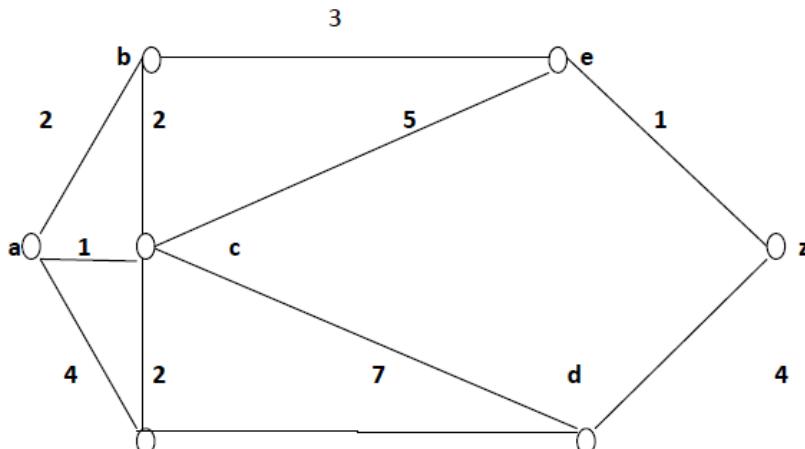


Graph G1



Graph G2

- C) Find a shortest path between vertices a and z in the given graph using Dijkstra shortest path algorithm.



Q.4 Solve Any Two of the following.

- A) Define the following with reference to tree with example

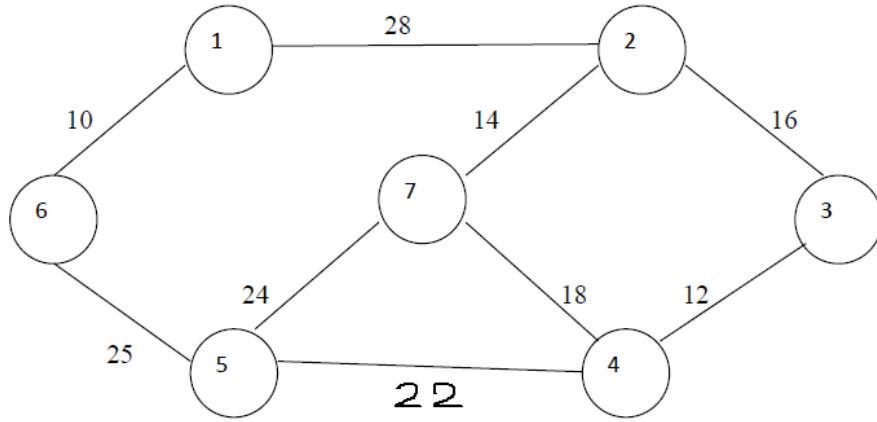
- a) Level and Height of a tree
- b) M-ary tree
- c) Fundamental Cut Sets

- B) Construct a minimum spanning tree (MST) for the given graph using Kruskal's.

(L3/CO3) 06

L1/CO3 06

L3/CO3 06



C)	Show that a tree with n vertices has n-1 edges	L1/CO3	06
Q. 5	Solve Any One of the following.		
A)	. Define the following terms 1. Algebraic structures 2. Semi Group 3. Monoids 4. Ring 5. Field 6. Group	L1/CO4	06
B)	For each of following, determine whether the binary operations * is commutative or associative? i) N is the set of natural numbers and $a*b=a+b+2$ for all a,b from N ii) on N where $a*b=\min(a, b+2)$ iii) on R where $a*b=a^b$	L3/CO4	06
C)	Determine whether $(\mathbb{Z}, +, *)$ is a ring with the binary operations $x + y = x + y - 7$ And $x*y = x + y - 3xy$ for all $x, y \in \mathbb{Z}$	L1/CO4	06
	*** End ***		

The grid and the borders of the table will be hidden before final printing.

Regular & Supplementary Winter Examination-2023

Course: B. Tech.

Branch : CE / CSE / CS/ Allied

Semester : III

Subject Code & Name: Discrete Mathematics [BTCOC302]

Max Marks: 60

Date:04-01-24

Duration: 03:00 Hrs.

Instructions to the Students:

1. All the questions are compulsory.
 2. The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in () in front of the question.
 3. Use of non-programmable scientific calculators is allowed.
 4. Assume suitable data wherever necessary and mention it clearly.

(Level/ Marks
CO)

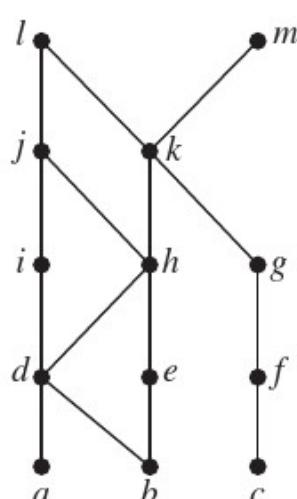
Q. 1 Attempt the following questions.

[12]

Q.2 Solve Any Two of the following.

[12]

- A) Answer these questions for the partial order represented by this Hasse diagram.

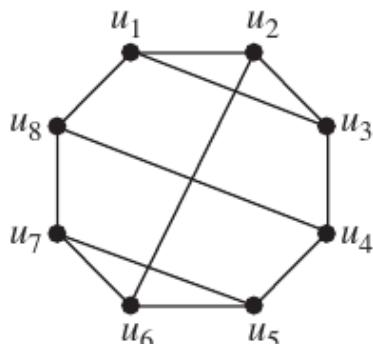


- a) Find the maximal elements.
 - b) Find the minimal elements.
 - c) Is there a greatest element?
 - d) Is there a least element?
 - e) Find all upper bounds of $\{a, b, c\}$.
 - f) Find all lower bounds of $\{f, g, h\}$.

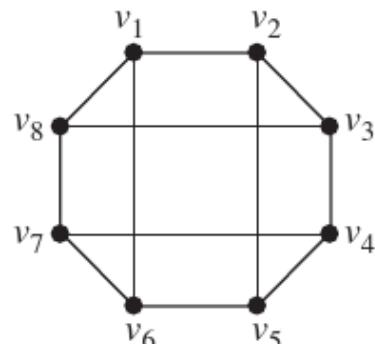
- B)** Let $f(x) = x + 2$, $g(x) = x - 2$, and $h(x) = 3x$ for $x \in R$ where $R = \text{set of real numbers}$. Find **CO2**
- gof
 - $fogoh$
 - foh
- C)** Solve the following homogeneous recurrence relation: **CO3**
 $t_n = 4t_{n-1} - 4t_{n-2}$.
 $t_0 = 1$, $n = 0$ and $n = 1$.

Q. 3 Solve Any Two of the following. **[12]**

- A)** Draw the following graphs. **CO4**
- K_7
 - $K_{1,8}$
 - $K_{4,4}$
 - C_7
 - W_7
 - Q_4
- B)** Use paths either to show that these graphs are not isomorphic or to find an **CO4** isomorphism between them.

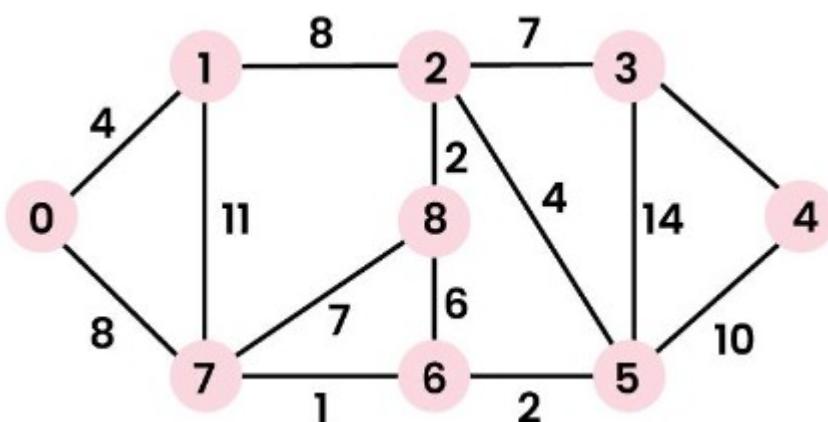


G



H

- C)** Use Dijkstra's algorithm to find the length of a shortest path between the vertices 1 **CO4** and 4 in the weighted graph displayed in Figure below.

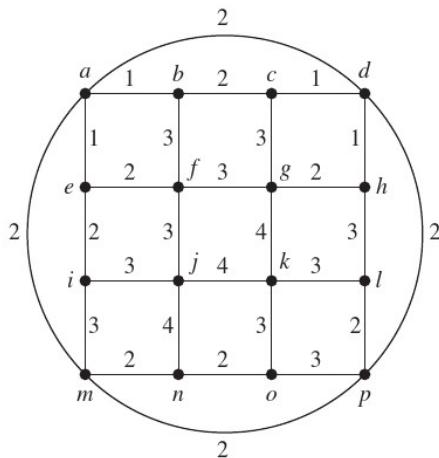


Q.4 Attempt the following questions. **[12]**

- A)** Use Huffman's algorithm to provide an optimal average-bit-length code for the **CO4** probability distribution a: 0.2, b: 0.2, c: 0.15, d: 0.15, e: 0.15, f: 0.1, and g: 0.05. Draw a binary tree to find the prefix code for each probability distribution

and compute the average bit-length of a codeword.

- B)** Use Kruskal's algorithm to find a minimum spanning tree for the weighted graph in **CO4** the Figure below.



- C)** (i) What is the value of each of the prefix expressions $+ - \uparrow 3 2 \uparrow 2 3 / 6 - 4 2?$ **CO4**
(ii) What is the value of each of the postfix expressions $3 2 * 2 \uparrow 5 3 - 8 4 / * -?$

Q. 5 Attempt the following questions.

[12]

- A)** Consider the binary operation defined on the set $A = \{a, b, c, d\}$ by following table. **CO5**
Find:

*	a	b	c	d
a	a	c	b	d
b	d	a	b	c
c	c	d	a	a
d	d	b	a	c

- (i) $c * d$ and $d * c$
(ii) $b * d$ and $d * b$
(iii) $a * (b * c)$ and $(a * b) * c$
- B)** Consider the group $G = \{1, 2, 4, 7, 8, 11, 13, 14\}$ under multiplication modulo 15. **CO5**
i) Find multiplication table of G.
ii) Find $2^{-1}, 7^{-1}$.
iii) Find the orders and subgroups generated by 7 and 11.

*** End ***