Code No: 871AA **R20**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
MCA I Semester Examinations, March - 2023
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Time: 3 Hours **Max.Marks:75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Prove that $\neg (p \wedge q) \equiv \neg p \vee \neg q$. [5]
b) Discuss the properties of relations with suitable examples. [5]
c) Show, using the definition, that $f(x)=3x^2+5x$ is $O(x^2)$ with A=4and n=5. Support your answer graphically. [5]
d) Discuss generating function and write generating function for the sequence 1,1,1,1,1,1?[5]
e) Write about connected and disconnected graph with examples. [5]

PART – B

(50 Marks)

2.a) Discuss in detail about types of quantifiers with an example.
b) Test the validity of $p \rightarrow \neg q$, $r \rightarrow q$, and $r \rightarrow \neg p$ using the truth table. [5+5]

OR

3.a) Determine truth value of $\forall x, |x| = x$ and $\exists x, x^2 = x$ for $x \in R$. Also write negation of both.
b) Prove that the premises $P \rightarrow Q$, $Q \rightarrow R$, $R \rightarrow S$, $S \rightarrow \neg R$, and $P \wedge S$ are inconsistent.[5+5]

4.a) Consider the set S = {1, 2, 3, 4} and Relation R on S given by
R = { (4, 3), (2, 2), (2, 1), (3, 1), (1, 2) }. Show that R is not transitive.
b) State and explain the properties of equivalence relations and give an example illustrating the same. [5+5]

OR

5.a) Let R be an equivalence on a set of positive integers defined by x R y if and only if $x \equiv y \pmod 3$. Then, find the equivalence class of 2 and also find the partition generated by the equivalence relation.
b) Draw a Venn diagram for each of these combinations of the sets A, B, and C.
$(A - B) \cup (A - C) \cup (B - C)$. [6+4]

6.a) Show that whenever $n \geq 3$, $f_n > a^{n-2}$, where $a = (1 + \sqrt{5})/2$, by strong induction Find P(n).
b) What is meant by structural induction? Use structural induction, to prove that $l(xy) = l(x) + l(y)$, where $x \in \Sigma^*$ and $y \in \Sigma^*$. [5+5]

OR

7.a) Show that well-formed formulae for compound propositions contains an equal number of left and right parentheses.
b) Define recursion? Write an algorithm for recursive function to find Fibonacci Series. [5+5]

8.a) Discuss in detail about Linear Nonhomogeneous Recurrence Relations with Constant Coefficients with an example.

b) Use generating functions to find the number of k-combinations of a set with n elements, i.e., C(n,k). [5+5]

OR

9.a) Solve the recurrence relation $a_{n+1} - a_n = 3n^2 - n$, $n \geq 0$, and $a_0 = 3$.

b) Define equivalence relation? Let Z be set of integers. Define R on Z if and only if 6 divides (a – b). Show that R is equivalence relation. Find Z/R. [5+5]

10.a) Discuss in detail about tree traversal techniques with an example.

b) Define Spanning tree and Minimum cost Spanning tree? Discuss Kruskal's algorithm with an example. [5+5]

OR

11.a) Illustrate cut edges and cut vertices with suitable example.

b) Define Isomorphism between the two graphs. Are the simple graphs with following adjacency matrices isomorphic? [5+5]

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 & 1 & 0 \end{bmatrix} \text{ and } \begin{bmatrix} 0 & 1 & 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 \end{bmatrix}$$

---ooOoo---