

(i) Printed Pages: 4

Roll No. ....

(ii) Questions : 9

Sub. Code : 

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Exam. Code : 

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**Bachelor of Computer Applications 5<sup>th</sup> 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  $f \circ f^{-1}$ .
- 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

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

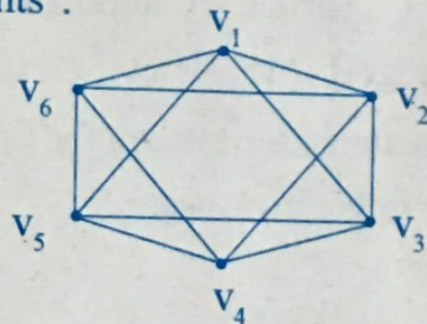
5. (i) For the recurrence relation  $s_n - 6s_{n-1} + 8s_{n-2} = 0$ ,  $n \geq 2$  and  $s_0 = 10$ ,  $s_1 = 25$ . Find generating function and also the sequence which satisfies it.

- (ii) Solve :

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

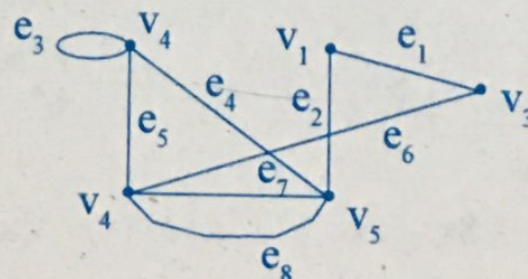
### UNIT—III

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 :

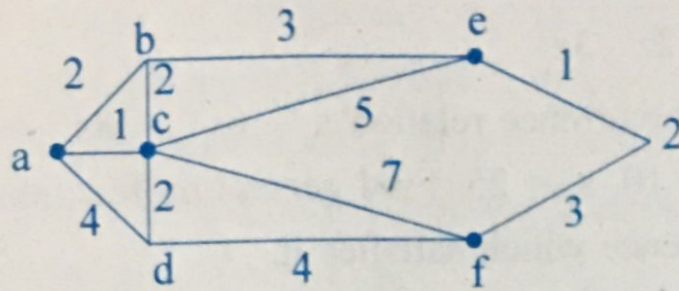


- (a) Find the adjacency matrix.  
 (b) Find the incidence matrix.

7,6



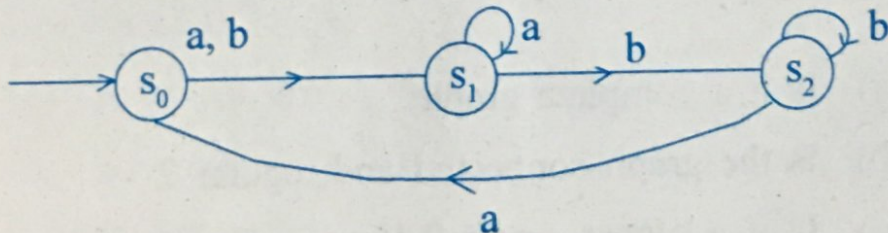
7. (i) Find the shortest path between a and z in the graph shown in figure using Dijkstra's Algorithm.



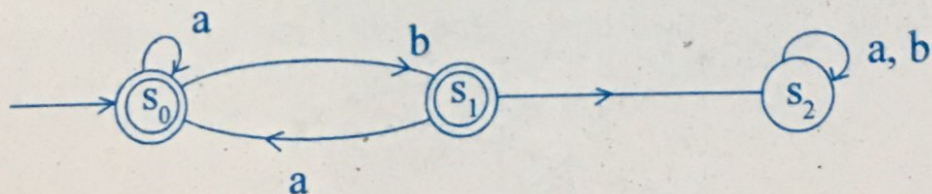
- (ii) A connected graph has 9 vertices having degrees 2, 2, 2, 3, 3, 3, 4, 4 and 5. How many edges are there? How many faces are there? 7,6

#### UNIT—IV

8. (i) Let  $A = \{a, b\}$ . Construct an automaton  $M$  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 diagram is given in figure. 7,6



9. (i) Determine whether the automaton  $M$  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