

(i) Printed Pages: 3

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  
(1129)**

**DISCRETE MATHEMATICAL STRUCTURE**

**Paper : BCA-16-502**

**Time Allowed : Three Hours]**

**[Maximum Marks : 65**

**Note :—** Attempt FIVE questions in all, including Q. 9 in Unit-V which is compulsory and taking ONE each from Unit-I to Unit-IV.

**UNIT—I**

1. (a) Find  $f \circ g$ ,  $g \circ f$ ,  $f \circ f$  and  $g \circ g$  compositions for the following functions :

$$f(x) = x^2 + 2, g(x) = 1 - \frac{1}{1-x}, x \neq 1.$$

- (b) Draw the graph of the function  $y = [x] - 2$ , where  $[x]$  is the greatest integer  $\leq x$ . 7,6
2. (a) Prove that  $f : \mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = x^2 + 3$  is neither one-one nor onto function.
- (b) Let  $A = \{1, 2, 3\}$ ,  $B = \{4, 5\}$  and  $C = \{1, 4\}$  be three sets. Find  $A \times B$ ,  $B \times A$ ,  $A \times (B \cup C)$  and  $(A \cap C) \times B$ .

7,6

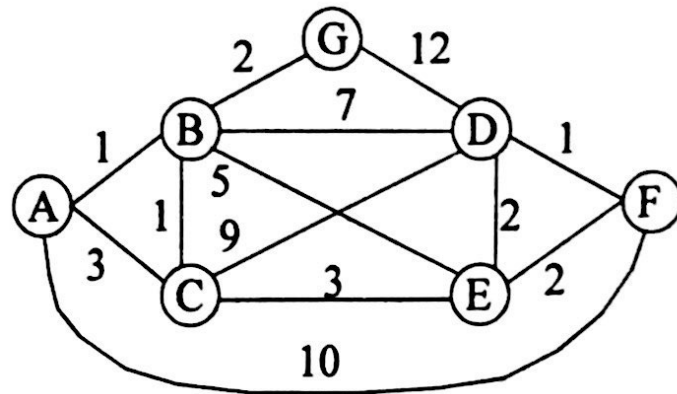
## UNIT—II

3. (a) A sequence is defined by the recurrence relation  $t_{n+1} = a t_n + b$  with  $t_1 = 4$ ,  $t_2 = 3.2$  and  $t_3 = 2.04$ . Find the values of  $a$  and  $b$ .
- (b) Find the sequence  $(t_n)$  satisfying the recurrence relation  $t_n = 2t_{n-1} + t_{n-2} - 2t_{n-3}$ ,  $n \geq 3$ , and the initial conditions  $t_0 = 1$ ,  $t_1 = 2$  and  $t_2 = 0$ . 7,6
4. (a) A sequence is defined by the recurrence relation  $t_{n+1} = 0.6 t_n + 4$  with  $t_0 = 7$ .  
Calculate the value of  $t_3$  and the smallest value of  $n$  for which  $t_n > 9.7$ .
- (b) Determine the generating function of the sequence :  
 $0, 1, 2^2, 3^2, \dots, n^2, \dots$  7,6

## UNIT—III

5. (a) For each of the following, either give an example, or prove there are none :
- (i) A simple graph with 6 vertices, whose degrees are 2, 2, 2, 3, 4, 4.
- (ii) A simple graph with 8 vertices, whose degrees are 0, 1, 2, 3, 4, 5, 6, 7.
- (iii) A simple graph with degrees 1, 2, 2, 3.
- (b) State Euler's formula for connected planar graphs. If a connected planar graph had 6 vertices and 9 edges then how many faces would it have ? 7,6

6. Calculate the single-source shortest paths from A to every other vertex in the following undirected, weighted graph :



13

#### UNIT—IV

7. What is a finite state machine ? Why is it required ? What are the elements of FSM ? Design an NFA which does not accept set of all strings with two consecutive zeros. 13
8. What is an algorithm ? What are its features ? How do you determine the time as well as space complexity of an algorithm ? Explain with examples. 13

#### UNIT—V

##### (Compulsory Question)

9. (a) Given that  $A = \{2, 4\}$  and  $B = \{x : x \text{ is a solution of } x^2 + 6x + 8 = 0\}$ . Are A and B disjoint sets ?
- (b) Write the power set of the set  $A = \{y : y \in \mathbb{N} \text{ and } 1 \leq y \leq 3\}$ .
- (c) A Moore state machine usually has power states than the equivalent Mealy machine. (True/False)
- (d) Define Travelling Salesman Problem.
- (e) Define Recursive algorithm.
- (f) What is regular expression in Automata theory ?

3,5×2=13