

12-15



**WEST BENGAL STATE UNIVERSITY**  
B.Sc. Honours 2nd Semester Examination, 2023

**CMSACOR04T-COMPUTER SCIENCE (CC4)**

[124 2211 400111]

Time Allotted: 2 Hours

Full Marks: 50

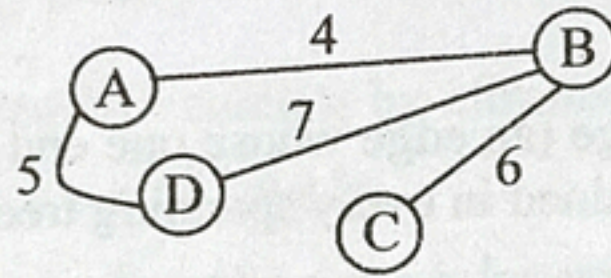
*The figures in the margin indicate full marks.  
Candidates should answer in their own words and adhere to the word limit as practicable.  
All symbols are of usual significance.*

**GROUP-A**

1. Answer any *five* questions from the following:

2×5 = 10

- ✓(a) Define Path with proper figure. ✓
- ✓(b) Draw the adjacency matrix for the following graph. ✓



- (c) Define tautology with a simple example.
- (d) What is a recurrence relation?
- (e) A committee of 5 members is to be formed from a group of 10 people. In how many ways this can be done?
- ✓(f) How many different arrangements can be made using the letters in "COMMITTEE"? ✓
- ✓(g) Prove that the maximum number of edges possible in a simple graph with  $n$  vertices is  $n(n-1)/2$ . ✓
- ✓(h) What is chromatic number of a graph? ✓

**GROUP-B**

Answer any *five* questions from this group

8×5 = 40

- 2. (a) A string like 12321, which reads the same forward and backward, is called a palindrome. How many palindromes can be made using characters from {0, 1, 2, 3, ..., 9} using (i) five digits, (ii) six digits? 4+4
- (b) Suppose a programming language allows its variable-names to be maximum six-character long. Characters can be from the set {A-Z, a-z, 0-9, \_}. The first character must be an alphabet or '\_'. How many distinct names are there?

3. (a) What are meant by time complexity and space complexity of an algorithm? 2+2+4  
 (b) Derive the Big-Oh notation of the function  $f(x) = x^2 + x \log x + 100$ .  
 (c) Formulate the recurrence relation to find out the time complexity of Binary search. Solve the recurrence relation formulated by you using the method of substitution.

4. (a) Define generating function of a sequence  $\{a_n\}$ . Find out the Generating Function for the infinite sequence  $\{a_n = 3^n, \text{ for } n \geq 0\}$ . 3+5  
 (b) Solve the recurrence relation, subject to the initial condition  $x_0 = 0, x_1 = 1$ :

$$x_n + 3x_{n-1} - 10x_{n-2} = n^2 + n + 1$$

- ✓5. (a) State the Generalized Pigeon-hole Principle. ✓ 2+3+3  
 (b) If 4 distinct natural numbers between 1 and 6 are selected, show that there exist at least two whose sum is 7. ✓  
 (c) If 11 distinct natural numbers between 1 and 100 are selected, show that there exist at least two whose difference is less than 10. ✓

- ✓6. (a) Define spanning tree. Prove that a pendant edge (an edge whose one end vertex is of degree one) in a connected graph  $G$  is contained in every spanning tree of  $G$ . ✓ 4+4  
 (b) Describe Prim's algorithm to find Minimum Spanning Tree of a given weighted connected graph. Give an example. ✓

- ✓7. (a) Define Edge-connectivity and vertex-connectivity of a graph. Give examples. ✓ 4+4  
 (b) Prove that a connected graph with  $n$  vertices and  $(n-1)$  edges is a tree. ✓

- ✓8. (a) Let  $A$  and  $B$  be two finite sets, then prove that 4+4

$$n(A \cup B) = n(A) + n(B) - n(A \cap B) \quad \checkmark$$

- (b) Let  $A = \{0, 2, 4, 6, 8\}$ ,  $B = \{0, 1, 2, 3, 4\}$  and  $C = \{0, 3, 6, 9\}$ . What are  $A \cup B \cup C$  and  $A \cap B \cap C$ ? ✓

- ✓9. Write short notes on any *two* of the following: 4×2 = 8

(a) Isomorphic graphs ✓

✓(b) Euler graph ✓

✓(c) Depth First Search.

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