Code: 9A05301

R09

B.Tech II Year I Semester (R09) Supplementary Examinations June 2017

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Common to CSS, IT & CSE)

Time: 3 hours | Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1 (a) Construct the truth table for the formula
$\sim (p \vee (q \wedge r)) \leftrightarrow ((p \vee q) \wedge (p \vee r))$

(b) Prove by contradiction
$\sim p \leftrightarrow q$, $q \rightarrow r$, $\sim r$, therefore p

2 Show that:
For all (x) (p(x) v q (x)) ➔ for all (x) p(x) v there exists x q(x)
By indirect method of proof.

3 Let (L,≤) be a lattice for any a, b, c ∈ L show that:
$b \le c \Rightarrow a * b \le a * c$ &
$b \le c \Rightarrow a ® b \le a ® c$

4 (a) Let G be the set of all non-zero real numbers and let a * b = ½ ab. Show that <G,*> is an abelian group.

(b) Prove for any elements a,b in a group G, we have:
(i) $(a^{-1})^{-1} = a$
(ii) $(ab)^{-1} = b^{-1}a^{-1}$

5 (a) Solve the recurrence relation using characteristic roots $a_n - 5a_{n-10} + 8a_{n-2} = 3^n$, for $n \ge 2$.

(b) Find the coefficient of x^5 in $(1-4x)^{-7}$.

6 A farmer buys 3 cows, 8 buffalos and 12 chickens from a man who has 9 cows, 25 buffalos and 100 chickens. How many choices does the farmer have?

7 (a) Explain the adjacency matrix representation of a graph with an example.

(b) Prove that a connected graph of n vertices and m edges has n-1 branches and m-n+1 chord.

8 (a) Prove that for any graph *G*, the sum of the degrees of the vertices of *G* is twice the number of edges.

(b) Find the number of simple graphs up to 3 nodes.

(c) Prove that all planar graphs are 5-colourable.

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Code: 13A05302 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations June 2017

DISCRETE MATHEMATICS

(Common to CSE and IT)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Use a Venn diagram to illustrate the set of all months of the year whose names do not contain the letter R.

(b) Use set builder notation to give a description of any two of these sets.
 (i) {0, 3, 6, 9, 12}
 (ii) {−3,−2,−1, 0, 1, 2, 3}
 (iii) {m, n, o, p}

(c) Given the relation R={(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)} ,decide whether it is reflexive or symmetric or anti-symmetric or transitive.

(d) Translate the logical equivalence $(T \wedge T) \vee \neg F \equiv T$ into an identity in Boolean algebra.

(e) How many ways are there to select five players from a 10-member tennis team to make a trip to a match at another school?

(f) What is the minimum number of students required in a discrete mathematics class to be sure that at least six will receive the same grade, if there are five possible grades, A, B, C, D, and F?

(g) Let R = {(1, 1), (2, 1), (3, 2), (4, 3)}. Find the powers Rn, n = 2, 3, 4, . …

(h) Define multi graph with example.

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

(j) Define minimum spanning tree.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Show that among any 4 numbers one can find 2 numbers so that their difference is divisible by 3. (Avoid considering the cases separately. Use Pigeonhole Principle!).

(b) Show that among any n+1 numbers one can find 2 numbers so that their difference is divisible by n.

OR

3 (a) What is the power set of the set {0, 1, 2}?

(b) What is the power set of the empty set? What is the power set of the set {∅}?

(c) Use a membership table to show that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

UNIT – II

4 Show that in a Boolean algebra, the idempotent laws $x \vee x = x$ and $x \wedge x = x$ hold for every element x.

OR

5 Consider the following relations on {1, 2, 3, 4}:

R_1 = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 4), (4, 1), (4, 4)},
R_2 = {(1, 1), (1, 2), (2, 1)},
R_3 = {(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)},
R_4 = {(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)},
R_5 = {(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)},
R_6 = {(3, 4)}.

Which of these relations are reflexive?

UNIT – III

6 Explain Groups, Subgroups and Normal Subgroups.

OR

7 (a) How many arrangements can be made out of the letters of the word 'ENGINEERING'?

(b) 25 buses are running between two places P and Q. In how many ways can a person go from P to Q and return by a different bus?

Contd. in page 2

UNIT – IV

8 Explain briefly about The Growth functions with example.

OR

9 Explain the following terms with an example:

(a) Generating Functions.

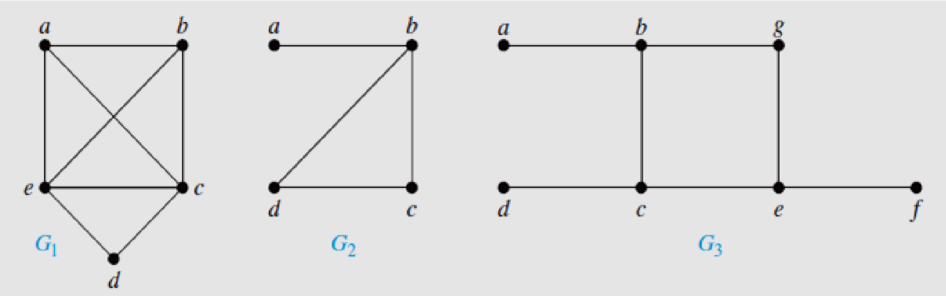
(b) Recursive Algorithms.

(c) Correctness of Recursive Algorithms.

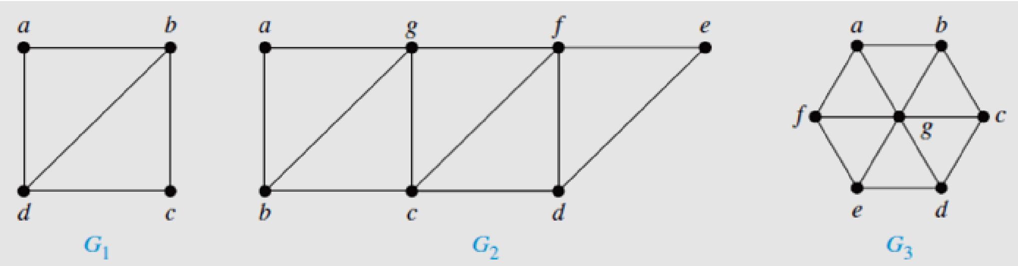
(d) Complexities of Recursive Algorithms.

UNIT – V

10 (a) Which of the following simple graphs in the figure below, have a Hamilton circuit or, if not, a Hamilton path?

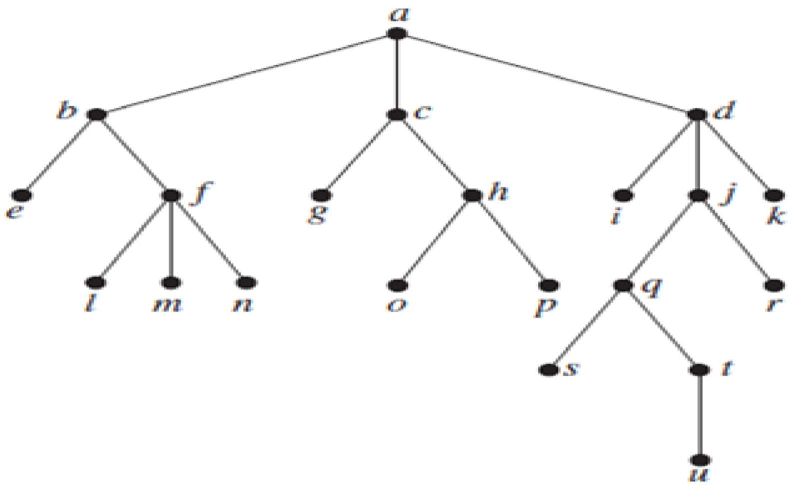


(b) Which graphs shown in Figure have an Euler path?



OR

11 Answer these questions about the rooted tree illustrated.



(i) Which vertex is the root?

(ii) Which vertices are internal

(iii) Which vertices are leaves?

(iv) Which vertices are children of j?

(v) Which vertex is the parent of h?

(vi) Which vertices are siblings of o?

(vii) Which vertices are ancestors of m?

(viii) Which vertices are descendants of b?

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Code: 15A05302 **R15**

B.Tech II Year I Semester (R15) Supplementary Examinations June 2017

DISCRETE MATHEMATICS

(Common to CSE & IT)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is conjunction? Construct the truth table.

(b) Show that the formula $Q \cup (P \cap \sim Q) \cup (\sim P \cap Q)$ is a tautology.

(c) Define functions.

(d) Let $\lfloor\sqrt{x}\rfloor$ be the greatest integer $\leq \sqrt{x}$. Show that $\lfloor\sqrt{x}\rfloor$ is a primitive recursive.

(e) Prove that the minimum weight of the nonzero code words in a group code is equal to its minimum distance.

(f) Prove that Boolean intensity $(a \cap b) \cup (a \cap b') = a$.

(g) Define planar graph.

(h) Mention the importance of graph coloring.

(i) Prove that a tree with $n -$ vertices has precisely $n - 1$ edges.

(j) A label identifier for a computer program consists of one letter followed by three digits. If repetitions are allowed, how many distinct label identifiers are possible.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Construct the truth table for $(P \vee Q) \vee \sim P$.

(b) Demonstrate that R is a valid inference from the premises $P \rightarrow Q, Q \rightarrow R$ and P.

OR

3 Obtain the principal disjunctive normal form of:

(a) $\sim P \vee Q$.

(b) $(P \cap Q) \vee (\sim P \cap R) \vee (Q \cap R)$.

UNIT – II

4 (a) Let Z be the set of integers and let R be the relation called congruence modulo 3 defined by: $R = \{< x, y >/x \in z \cap y \in z \cap (x - y) \text{ is divisible by } 3\}$, determine the equivalence classes generated by the elements of z.

(b) Let $X = \{2, 3, 6, 12, 24, 36\}$ and the relation $\leq$ be such that $x \leq y$ if x divides y. Draw the Hasse diagram of $< x, \leq >$.

OR

5 Let F_x be the set of all one to one, onto mappings from X onto X = {1, 2, 3, 4}. Find all the elements of F_x and find the inverse of each element.

UNIT – III

6 (a) Prove that a subset $S \neq \phi$ of G is a subgroup of $< \mathbf{G}, * >$. If for any pair of elements $a, b \in S, a * b^{-1} \in S$.

(b) Show that every cyclic group of order n is isomorphic to the group $< Z_n, t_n >$.

OR

7 (a) Let $< L, \leq >$ be a lattice in which * and $\oplus$ denote the operations of meet and join respectively. For any $a, b \in L \quad a \leq b = a \Leftrightarrow a \oplus b = b$

(b) In a bounded lattice $< L, *, \oplus, 0.1 >$, an element $b \in L$ is called a complement of an element $a \in L$ if a*b = 0 and $a \oplus b = 1$.

Contd. in page 2

UNIT – IV

8 Explain the merge sort with an example and algorithm.

OR

9 (a) Explain the weighted trees and prefix codes thoroughly.

(b) What is spanning tree? Illustrate with one example.

UNIT – V

10 In how many ways can the 26 letters of the alphabet be permitted so that none of the patterns car, dog, pun or byte occurs?

OR

11 Use generating functions to determine how many four elements subsets of $S = \{1, 2, 3, \ldots . 15\}$ contains no consecutive integers.

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Code: 13A05302 **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations June 2016

DISCRETE MATHEMATICS

(Common to CSE and IT)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) What are basic logical operations? Define them.

(b) Find the minimum number of persons selected so that at least eight of them will have birthdays on the same day of week.

(c) Find the dual of the $wx(y'z + yz') + w'x'(y' + z)(y + z')$ of the Boolean expression.

(d) Define Lattices as algebraic system.

(e) State Lagrange's theorem.

(f) What is the coefficient of $x^3\, y^2\, z^2$ in $(x + y + z)^9$?

(g) State the principle of mathematical induction.

(h) Find the generating function of the sequence $a_n = n, n \geq m$.

(i) Find a chromatic number of a bipartite graph.

(j) Define Binary tree. Give an example.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Show that the arguments: (i) $p \overset{p}{\rightarrow} q$

$\therefore q$

(ii) $p \underset{p}{\rightarrow} q$

$\therefore$ q is valued.

OR

3 How many people among 200,000 are born at the same time (hour, minute, seconds)?

UNIT – II

4 (a) State and prove fundamental theorem on relations.

(b) Let $A = \{0,1,2,3,4\}$. Find the equivalence classes of the equivalence relation $R = \{(0,0), (0,4), (1,1), (1,3), (2,2), (3,1), (3,3), (4,0), (4,4)\}$ defined on A. Draw digraph of R and write down the partition of A induced by R.

OR

5 The direct product of any two distributive lattices is a distributive lattice.

UNIT – III

6 Let G be a group and let $Z = \{a: ax = xa \text{ for all } x\varepsilon G\}$ is a centre of the group G. Then prove that $'z'$ is a normal subgroup of G.

OR

7 A person writes letters to five friends and addresses on the corresponding envelops. In how many ways can the letters be placed in the envelops so that: (i) All the letters are in the wrong envelops. (ii) At least two of them are in the wrong envelops.

Contd. in page 2

UNIT – IV

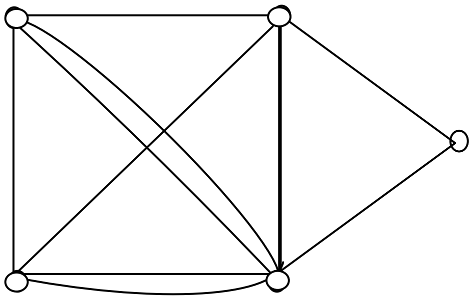
8 Prove $F_{m+n} = F_{m-1}F_n + F_mF_{n+1}$ for $m, n \geq 1$ by induction.

OR

9 Using Generating function solve the recurrence relation $a_n - a_{n-1} - 6a_{n-2} = 0$ given $a_0 = 2, a_1 = 1$.

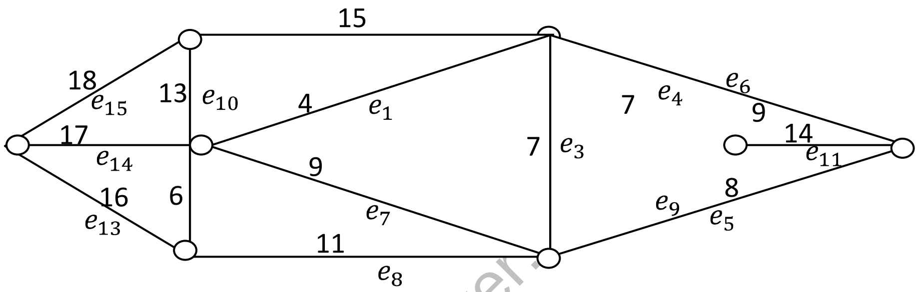
UNIT – V

10 Write an algorithm for getting an Euler line in Euler graph. Using this algorithm. Test whether the graph given has an Euler line or not?.



OR

11 Using Kruskal's algorithm, obtain a minimal tree for the graph given in below.



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