UNIT – IV

8. (a) Let R be the relation on the set of ordered pairs of positive integers such that $((a, b), (c, d)) \in R$ if and only if $a + d = b + c$. Show that R is an equivalence relation. (6M) CO4

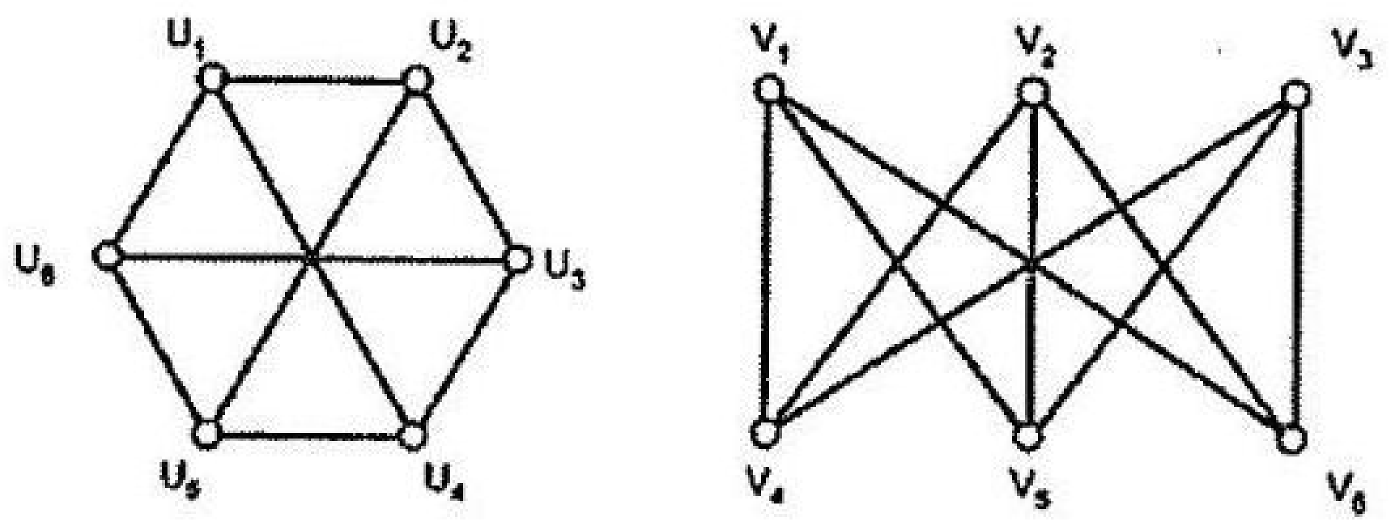
(b) Draw the Hasse diagram representing the partial ordering. (6M) CO4

(i) $\{(a, b) \mid a \text{ divides } b\}$ on $\{1, 2, 3, 4, 6, 8, 12\}$.

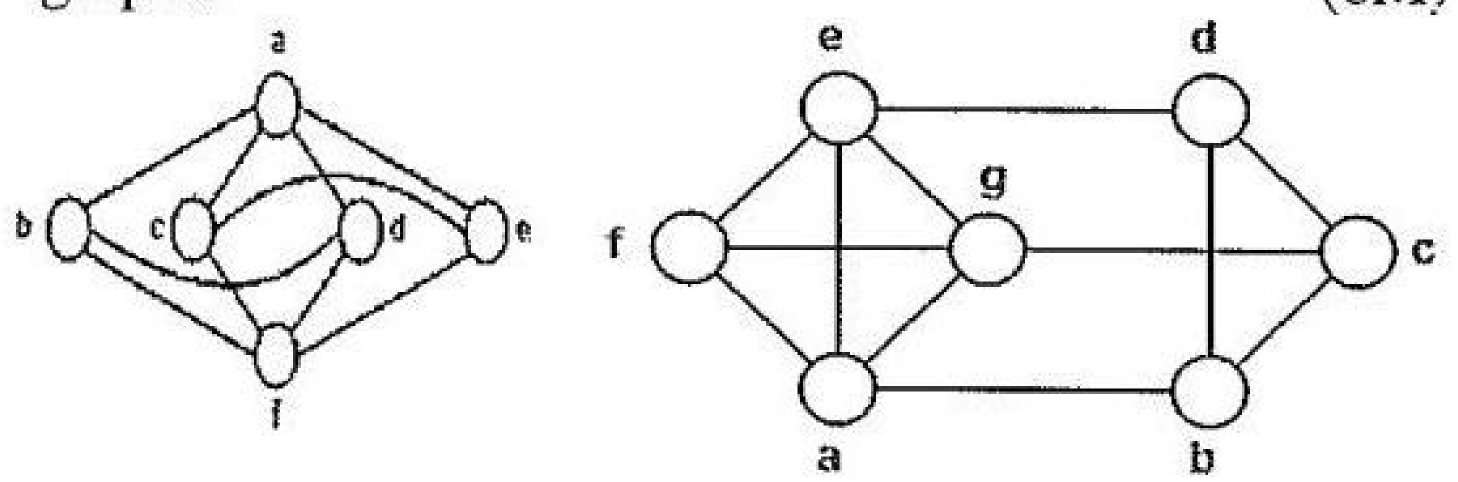
(ii) $\{(A,B) \mid A \subseteq B\}$ on the power set $P(S)$ where $S = \{a, b, c\}$.

(OR)

9. (a) Determine whether the graphs are isomorphic or not. (6M) CO4



(b) Find the chromatic number of the following graphs. (6M) CO4



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CS/IT214(R18)

Hall Ticket Number:

CS/IT214(R18)

B.TECH. DEGREE EXAMINATION, DECEMBER-2020

Semester III [Second Year] (Regular & Supplementary)

DISCRETE MATHEMATICS

Time: Three hours Maximum Marks: 60

Answer Question No.1 compulsorily. (12 x 1 = 12)
Answer One Question from each unit. (4 x 12 = 48)

1. Answer the following:

(a) Let $Q(x, y)$ denote the statement "$x = y + 3$". What are the truth values of the propositions $Q(1, 2)$ and $Q(3, 0)$? CO1

(b) Write the power set for $A = \{1, 2, 3\}$. CO1

(c) Simplify $(A\text{-}A') \cup (A'\text{-}A)$. CO1

(d) A pair of dice is rolled once. How many possible outcomes are there? CO2

(e) Define pigeonhole principle. CO2

(f) Define permutation. CO2

(g) Define inclusion-exclusion principle. CO3

(h) Define anti-symmetric relation. CO3

(i) Let R be a relation on set $\{1, 2, 3, 4\}$ with $R=\{(1,1), (1,4), (2,3), (3,1), (3,4)\}$. Find the reflexive closure of R. CO3

(j) Let R be an equivalence relations on the set $A = \{4, 5, 6, 7\}$ defined by $R = \{(4, 4), (5, 5), (6, 6), (7, 7), (4, 6), (6, 4)\}$. Determine its equivalence classes. CO4

(k) Define isomorphism. CO4

(l) Define multi-graph. CO4

UNIT – I

2. (a) Show that $(p\wedge(\sim p \vee q)) \vee (q \sim (p \wedge q)) = q$. (6M) CO1

   (b) Consider the following statements in which the first three are premises and the fourth is a valid conclusion. (6M) CO1

   (i) "All hummingbirds are richly colored."

   (ii) "No large birds live on honey."

   (iii) "Birds that do not live on honey are dull in color."

   (iv) "Humming birds are small."

(OR)

3. (a) Show that the premises "If you send me an e-mail message, then I will finish writing the program," "If you do not send me an e-mail message, then I will go to sleep early," and "If I go to sleep early, then I will wake up feeling refreshed" lead to the conclusion "If I do not finish writing the program, then I will wake up feeling refreshed." (6M) CO1

   (b) How can we produce the terms of a sequence if the first 10 terms are 5, 11, 17, 23, 29, 35, 41, 47, 53, 59? (6M) CO1

UNIT – II

4. (a) Prove that for every positive integer n, $1 \cdot 2 \cdot 3 + 2 \cdot 3 \cdot 4 + \cdots + n(n+1)(n+2) = n(n+1)(n+2)(n+3)/4$. (6M) CO2

   (b) Give a recursive algorithm for computing the greatest common divisor of two nonnegative integers a and b with $a < b$. (6M) CO2

(OR)

5. (a) Suppose that a saleswoman has to visit eight different cities. She must begin her trip in a specified city, but she can visit the other seven cities in any order she wishes. How many possible orders can the saleswoman use when visiting these cities? (6M) CO2

   (b) The English alphabet contains 21 consonants and five vowels. How many strings of six lowercase letters of the English alphabet contain. (6M) CO2

   (i) exactly one vowel?

   (ii) exactly two vowels?

   (iii) at least one vowel?

UNIT – III

6. (a) What is the solution of the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2$ and $a_1 = 7$? (6M) CO3

   (b) There are 345 students at a college who have taken a course in calculus, 212 who have taken a course in discrete mathematics, and 188 who have taken courses in both calculus and discrete mathematics. How many students have taken a course in either calculus or discrete mathematics? (6M) CO3

(OR)

7. (a) The relation R on a set A is transitive if and only if $R^n \subseteq R$ for n = 1, 2, 3, ... (6M) CO3

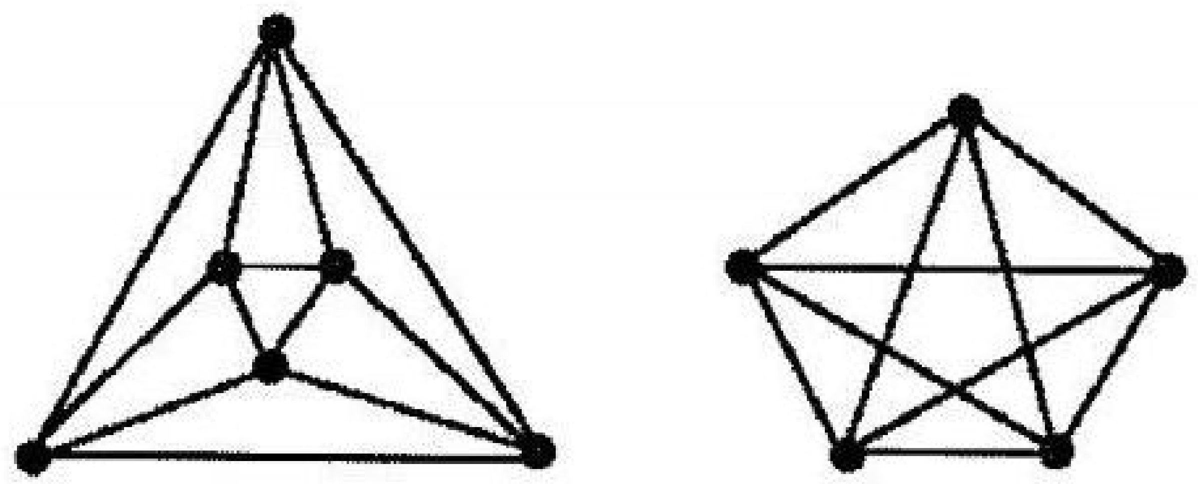
   (b) Find the zero–one matrix of the transitive closure of the relation R where (6M) CO3

$$M_R = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 0 \end{pmatrix}$$

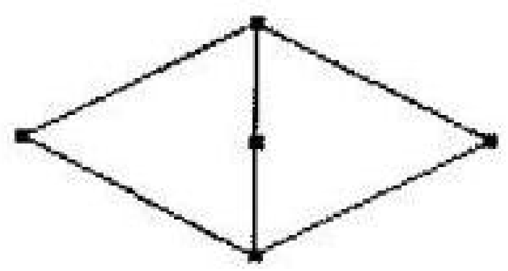
(b) Let R be the relation on the set of real numbers such that aRb if and only if $a - b$ is an integer. Is R an equivalence relation? (6M) CO4

(OR)

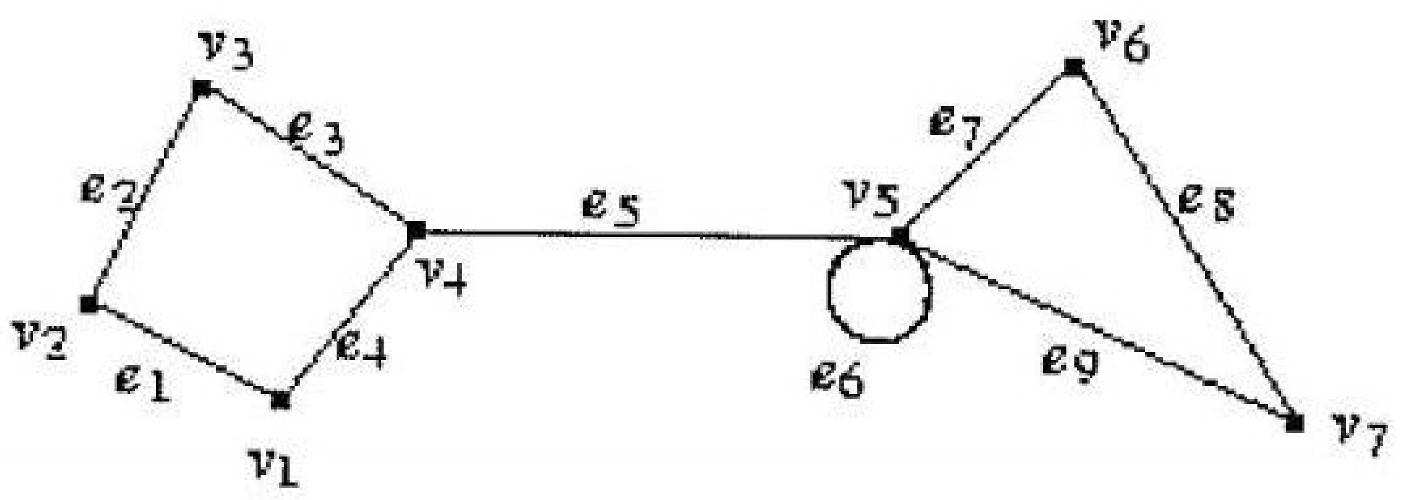
9\. (a) Check whether the following graphs contain Hamiltonian cycle. (6M) CO4



(b) (i) Check whether graph has Euler path and circuit. (6M) CO4



(ii) Find an Euler path for the graph G below:



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Hall Ticket Number:

CS/IT214(R18)

B.TECH. DEGREE EXAMINATION, MARCH-2021

Semester III [Second Year] (Regular & Supplementary)

DISCRETE MATHEMATICS

Time: Three hours Maximum Marks: 60

Answer Question No.1 compulsorily. (12 x 1 = 12)
Answer One Question from each unit. (4 x 12 = 48)

1\. Answer the following:

(a) What is the contra positive of the conditional statement "The home team wins whenever it is raining"? CO1

(b) How can this English sentence be translated into a logical expression?
"You cannot ride the roller coaster if you are under 4 feet tall unless you are older than 16 years old. CO1

(c) Define cardinality of set. CO1

(d) Define recursive algorithm. CO2

(e) List all the combinations of $\{a, b, c\}$. CO2

(f) How many different strings can be made from the letters in *MISSISSIPPI*, using all the letters? CO2

(g) Define recurrence relation. CO3

(h) Let A be the set $\{1, 2, 3, 4\}$. Which ordered pairs are in the relation $R = \{(a, b) \mid a \text{ divides } b\}$? CO3

(i) Define symmetric closure. CO3

(j) Check whether the relation R={(0, 0), (0, 2), (2, 0), (2, 2), (2, 3), (3, 2), (3, 3)} is an equivalence relation? CO4

(k) Define simple graph. CO4

(l) Define connected graph. CO4

UNIT – I

2\. (a) Determine whether $(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$ is a tautology. (6M) CO1

(b) Show that 't' is a valid conclusion from the premises. $p \to q$, $q \to r$, $r \to s$, $\sim s$ and $p \vee t$. (6M) CO1

(OR)

3. (a) Use rules of inference to show that the hypotheses "Randy works hard," "If Randy works hard, then he is a dull boy," and "If Randy is a dull boy, then he will not get the job" imply the conclusion "Randy will not get the job." (6M) CO1

(b) Give a proof by contradiction of the theorem "If $3n + 2$ is odd, then n is odd." (6M) CO1

UNIT – II

4. (a) Use mathematical induction to prove that $7^{n+2} + 8^{2n+1}$ is divisible by 57 for every non negative integer n. (6M) CO2

(b) How many positive integers between 1000 and 9999 inclusive

i) are divisible by 9?

ii) are even?

iii) are not divisible by 3? (6M) CO2

(OR)

5. (a) The chairs of an auditorium are to be labeled with an uppercase English letter followed by a positive integer not exceeding 100. What is the largest number of chairs that can be labeled differently? (6M) CO2

(b) Suppose that there are 9 faculty members in the mathematics department and 11 in the computer science department. How many ways are there to select a committee to develop a discrete mathematics course at a school if the committee is to consist of three faculty members from the mathematics department and four from the computer science department? (6M) CO2

UNIT – III

6. (a) Suppose that there are 1807 freshmen at your school. Of these, 453 are taking a course in computer science, 567 are taking a course in mathematics, and 299 are taking courses in both computer science and mathematics. How many are not taking a course either in computer science or in mathematics? (6M) CO3

(b) In how many different ways can eight identical cookies be distributed among three distinct children if each child receives at least two cookies and no more than four cookies by using generating functions? (6M) CO3

(OR)

7. (a) Let R_1 and R_2 be relations on a set A represented by the matrices

$$M_{R1} = \begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix} \quad M_{R2} = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix}$$

Find the matrices that represent

(i) $R_1 \cup R_2$ (ii) $R_1 \cap R_2$ (iii) $R_2 \circ R_1$ (6M) CO3

(b) Let R_1 and R_2 be the "divides" and "is a multiple of" relations on the set of all positive integers, respectively. That is, $R_1 = \{(a, b) \mid a$ divides $b\}$ and $R_2 = \{(a, b) \mid a$ is a multiple of $b\}$. Find (i) $R_1 \cup R_2$ (ii) $R_1 \cap R_2$ (iii) $R_1 - R_2$. (6M) CO3

UNIT – IV

8. (a) Determine whether the following posets are lattices.

(i) $(\{1, 2, 3, 4, 5\}, |)$ (ii) $(\{1, 2, 4, 8, 16\}, |)$ (6M) CO4

(b) Define Eulerian and Hamiltonian graph. Give examples of graph that is (6M)

(i) Eulerian but not Hamiltonian

(ii) Hamiltonian but not Eulerian

(iii) Eulerian as well as Hamiltonian.

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L1B

Hall Ticket Number:

CS/IT214(R18)

B.TECH. DEGREE EXAMINATION, FEBRUARY-2020

Semester III [Second Year] (Supplementary)

DISCRETE MATHEMATICS

Time: Three hours Maximum Marks: 60

Answer Question No.1 compulsorily. (12 x 1 = 12)
Answer One Question from each unit. (4 x 12 = 48)

1. Answer the following:
   (a) Define contrapositive statement.
   (b) Define Modus Tollens.
   (c) Define Venn diagram with the help of an example.
   (d) How many different bit (0 or 1) strings of length seven are there?
   (e) Write a recursive algorithm for finding the sum of first n positive integers.
   (f) State Pigeonhole principle.
   (g) State the principle of inclusion and exclusion for finite sets A_1, A_2 and A_3.
   (h) Define divide-and-conquer recurrence relation.
   (i) Define Antisymmetric relation with example.
   (j) Define Equivalence relation.
   (k) Define Graph isomorphism.
   (l) Define Planar graph.

UNIT – I

2. (a) Check whether $(p \wedge (\neg p \vee q)) \wedge \neg q$ is a tautology or contradiction. (6M)
   (b) Let A = {1, 2, 3, 4, 5} and B = {0, 3, 6}. Find (i) $A \cup B$ (ii) $A \cap B$ (iii) $A - B$ (iv) $B - A$. (6M)

(OR)

3. (a) Using rule of inferences show that the premises "If you send me an e-mail message, then I will finish writing the program," "If you do not send me an e-mail message, then I will go to sleep early" and "If I go to sleep early, then I will wake up feeling refreshed" lead to the conclusion "If I do not finish writing the program, then I will wake up feeling refreshed". (6M)

(b) Conjecture a simple formula for a_n if the first 10 terms are (6M)

(i) 5, 11, 17, 23, 29, 35, 41, 47, 53, 59.

(ii) 1, 2, 2, 3, 4, 4, 5, 6, 6, 7, 8, 8.

UNIT – II

4. (a) Prove by the principle of mathematical induction to verify that "2 divides $n^2 + n$ whenever n is a positive integer". (6M)

(b) Show that if there are 30 students in a class, then at least two have last names that begin with the same letter. (6M)

(OR)

5. (a) Show that if n is an integer greater than 1, then n can be written as the product of primes. (6M)

(b) How many different ways are there to put five temporary employees into four identical offices? (6M)

UNIT – III

6. (a) What is the solution of recurrence relation $a_n = 7a_{n-1} - 10a_{n-2}$ with initial conditions $n \geq 0$, $a_0 = 2$ and $a_1 = 1$. (6M)

(b) Let A = {1, 2, 3}, B = {a, b, c} and C = {x, y, z}. Consider the relations R and S from A to B and from B to C, respectively, as R = {(1, b), (2, a), (2, c)} and S = {(a, y), (b, = z), (c, y), (c, z)}. Find the matrices M_R, M_{R^2}, M_{RoS} of the respective relation R, R^2 and R o S. (6M)

(OR)

7. (a) In how many ways can eight identical cookies be distributed among three distinct children if each child receives at least two cookies and not more than four cookies? (6M)

(b) Let R be the relation from a set A to B. Let R = {(a, b)|`a divides b' on the set of positive integers. Determine whether R is symmetric, antisymmetric or transitive. Find the inverse relation R^{-1} and the complementary relation $\overline{R}$. (6M)

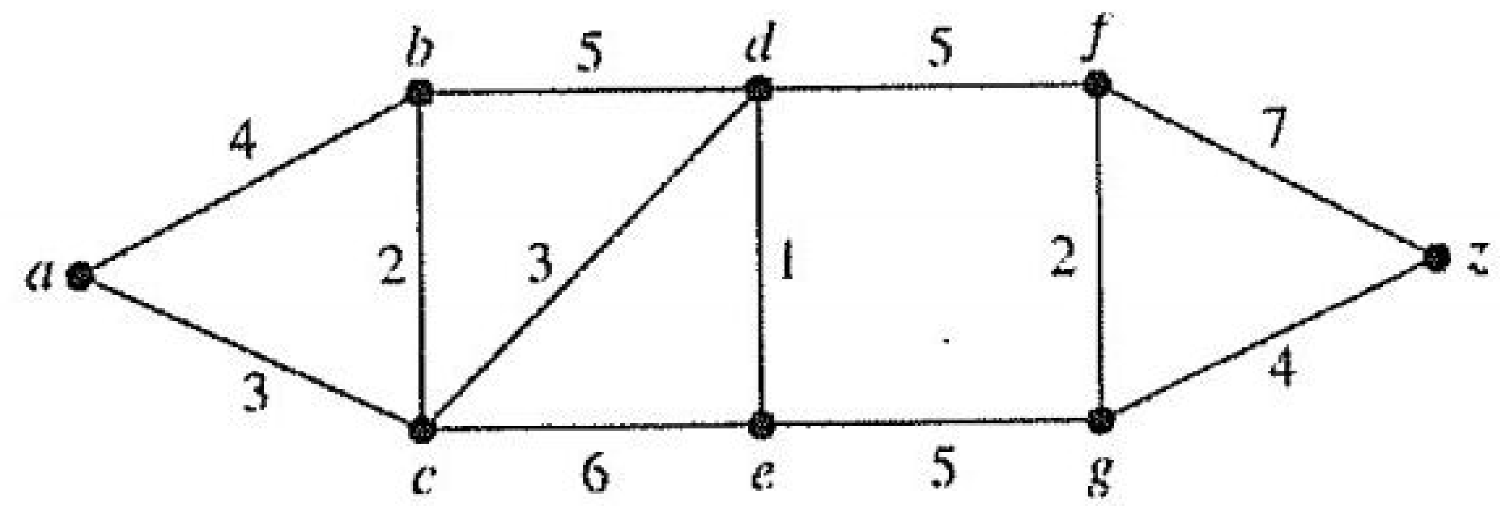
UNIT – IV

8. (a) Define a relation ≡ on integers by a ≡ b if a − b is a multiple of a fixed positive integers n. (6M)

(i) Prove that it is an equivalence relation

(ii) Describe equivalence class [0]

(b) Find the shortest path between a to z for the given weighted graph. (6M)



(OR)

9. (a) Let R be the relation on the set of people such that x R y if z and y are people and z is older than y. Show that R is not a partial ordering. (6M)

Hall Ticket Number:

CS/IT214(R18)

B.TECH. DEGREE EXAMINATION, OCTOBER-2019

Semester III [Second Year]

DISCRETE MATHEMATICS

Time: Three hours Maximum Marks: 60

Answer Question No.1 compulsorily. (12 x 1 = 12)
Answer One Question from each unit. (4 x 12 = 48)

1. Answer the following in brief:
   (a) Implication.
   (b) Modus Ponens.
   (c) Draw Venn diagram of $A \cap B^c$.
   (d) How many different permutations are there of the set {a, b, c, d, e, f, g}?
   (e) Write a recursive algorithm for computing a^n, where a is a nonzero real number and 'n' is a nonnegative integer.
   (f) Pigeonhole principle.
   (g) How many elements are in $A_1 \cup A_2$ if $|A_1|=12$, $|A_2|=18$ and $A_1 \subseteq A_2$?
   (h) Divide-and-conquer recurrence relation.
   (i) Transitive relation with an example.
   (j) Partial ordering.
   (k) Bipartite graphs.
   (l) Planar graph.

UNIT – I

2. (a) Show that $[(p \vee q) \wedge (q \rightarrow r)] \rightarrow r$ is a tautology. (6M)
   (b) Let A = {a, b, c, d, e} and B = {a, b, c, d, e, f, g, h}. Find (i) $A \cup B$ (ii) $A \cap B$ (iii) A – B (iv) B – A (6M)

(OR)

3. (a) Show that the premises "A student in this class has not read the book", and "Everyone in this class passed the first exam", Imply the conclusion "Someone who passed the first exam has not read the book". (6M)

(b) Conjecture a simple formula for a_n if the first 10 terms are (6M)

(i) 1, 3, 4, 7, 11, 18, 29, 47, 76, 123

(ii) 1, 2, 2, 3, 4, 4, 5, 6, 6, 7, 8, 8

UNIT – II

4. (a) Prove by the principle of mathematical induction to verify that '5 divides $n^5 - n$ whenever n is a non-negative integer'. (6M)

(b) Show that among any group of five integers there are two with the same remainder when divided by 4. (6M)

(OR)

5. (a) Show that if n is an integer greater than 1, then n can be written as the product of primes. (6M)

(b) How many different strings can be made from the letters AARDVARK using all the letters if all three A's must be consecutive? (6M)

UNIT – III

6. (a) What is the solution of recurrence relation $a_{n+2} = -4a_{n+1} + 5a_n$ with initial conditions $n \geq 0$, $a_0 = 2$, $a_1 = 8$. (6M)

(b) Let A = {1, 2, 3}, B = {a, b, c} and C = {x, y, z}. Consider the relations R and S from A to B and from B to C, respectively, as R = {(1, b), (2, a), (2, c)} and S = P{(a, y), (b, x), (c, y), (c, z)}. Find the matrices M_R, M_{R^2}, $M_{R\circ S}$ of the respective relation R, R^2 and R o S. (6M)

(OR)

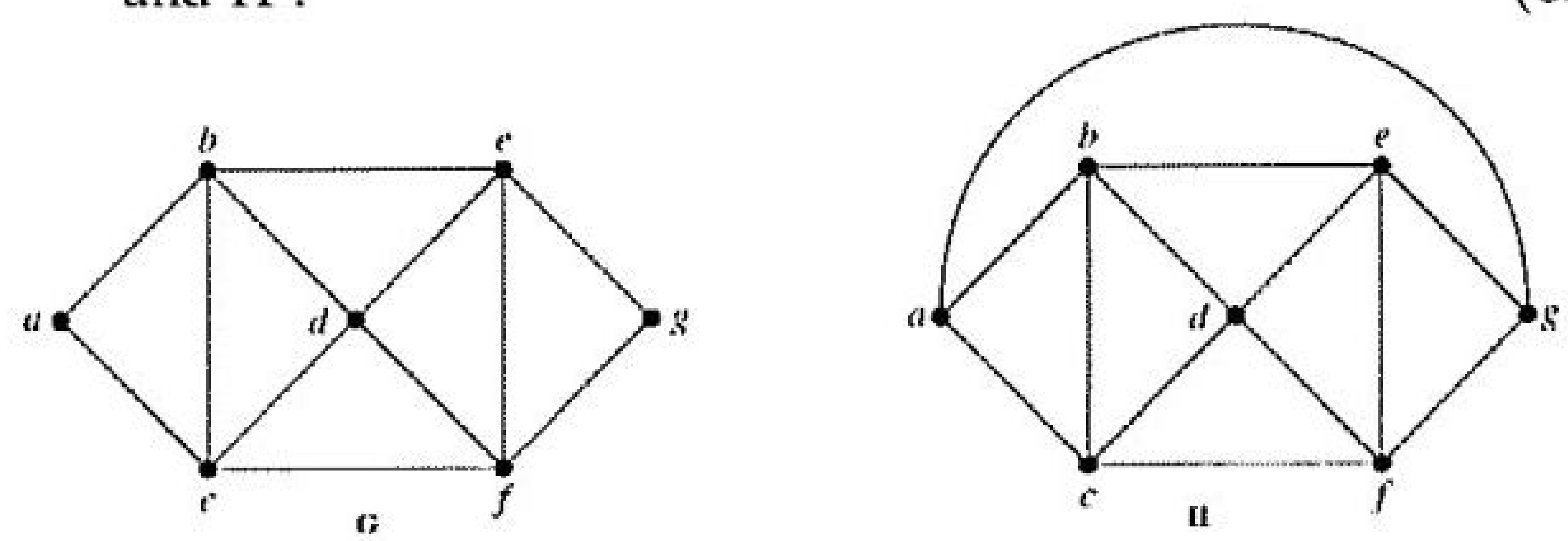
7. (a) How many positive integers not exceeding 1000 are divisible by 7 or 11? (6M)

(b) Let R be the relation on A = {1, 2, 3, 4} where R = {(1, 3), (1, 4), (3, 2), (3, 3), (3, 4)}. Determine whether R is symmetric, antisymmetric or transitive. Find symmetric and reflexive closures of R. (6M)

UNIT – IV

8. (a) Consider the set Z of integers. Define aRb by $b = a^r$ for some positive integer r. Show that R is a partial order on Z. (6M)

(b) What is the chromatic number of the below graphs G and H? (6M)



(OR)

9. (a) What are the sets in the partition of the integers arising from congruence modulo 5? (6M)

(b) Answer the following: (6M)

(i) Define the degree of a vertex in an undirected graph.

(ii) How many edges are there in a graph with 10 vertices each of degree six?

(iii) Can a simple graph exist with 15 vertices each of degree five?

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