RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, JUNE 2022

FIRST YEAR (BATCH 2021-24)

Date : 22/06/2022 **COMPUTER SCIENCE (HONOURS)**

Time : 11.00 am – 1.00 pm **Paper : IV [CC4]** Full Marks : 50

Answer **any five** questions of the following: [5×10]

1. a) If A, B, C are non-empty sets, then prove or disprove that
   $A \times (B \cup C) = (A \times B) \cup (A \times C)$
   b) What do you mean by partition of a set ? Give example.
   c) A relation ρ is defined on z by "xρy if and only if $x^2 - y^2$ is divisible by 5 " for x, y ∈ z . Prove that ρ is an equivalence relation on z.
   d) Define antisymmetric relation. [3+2+4+1]

2. a) Let (S, ≤) is a poset. A relation ≥ is defined on S by " $x \geq y$ if and only if $x \leq y$ " for x, y ∈ S. Prove that (S, ≥) is a poset.
   b) How many committee consisting with 5 members can be formed by chosing the candidates from 5 male and 4 female, where in each committee there should be atleast 3 male candidates ?
   c) Define cyclic group.
   d) What is the power set of { }? [4+3+2+1]

3. a) Prove that the fourth roots of unity 1, -1, i, -i form an abelian multiplicative group.
   b) Prove that the necessary and sufficient condition for a non-empty subset H of a group (G, *) to be a subgroup is $a,b \in H \Rightarrow a*b^{-1} \in H$, where b^{-1} is the inverse of b in G .
   c) Show that in any set of eleven integers, there are two integers whose difference is divisible by 10.
   [4+4+2]

4. a) Find a closed form for the generating function for the following sequence
   0, 0, 2, 4, 6, 8, . . .
   b) Using characteristic roots method, solve the following recurrence relation
   $a_{n+2} - 5a_{n+1} + 6a_n = 2^n$, with initial condition $a_0 = 1$ and $a_1 = -1$.
   c) What do you mean by onto mapping? [3+6+1]

5. a) Define and explain the following events with an example. [4×2]
   i) mutually exclusive events
   ii) exhaustive events
   iii) equally likely events
   iv) dependent events
   b) Three electric bulbs are chosen at random from 10 bulbs, of which 4 are defective. Find the probability that at least one is defective. [2]

6. Define the following terms and explain with example. [4×2.5]
   i) product of graphs ii) cut vertex and cut set
   iii) isomorphic graph iv) minimal spanning tree

7. a) Find out the number of pendant vertices in a binary tree with n vertices.
   b) If G is connected simple planar graph with n (≥ 3) vertices and e edges and having no circuits of length 3, then show that $e \leq 2n - 4$.
   c) What is the incidence matrix ? Write down some important observations on it.
   d) Do you think any complete grapgh can be represented as a bipartite graph ? Give the reasons in favour of your answer.
   e) "We can find a complete graph with n (>4) vertices, which must be a planar graph " - State whether this statement is true or false. Give the explanation. [2+2+2+2+2]

———— × ————