

(i) Printed Pages : 4

Roll No.

(ii) Questions : 9

Sub. Code :

1	7	9	4	8
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Exam. Code :

0	0	3	1
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Bachelor of Computer Applications 5th Semester

(2125)

DISCRETE MATHEMATICAL STRUCTURE

Paper : BCA-16-502

Time Allowed : Three Hours]

[Maximum Marks : 65

Note :— Attempt **FIVE** questions in all, selecting **ONE** question from each unit. Question No. 1 is compulsory.

(Compulsory)

1. (i) Let $U = \{1, 2, 3, 4, \dots, 8, 9\}$, $A = \{x \in U \mid x \text{ is a multiple of } 3\}$, $B = \{x \in U \mid x^2 - 5 \geq 0\}$. Determine $A \cap B$ and B^c .
- (ii) Is the relation $R_1 = \{(1,1), (1,2), (2,1), (2,2), (3,4), (4,1), (4,4)\}$ reflexive, symmetric, antisymmetric, and transitive?
- (iii) If $S(k) = k^2 - 1$, $k \geq 1$ is the closed expression for the sequence S . Show that $S(k + 1) = S(k) + 2k$, $k \geq 1$. Is this a recurrence relation of the sequences?
- (iv) Define multiple graph, directed graph. Also explain by giving examples.
- (v) Draw the graphs $k_{2,4}$ and $k_{2,5}$.
- (vi) Show that $x^2 - 2x + 1$ is not $0(x)$. 5×2,3

UNIT-I

2. (a) Let $A = \{1, 2, 3\}$, $B = \{a, b, c\}$ and $C = \{x, y, z\}$. Let R and S be relations from $A \rightarrow B$ and from $B \rightarrow C$ as $R = \{(1, b), (2, a), (2, c)\}$ & $S = \{(a, y), (b, x), (c, y), (c, 2)\}$. Find the composition relation SoR . Find matrices M_R , M_S and M_{SoR} of relations R , S and SoR and compare M_{SoR} to $M_R M_S$.
- (b) Let $A = \{1, 2, 3, 4\}$ and $R = \{(a, b) \mid a > b\}$ be a relation from $A \rightarrow A$. Draw the graph of R and write M_R . 7,6
3. (a) Show that the function $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 2x + 3$ is one-one and onto. Does the inverse f^{-1} exist? If so, find f^{-1} . Also find $f \circ f^{-1}$.
- (b) Let $f(x) = \frac{x+1}{x+2}$ be a function from $\mathbb{R} \rightarrow \mathbb{R}$. Find the domain and range of $f(x)$. 7,6

UNIT-II

4. (a) Solve the recurrence relation
$$S(k) - 4S(k-1) + 3S(k-2) = 5^n.$$
- (b) Solve the recurrence relation $S_k - 2S_{k-1} + S_{k-2} = 1$,
$$S_0 = 2, S_1 = \frac{11}{2}.$$
 7,6
5. (a) Write the sequence whose generating function is $\frac{5+2z}{1-4z^2}$.
- (b) Solve the recurrence relation $S(k) - 4S(k-1) + 4S(k-2) = 0$, $S(0) = 1$, $S(1) = 6$ using generating function. 7,6

UNIT-III

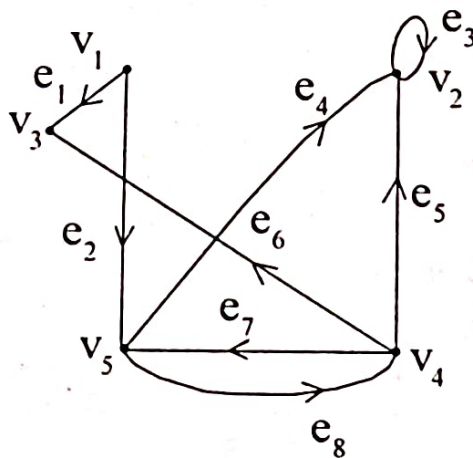
6. (a) Is it possible to construct a graph with 12 vertices such that 2 of the vertices have degree 3, 3 of degree 2, and the remaining of degree 4?

(b) Find the

(i) Adjacency matrix

(ii) Incident matrix

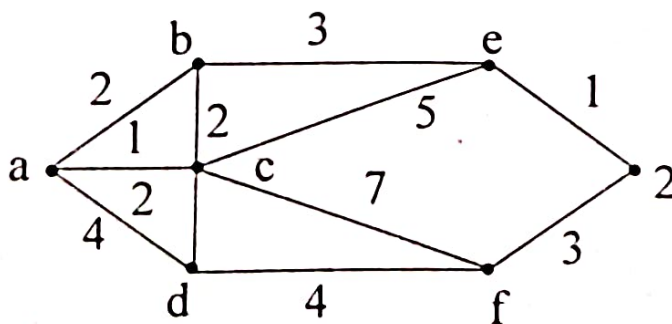
for the graph G given in the figure.



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7. (a) Let $G(V, E)$ be a graph having n vertices. Prove that G or its complement \bar{G} is non-planar.

(b) Find the distance from a to z using Dijkstra's algorithm.



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UNIT-IV

8. (a) Let $A = \{a, b\}$ be an alphabet. Show that

(i) $aa^* (a \cup b)^* a$

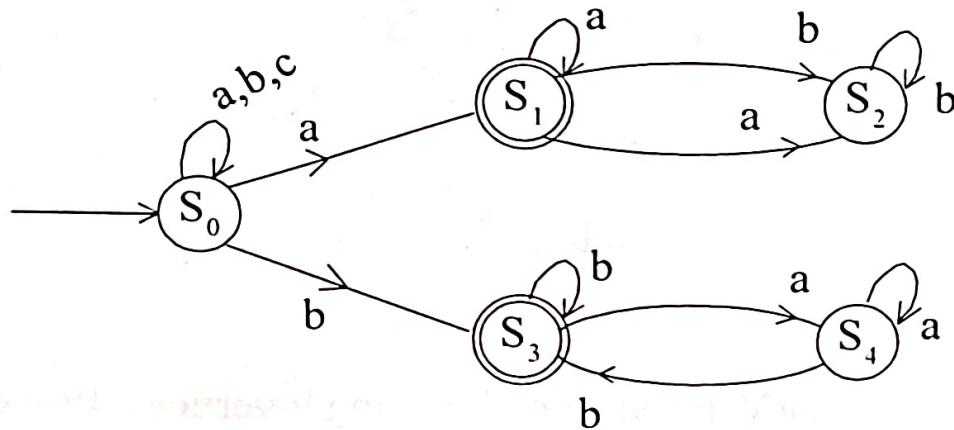
(ii) $(a \cup b)^* (a \cup \phi)$

(iii) $a(a \cup b)^*$ are regular expression over A .

(b) Define Finite State Machines (FSM). Give an example.

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9. (a) Write the language of FSM shown below:



(b) If $3r^3 + r^2 \log r = O(r^n)$, find the least positive integer n .
Are $3r^3$ and $r^2 \log r$ of the same order?

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