WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 2nd Semester Examination, 2022

CMSACOR04T-COMPUTER SCIENCE (CC4)

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) Prove that for any three sets A, B, and C

   $$(A \cup B) \cap C = (A \cap C) \cup (B \cap C)$$

   (b) How many distinct arrangements can be made with the letters of the word 'VIBGYOR'? How many of them start with 'R' and end with 'B'?

   (c) Three boys and three girls are going to take admission in B.Sc. Computer Science Hons. course. In how many ways can the students take admission so that none of them takes admission in the girls' college, if three colleges in the locality (two co-education and one girls' college) offer the course?

   (d) Prove that the proposition $(p \to q) \vee (q \to p)$ is a tautology.

   (e) With an example, show the difference between function and relation.

   (f) Define planar graph.

   (g) What is a circuit?

GROUP-B

Answer any *five* questions from this GROUP 8×5 = 40

2. (a) Prove by mathematical induction that: $3^{2n} - 1$ is divisible by 8, for all natural number n. 5

   (b) When a relation is said to be Partial ordering relation? 3

3. (a) Solve the recurrence relation: 5

   $u_n = 7u_{n-1} - 10u_{n-2}, \quad n \geq 2$ with initial conditions $u_0 = 4, \quad u_1 = 17$

   (b) State De Morgan's laws in Boolean algebra. 3

4. (a) Prove by mathematical induction that: 4

$$P(n): 1^2 + 2^2 + 3^2 + .. + n^2 = \frac{n(n+1)(2n+1)}{6}$$

(b) Prove that the number of vertices of odd degree in a graph is always even. 4

5. (a) Prove that a tree has either one or two centers. 3

(b) Define a binary tree. 2

(c) Find out the maximum number of nodes possible in a binary tree of depth *k*. 3

6. (a) Define a recurrence relation. 2

(b) Solve the recurrence relation $a_n - a_{n-1} - 6a_{n-2} = 0, \quad a_0 = 5, \quad a_1 = 0$. 4

(c) Find out the Generating Function for the infinite sequence $\{a_n = (n+1), \text{ for } n \geq 0\}$. 2

7. (a) By method of induction, prove that $7^{n+2} + 8^{2n+1}$ is divisible by 57 for every non negative integer *n*. 5

(b) There are 100 people in a certain room, in this group, 60 are men, 30 are young and 10 are young men. How many are old women? 3

8. (a) Let *A* and *B* be two finite sets, then prove that $n(A \cup B) = n(A) + n(B) - n(A \cap B)$. 4

(b) If three dice are rolled, find the probability that exactly one face shows a number less than or equal to 4. 4

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

(a) Sub-graphs

(b) Hamiltonian circuit

(c) Breadth-First search.

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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