

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Winter 2018

Course: B. Tech in Computer Science and Engg

Sem: III

Subject Name: Discrete Mathematics

Subject Code: BTCOC302

Date: 03/12/2018

Max Marks: 60

Duration: 3 Hrs.

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. 4M
- 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. 4 M
- i) Membership ii) Subset iii) Equality of two sets iv) Union
- C) Use mathematical induction to show that $1+5+9+\dots+(4n-3) = n(2n-1)$, $\forall n \geq 1, n \in \mathbb{Z}$ 4M
- D) Explain Universal quantifiers and Existential quantifiers with example. What is De Morgan’s law for quantifiers? 4M

Q.2 Solve the following.

- A) Check whether the relation R defined in the set $\{1, 2, 3, 4, 5, 6\}$ is 6 M
 $R = \{ (a, b) : b = a+1 \}$ is reflexive, symmetric or transitive. Justify your answer. Find the relation Matrix.
- B) Explain surjective, injective, bijective and inverse function each with example. 6M

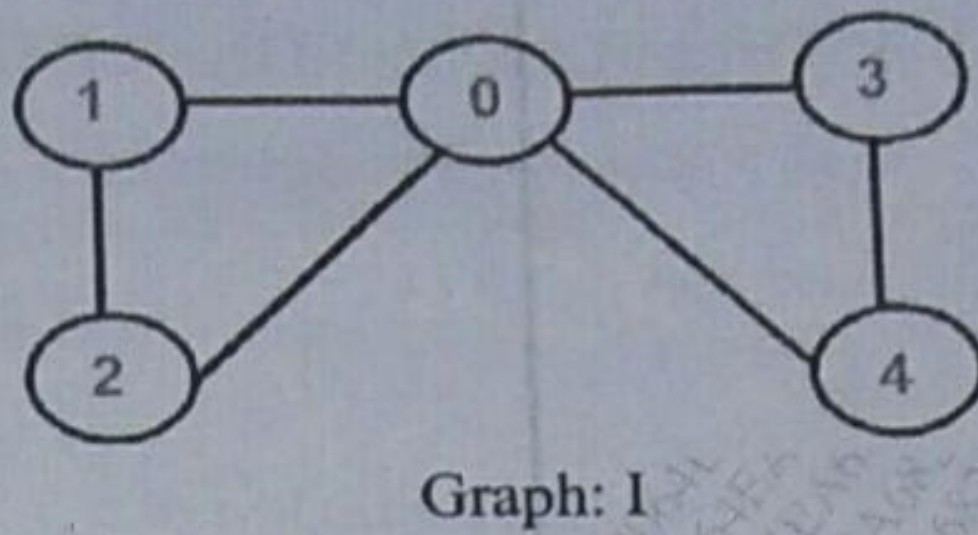
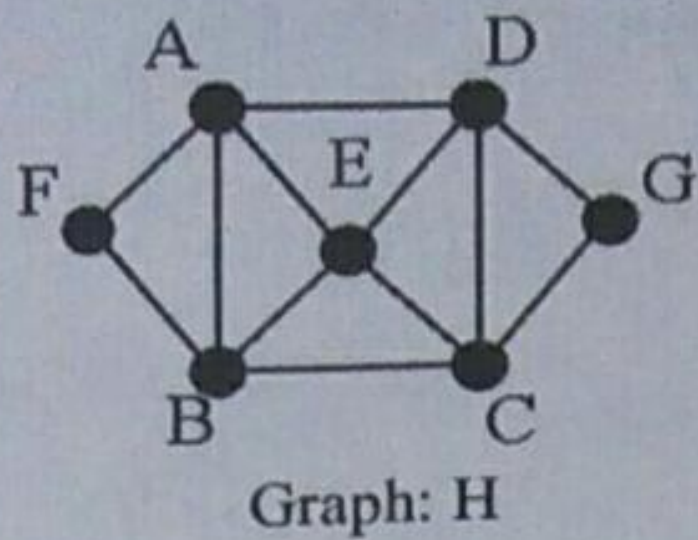
Q.3 Solve Any three of the following.

- A) Explain the pigeonhole principle with example. 4M
- 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? 4M
- C) What is the expansion of $(3x + y)^4$? 4M
- 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 $n = 2, 3, 4, \dots$ 4M

Q.4 Solve the following.

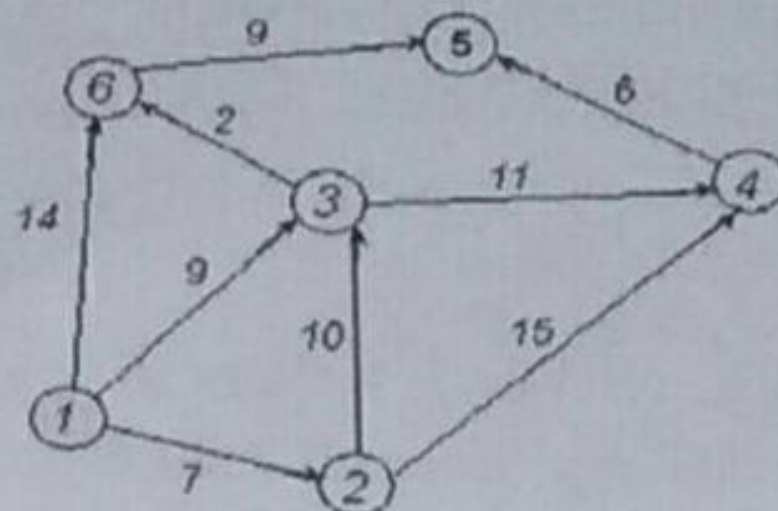
- A) Define Euler graph and Hamiltonian Graph. 6M
- i) For a given graph G :
- (a) Find a Hamiltonian path that begins at A and ends at E.
- (b) Find a Hamiltonian circuit that starts at A and ends with the pair of vertices E, A.
- (c) Find a Hamiltonian path that begins at F and ends at G.
- ii) For a given graph I find Eulerian path and Eulerian cycle.

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

6M



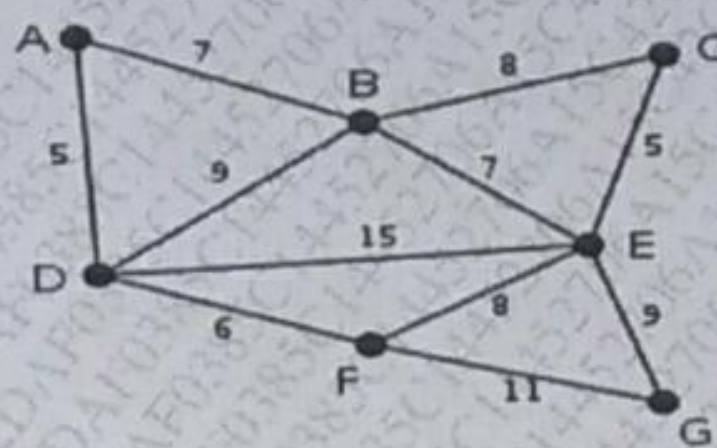
Q. 5 Solve Any three of the following.

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

4M

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

4M



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

4M

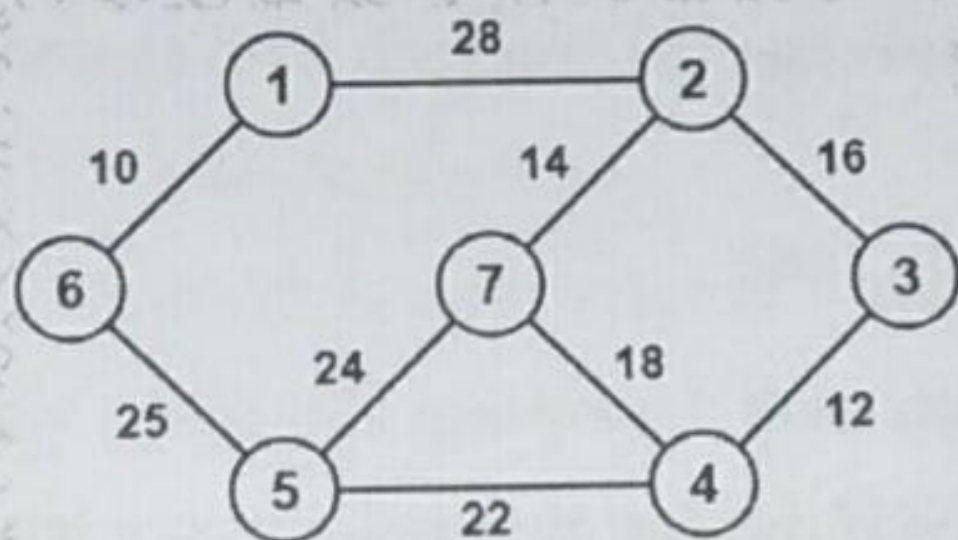
i) Level and Height of a tree

ii) M-ary Tree

iii) Eccentricity of a vertex

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

4M



Q. 6 Solve the following.

6M

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?

6M

i) \mathbb{N} is the set of natural numbers and $a * b = a + b + 2$ for $a, b \in \mathbb{N}$

ii) On \mathbb{N} where $a * b = \min(a, b+2)$

iii) On \mathbb{R} where $a * b = a^b$

*** End ***

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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/ CO)	Marks
Q.1 Solve Any Three of the following.		
A) Among integers 1 to 1000,	Application	4
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,	Application	4
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 $(p \wedge q) \vee (\sim p \wedge q \wedge r)$	understand	4
ii. Obtain the Disjunctive Normal Form of $(p \wedge q) \vee (\sim p \wedge q \wedge r)$		
D) Transcribe the following into logical notation. Let the universe of discourse be the real numbers.	understand	4
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.		
Q.2 Solve Any Two of the following.		
A) $X = \{2, 3, 6, 12, 24, 36\}$ R on $X = \{(x, y) \in R, x \text{ divides } y\}$	Synthesis	6
(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:	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 .

understand 6

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 $a_1 = 7$,

Application 6

- (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

Understand 6

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

with initial conditions

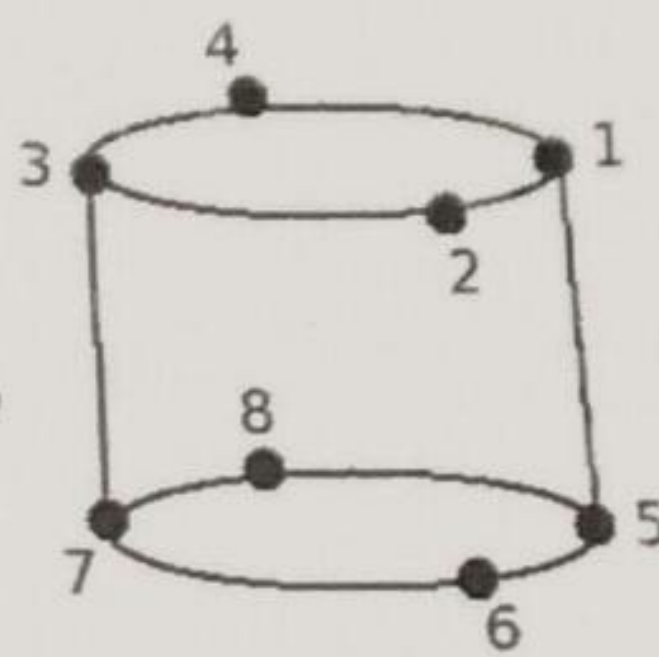
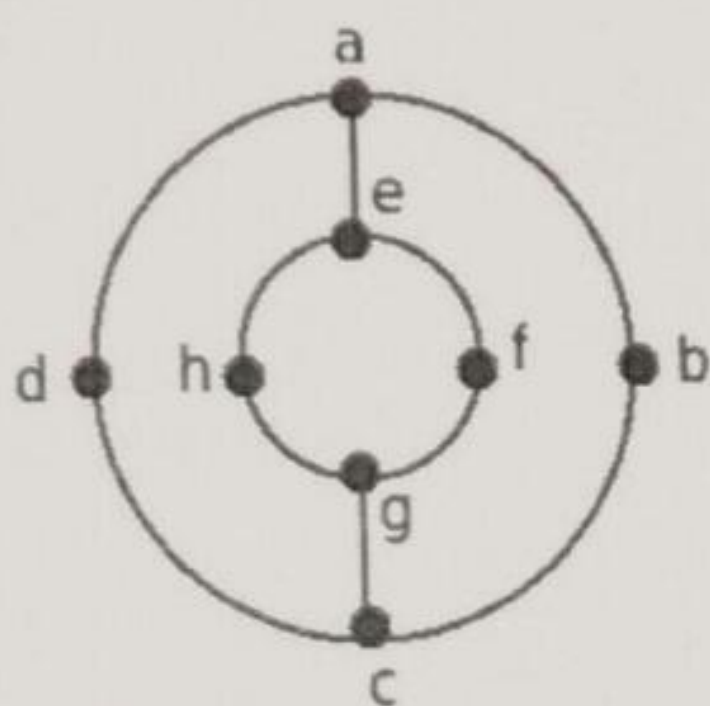
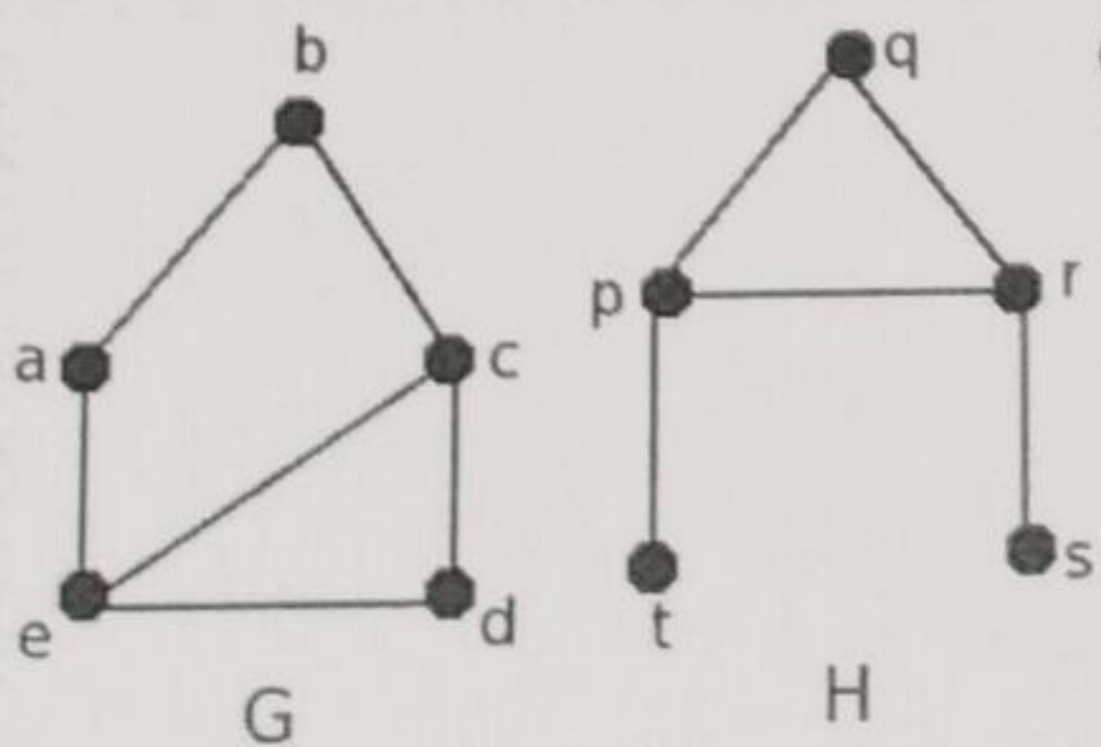
ENGG SOLUTION

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

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)

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

Understand 6

(b) Define the following terms:

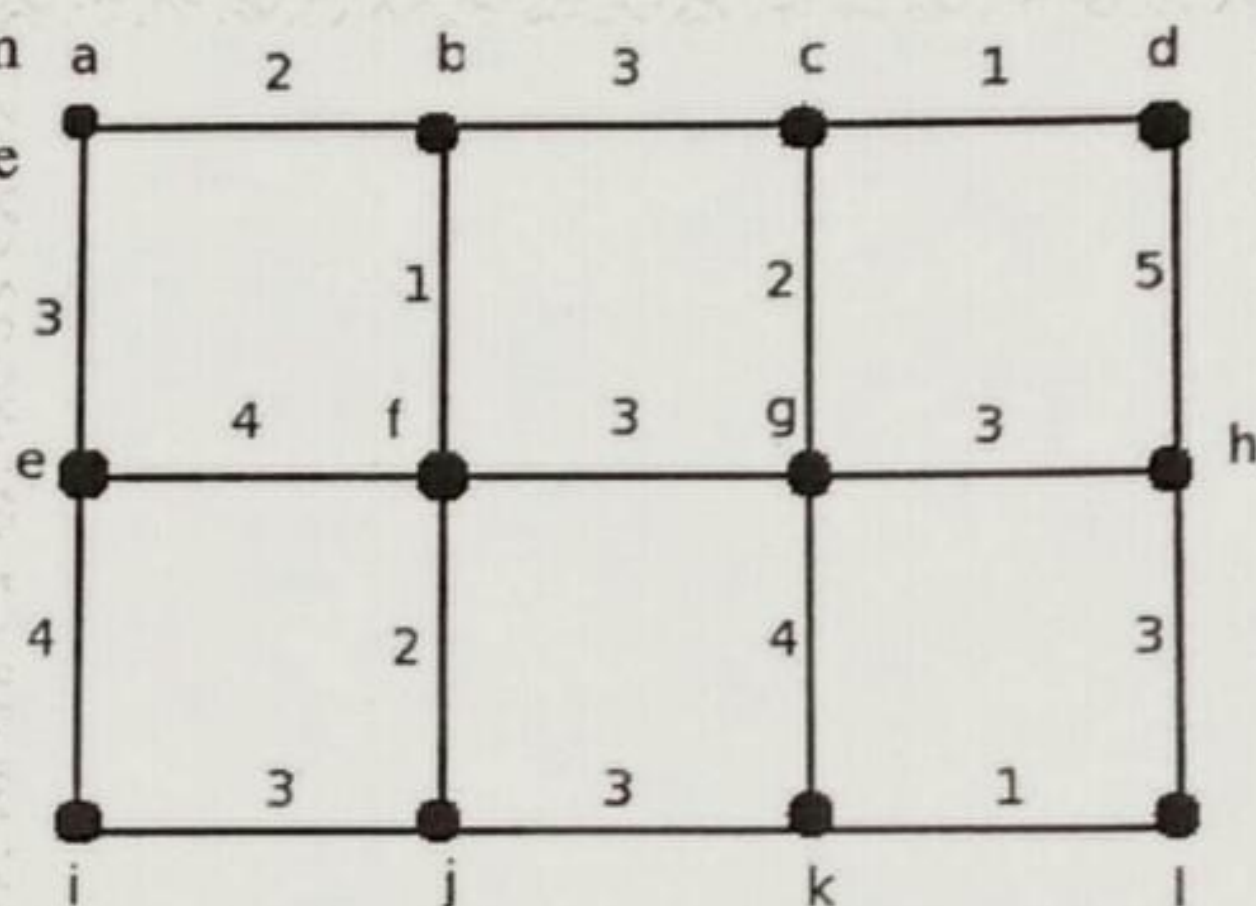
- (i) Planar Graph (ii) Bipartite Graph (iii) Complete graph

(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 $q \leq 3p - 6$. 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.

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

Application 6

Q.6 Solve the following.

A) Define the following terminology:

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

Knowledge 6

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 -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.

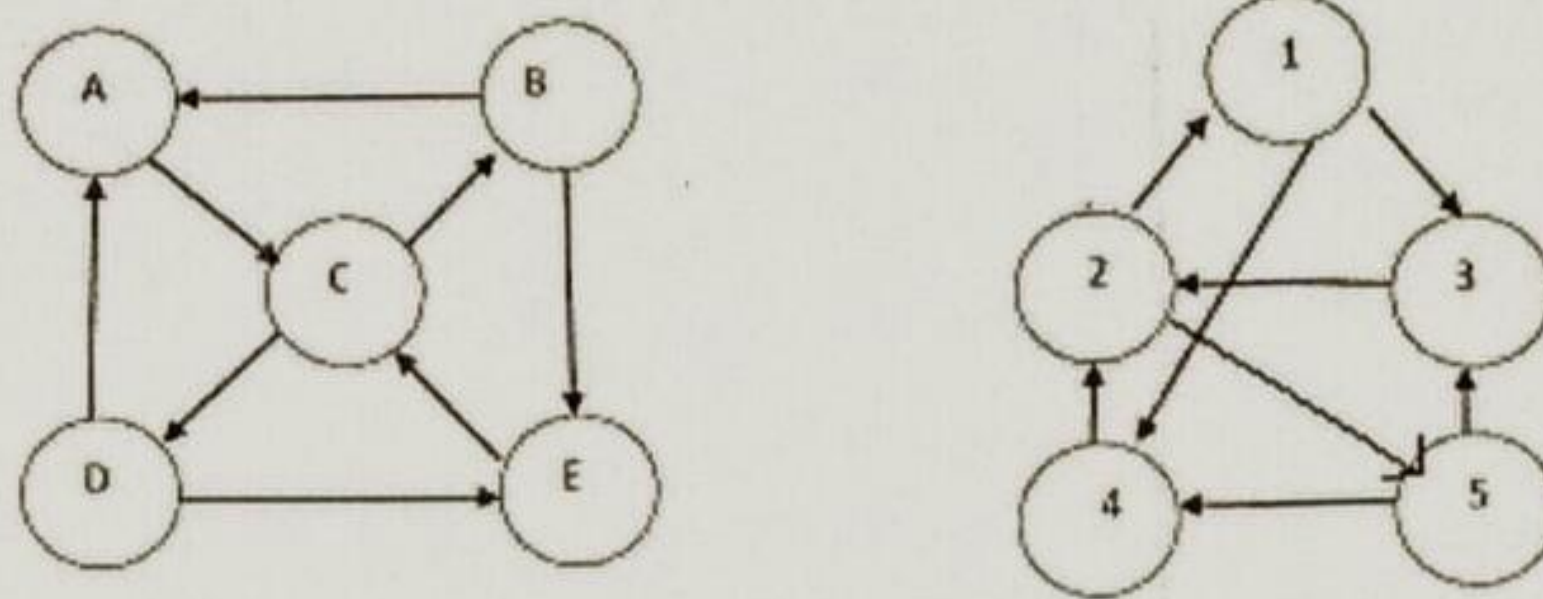
Instructions to the Students

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

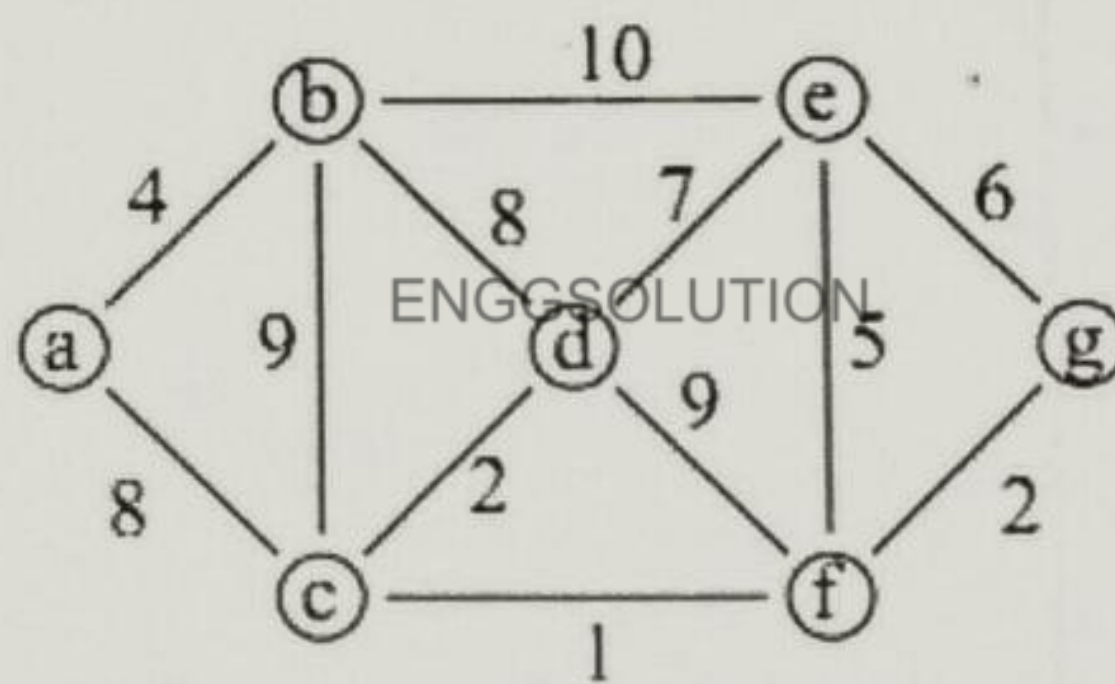
Q.4. a) (i) Show that the maximum number of edges in a simple graph having n vertices is $n * (n-1) / 2$. (6)

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. 32, 56, 47, 28, 30, 45, 15, 72, 25 (6)

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



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 $a * b = (a + b) \text{ mod } 4$. Find $\forall a \in A, a^2, a^3, a^4$. (6)

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

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

Course: (II nd Year)B. Tech.

Branch : Information Technology

Semester :IV

Subject Code & Name: BTITC403 & Discrete Mathematics

Max Marks: 60

Date: 18/08/2022

Duration: 3.45 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.

Q.1 Solve Any Two of the following.

(Level/CO)

A) Define with example with suitable examples

- i) Subsets ii) Power set iii) NULL Set iv) Universal set.

6

B) Draw the Venn diagrams for each of these combinations of the sets A, B, and C.

6

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

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

c) $(A \cap \overline{B}) \cup (A \cap \overline{C})$

C) In a class of 55 students, the number of students studying different subjects are 23 in Mathematics and 24 in Physics, 19 in Chemistry, 12 in Mathematics and Physics, 9 in Mathematics and Chemistry, 7 in Physics and Chemistry and 4 in all the three subjects, Find the number of students who have taken exactly one subject?

6

Q.2 Solve Any Two of the following.

A) Let g be the function from the set {a, b, c} to itself such that $g(a) = b$, $g(b) = c$, and $g(c) = a$. Let f be the function from the set {a, b, c} to the set {1, 2, 3} such that $f(a) = 3$, $f(b) = 2$, and $f(c) = 1$. What is the composition of f and g, and what is the composition of g and f?

6

B) Let $X = \{x, y, z, k\}$ and $Y = \{1, 2, 3, 4\}$. Determine which of the following are functions. Give reasons if it is not. Find range if it is a function.

6

1. $f = \{(x, 1), (y, 2), (z, 3), (k, 4)\}$

2. $g = \{(x, 1), (y, 1), (k, 4)\}$

3. $h = \{(x, 1), (x, 2), (x, 3), (x, 4)\}$

4. $d = \{(x, 1), (y, 2), (y, 3), (z, 4), (z, 4)\}$

C) Two mathematics papers & 5 other papers are to be arranged at an examination

6

Find the total no of ways if Math papers are consecutive.

Q.3 Solve Any Two of the following.

- A) Define with example: 1. Injective(one-to-one) function 2. Surjective(Onto) function 3. Bijective(one-to-one onto) function
- B) Find the number of distinct permutations that can be formed from all the letters of each word. I) RADAR II) UNUSUAL III) COMBINATION IV) BANANA
- C) Prove using mathematical induction that for all $n \geq 1$,
 $1 + 4 + 7 + \dots + (3n - 2) = n(3n - 1) / 2$

Q.4 Solve Any Two of the following.

- A) Define i) Integral Domain ii) Commutative Ring with unity iii) Field
- B) Consider these relations on the set of integers:

$$R1 = \{ (a,b) \mid a \leq b \}$$

$$R2 = \{ (a,b) \mid a > b \}$$

$$R3 = \{ (a,b) \mid a = b \text{ or } a = -b \}$$

$$R4 = \{ (a,b) \mid a = b \}$$

$$R5 = \{ (a,b) \mid a = b + 1 \}$$

$$R6 = \{ (a,b) \mid a + b \leq 3 \}$$

Which of these relations are transitive? ENGG SOLUTION

- C) Explain applications of database and relations?

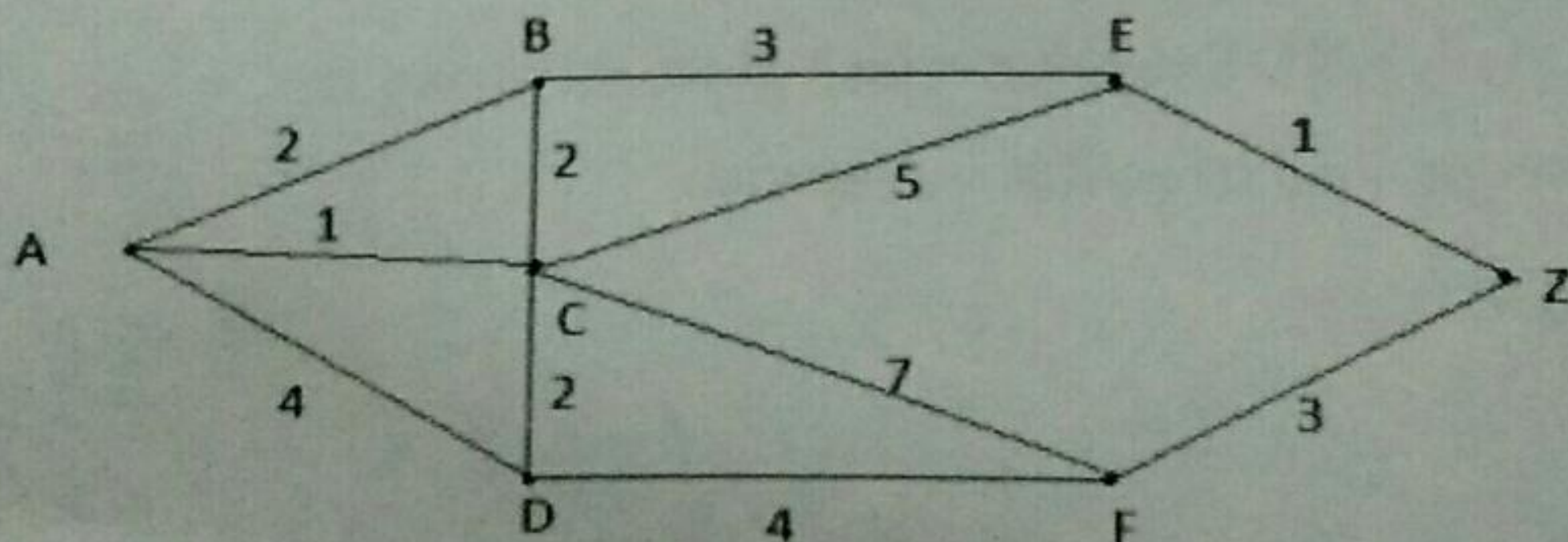
Q.5 Solve Any two of the following.

- A) Define with example: 1. Null Graph 2. Undirected Graph 3. Multigraph

- B) Draw Binary Search Tree for input data 3, 1, 4, 6, 9, 2, 5, 7

List out a root node, leaf nodes and interior nodes.

- C) Apply Dijkstra's shortest path algorithm to find shortest path between vertices a and z in following graph.



*** End ***