



**WEST BENGAL STATE UNIVERSITY**  
B.Sc. Honours 2nd Semester Examination, 2020

**CMSACOR04T-COMPUTER SCIENCE (CC4)**

**DISCRETE STRUCTURES**

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.*

**Answer Question No. 1 and any five from the rest**

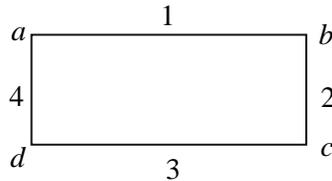
1. Answer any **five** questions from the following: 2×5 = 10
- (a) What do you mean by uncountably infinite set? Give an example.
  - (b) A set  $S$  has  $n$  elements. Prove by mathematical induction that it has  $2^n$  sub-sets.
  - (c) What do you mean by a reflexive relation? Give an example.
  - (d) If  $P$  and  $Q$  are two propositions, prove that  $((P \vee Q) \sim Q) \rightarrow P$  is a tautology.
  - (e) Find out the number of distinguishable arrangements of the word GOOGLE so that two O's are always together.
  - (f) Show that number of odd degree vertices in a graph is always even.
  - (g) Define a complete graph.
  - (h) Prove that the maximum number of edges possible in a simple graph with  $n$  vertices is  $\frac{n(n-1)}{2}$ .
  - (i) What is chromatic number of a graph?
  - (j) Derive the Big-Oh notation of the function  $f(x) = x^2 + x \log x + 100$ .
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  $\{0, 1, 2, 3, \dots, 9\}$  using (i) five digits, (ii) six digits? 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? 4
3. (a) What is meant by time complexity of an algorithm? Formulate the recurrence relation to find out the time complexity of Binary search. 4
- (b) Solve the recurrence relation formulated by you using the method of substitution. 4

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

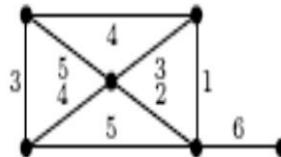
$$x_{n+2} + 2x_{n-1} - 15x_n = 0, \quad n \geq 2$$

5. (a) State the Principle of Inclusion and Exclusion (PIE) for four sets A, B, C, D. 3
- (b) Find out the number of primes between 1 and 100 using PIE. 5

6. (a) Distinguish between a graph and a multi-graph. 3
- (b) Compare between the adjacency matrix and the adjacency list representation of a graph. Illustrate with the following graph with vertex-set and edge-set  $\{a, b, c, d\}$  and  $\{1, 2, 3, 4\}$  respectively. 5



7. (a) What is a minimally connected graph? Prove that a minimally connected graph is a tree. 4
- (b) What is a spanning tree? Find out two distinct spanning trees of the following graph. 4



8. (a) Compare between an Eulerian graph and a Hamiltonian graph. 3
- (b) Draw graphs which are 5
- (i) Both Eulerian and Hamiltonian
  - (ii) Eulerian but not Hamiltonian
  - (iii) Hamiltonian but not Eulerian.

**N.B. :** Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.

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