(i) **Printed Pages: 4** **Roll No. .....**

(ii) **Questions : 9** **Sub. Code :** 0 9 4 8

Exam. Code : 0 0 3 1

Bachelor of Computer Applications 5th Semester

1128

DISCRETE MATHEMATICAL STRUCTURE

Paper : BCA-16-502

Time Allowed : Three Hours] **[Maximum Marks : 65**

Note :— Attempt **five** questions in all, selecting at least **one** question from each unit. Question No. **1** is compulsory. All questions carry equal marks.

1. (i) What is the number of subsets of a set having n elements ? Write down all the proper subsets of the set {1, 2, 3}. 2

(ii) Write the generating function of the sequence :

$S_n = 2^n[3 + 2(-1)^n]$. 2

(iii) Does there exist a graph with 24 edges, 3 vertices of degree 4 and all other vertices of degree 3 ? If so, find the number of vertices. 3

(iv) Find the number of regions defined by a connected planar graph with 4 nodes and 8 edges. 2

(v) For the words $u = a^2bab^2$ and $v = bab^2$ find (a) uv, (b) $u \lambda v$. 2

(vi) Show that $f(x) = 5.5x^2 + 7x$ is $O(x^2)$. 2

UNIT—I

2. (i) State and prove De Morgan's Laws for two sets.

(ii) In a survey of 60 people; it was found that 25 read Newsweek magazine, 26 read Times, 26 read Fortune, 9 read both Newsweek and Fortune, 11 read both Newsweek and Times, 8 read both Times and Fortune and 3 read all the three magazines. Find :

(a) The number of people who read at least one of the three magazines.

(b) The number of people who read Newsweek only, Times only and Fortune magazine only.

(c) The number of people who read exactly one magazine. 6,7

3. (i) Define relation for sets A and B. If A = {a, b, c, d}, B = {p, q, r, s}. Then which of the following are relations from A to B ?

(a) $R_1 = \{(a, q), (b, s), (c, d), (d, r)\}$

(b) $R_2 = \{(a, r), (c, p), (b, q)\}$. Justify your answer with explanation.

(ii) Is the function $f(x) = \frac{x}{x+1}$ invertible in its domain ? If so, find $f^{-1}(x)$ and its domain and range. Also evaluate fof^{-1}. 6,7

UNIT—II

4. (i) Solve the recurrence relation :

$$a_k - 2a_{k-1} + a_{k-2} = 1,\ a_0 = 2,\ a_1 = \frac{11}{2}.$$

(ii) Write the sequence whose generating function is

$$\frac{3-5z}{1-2z-3z^2}.$$ 6,7

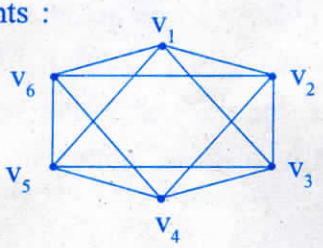
5. (i) For the recurrence relation $s_n - 6s_{n-1} + 8s_{n-2} = 0$, $n \geq 2$ and $s_0 = 10$, $s_1 = 25$. Find generating function and also the sequence which satisfies it.

(ii) Solve :

$$s_n = 10s_{n-1} - 9s_{n-2},\ s_0 = 3,\ s_1 = 11.$$ 8,5

UNIT—III

6. (i) Consider the graph in figure. Justify the following statements :

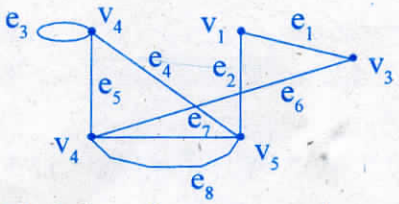


(a) Is it a complete graph ?

(b) Is the graph connected and regular ?

(c) Is it a planar graph ? If true, find the number of regions using Euler's formula.

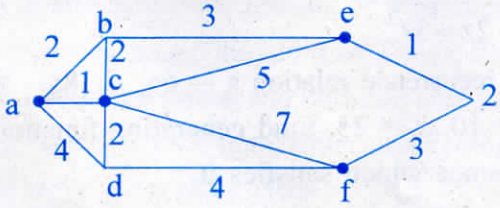
(ii) For the given graph :



(a) Find the adjacency matrix.

(b) Find the incidence matrix. 7,6

7. (i) Find the shortest path between a and z in the graph shown in figure using Dijkstra's Algorithm.

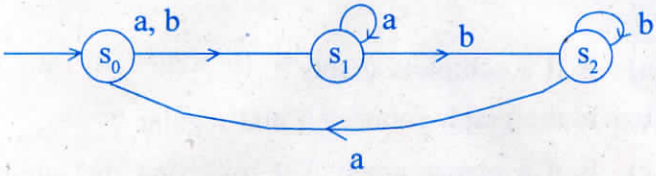


(ii) A connected graph has 9 vertices having degrees 2, 2, 2, 3, 3, 3, 4, 4 and 5. How many edges are there ? How many faces are there ? 7,6

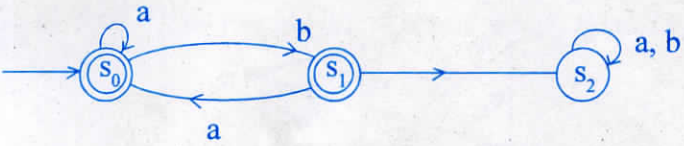
UNIT—IV

8. (i) Let A = {a, b}. Construct an automation M which will accept the language L(M) = $\{a^r b^s; r > 0, s > 0\}$.

(ii) Construct the state transition table of the finite state machine whose diagraph is given in figure. 7,6



9. (i) Determine whether the automation M in figure accepts the words (a) w = bbaba, (b) w = baab, (c) w = w.



(ii) Prove that $f(x) = 8x^3 + 5x^2 + 7$ is $\Omega(g(x))$ where $g(x) = x^3$. 7,6

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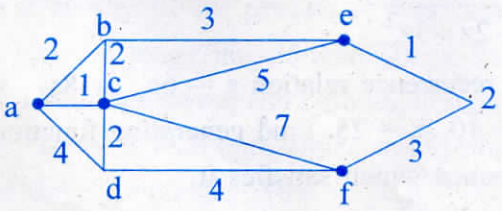

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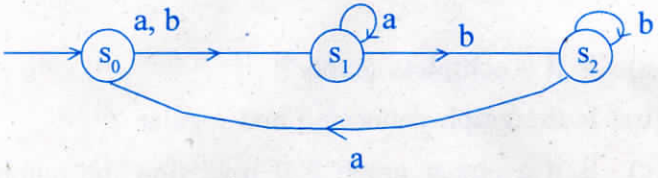

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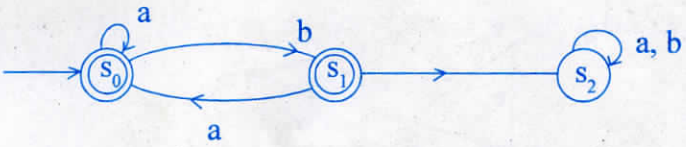

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