Roll No. 2 2 1 0 5 6 1

22-CS-12

M.Sc. I SEMESTER [MAIN/A.T.K.T.] EXAMINATION
DECEMBER 2022 - JANUARY 2023

COMPUTER SCIENCE

Paper - II

[Discrete Structure]

[Max. Marks : 75] *[Time : 3:00 Hrs.]* *[Min. Marks : 26]*

Note : Candidate should write his/her Roll Number at the prescribed space on the question paper.
Student should not write anything on question paper.
Attempt five questions. Each question carries an internal choice.
Each question carries **15 marks.**

Q. 1 a) Is the function $y = f(x) = 3x + 2$, $x, y \in R$ onto ? Is it one - to - one ? What if $x, y \in z$. Explain. **(7½ marks)**

b) Prove that $A \times (B \cap C) = (A \times B) \cap (A \times C)$. **(7½ marks)**

OR

a) What are Functions ? Discuss various types of functions. **(7 marks)**

b) Let p denotes the statement, "The weather is nice" and q denotes the statement, "We have a picnic." Translate the following in English and Simplify : **(8 marks)**

i) $p \wedge \overline{q}$

ii) $p \leftrightarrow q$

iii) $\overline{q} \rightarrow \overline{p}$

iv) $(\overline{p} \vee \overline{q})$

v) $\sim(p \wedge \overline{q})$

Q. 2 a) What is phrase structure grammer ? Also explain types of phrase structure grammer. **(7 marks)**

b) Show that **(8 marks)**

$$1^2 + 3^2 + 5^2 + \ldots + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$$

by mathematical induction.

OR

a) What is recursive algorithm ? Write a recursive algorithm for sequential search. **(8 marks)**

P.T.O.

b) Give a type - 3 grammer that generates the language - (7 marks)

L = $\{x / x \in (a, b)^*$ and x does not contain two consecutive a's ?

Q. 3 a) A shop window designer has 7 balloons, of which 1 is white, 2 are blue and 4 are red. She hangs these balloons in a line in the shop front. find the number of arrangements she can make by using : (8 marks)

i) All 7 balloons.

ii) Exactly 6 balloons.

b) What is Algorithm ? Explain types of algorithm complexity. (7 marks)

OR

a) What is Piegeon Hole Principle ? In a computer science department, a student club can be formed with either 10 members from first year or 8 members from second year or 6 from third year or 4 from final year. What is the minimum no. of students we have to choose randomly from department to ensure that a student club is formed ? (7 marks)

b) Find the number of ways in which we can make up strings of four distinct letters followed by three distinct digits. (4 marks)

c) Suppose a house keeper wants to schedule dinners three times each week. Find the number of ways of scheduling. (4 marks)

Q. 4 a) Define a relation R on the set of natural numbers : a R b if and only if $|a - b| < 3$. Is R equivalence relation ? (8 marks)

b) Solve the recurrence relation by substitution : (7 marks)

$a_n = a_{n-1} + n \times 3^n$ where $a_0 = 1$

OR

a) Define Relation ? explain operations performed on relation. (8 marks)

b) Show that the relation 'Divides' defined on N is a partial order relation. (7 marks)

Q. 5 a) What is minimum spanning tree ? With the help of an example illustration, explain the basic concepts and terminology of minimum spanning tree.

b) What is Graph Coloring ? Discuss the statement 'Every planar graph is not 2 - colorable'. (7½ marks)

OR

a) What is Tree ? Explain tree traversal techniques. (7 marks)

b) Determine a shortest path between and z in the graph, where the number associated with the edges are the distance between vertices. (8 marks)