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

(ii) Questions : 9 Sub. Code : 0948

Exam. Code : 0031

Bachelor of Computer Applications 5th Semester

(2122)

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. **I** is compulsory.

I. (a) Let A, B be two sets such that A × B consists of 6 elements. If three elements of A × B are {(1, a), (2, b), (3, b)}, find A × B and B × A.

(b) Write the generating function of the sequence

$$2^{n-1} + \left(\frac{1}{3}\right)^{n-1} + 3.$$

(c) A graph G has 21 edges, 4 vertices of degree 3 and all other vertices of degree 2. Find the number of vertices in G.

(d) Let A = {a, b}. Describe the Language L(r) where (i) r = abb*a (ii) r = a ∨ b*. 3×3,4

UNIT–I

II. (a) For a certain test, a candidate could offer English or Hindi or both the subjects. Total number of students was 550, of whom 325 appeared in English and 120 in both the subjects. Use set operations to find :

(i) How many appeared in English only ?

(ii) How many appeared in Hindi ?

(iii) How many appeared in Hindi only ?

(b) Let A = {1, 2, 3}. Determine whether the relation R whose Matrix $M_R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$, is an equivalence relation ?

7,6

III. (a) Let R and S be the relations on X = {a, b, c} defined by R = {(a, b), (a, c), (b, a)} and S = {(a, c), (b, a), (b, b), (c, a)} :

(i) Find the composition relation RoS and M_{RoS}.

(ii) Find S^{-1} and matrix MS^{-1}.

(b) Find domain and range of the function $f(x) = \frac{1}{2x-1}$. Is f(x) invertible ? If so, find f^{-1} and $f^{-1} \circ f$, $f \circ f^{-1}$. 6,7

UNIT–II

IV. (a) Solve the recurrence relation :

$$S(n) - 5S(n-1) + 6S(n-2) = 5^n.$$

(b) Solve $S(n) - 2S(n-1) + S(n-2) = 2$ with $S(0) = 25$, $S(1) = 16$. 6,7

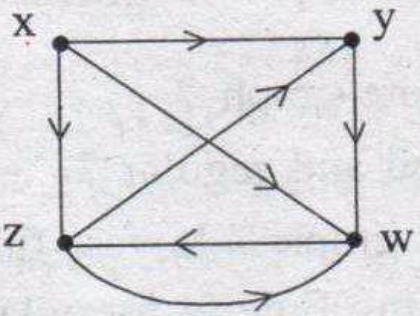
V. (a) Write the sequence whose generating function is $\frac{6 - 29z}{30z^2 - 11z + 1}$.

(b) Find the generating function of the recurrence relation $S_n + 3S_{n-1} - 4S_{n-2} = 0$, $n \geq 2$ with $S_0 = 3$, $S_1 = -2$. 6,7

UNIT–III

VI. (a) Find n if a complete graph with n vertices has 15 edges. Draw the graph also.

(b) Consider the directed graph G in figure :



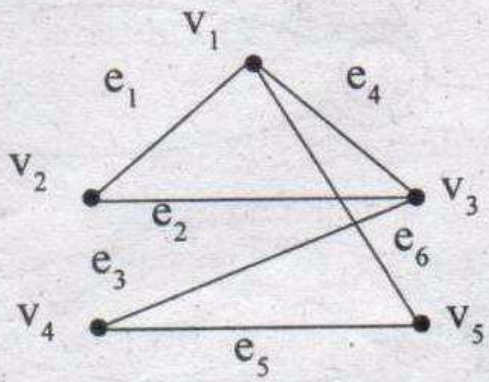
(i) Find the indegree and outdegree of each vertex of G.

(ii) Are there any sources or sinks ?

(iii) Find all simple paths from y to z.

(iv) Find all cycles in G. 6,7

VII. (a) For the given graph :

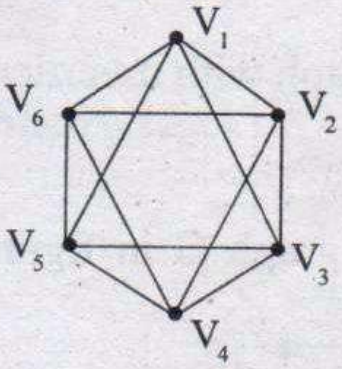


(i) Write adjacency matrix.

(ii) Find incidence matrix.

(iii) Draw complement graph.

(b) Consider the graph in the figure :



(i) Is it a complete graph ?

(ii) Is it connected and regular ?

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

Explain your answers. 7,6

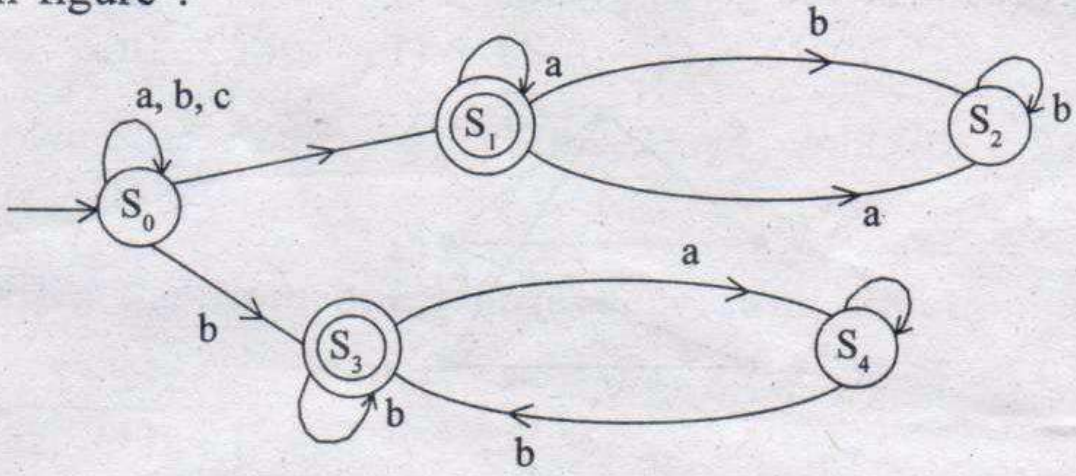
UNIT—IV

VIII. (a) Let A = {a, b, c} and w = abc. Find whether w belongs to L(r)* where :

(i) r = a*(b + c)*

(ii) r = ab*(bc)*.

(b) Find the language of FSM (Finite State Machine) shown in figure :



Describe the machine. Does it accept the words abaaabb, bbbaabab ? 6,7

IX. (a) Prove that $5.5n^2 + 7n$ is $\mathbf{O}(n^2)$.

(b) Show that 2^n is $\mathbf{O}(3^n)$ but (3^n) is not $\mathbf{O}(2^n)$. 6,7