

Code No: 153CF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech II Year I Semester Examinations, April/May - 2023****DISCRETE MATHEMATICS****(Computer Science and Engineering – Artificial Intelligence and Machine Learning)****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) Define the disjunction of two propositions and give its truth table. [2]
- b) Define a predicate and give an example for a predicate. [3]
- c) Define a set and give an example. [2]
- d) Define an equivalence relation and give an example. [3]
- e) Write the steps involved in strong induction. [2]
- f) Give a big-O estimate for $f(x) = (x+1)\log(x^2+1) + 3x^2$. [3]
- g) Write the axioms of probability. [2]
- h) What is the generating function? [3]
- i) Define a graph. [2]
- j) Define a spanning tree and a minimal spanning tree. [3]

PART – B**(50 Marks)**

- 2.a) Define a tautology and a contradiction and give their truth tables.
- b) Use quantifiers to express the definition of the limit of a real-valued function $f(x)$ of a real variable x at a point a in its domain. [5+5]

OR

3. Show that $(x)(P(x) \rightarrow Q(x)) \wedge (x)(Q(x) \rightarrow R(x)) \Rightarrow (x)(P(x) \rightarrow R(x))$. [10]
4. Define a function. List all possible functions from $X = \{a, b, c\}$ to $Y = \{0, 1\}$ and indicate in each case whether the function is one-to-one, is onto, and is one-to-one onto. [10]

OR

5. Let $A = \{a, b, c\}$ and the subsets of A are denoted by $B_0 = \phi$, $B_1 = \{c\}$, $B_2 = \{b\}$, $B_3 = \{b, c\}$, $B_4 = \{a\}$, $B_5 = \{a, c\}$, $B_6 = \{a, b\}$, and $B_7 = \{a, b, c\}$. If R is the relation of proper inclusion on the subsets B_0, B_1, \dots, B_7 , then give the matrix of this relation. [10]

6.a) Let $f(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \dots + a_1 x + a_0$ where $a_0, a_1, \dots, a_{n-1}, a_n$ are real numbers then prove that $f(x)$ is $O(x^n)$.

b) Use mathematical induction to show that $1 + 2 + 2^2 + \dots + 2^n = 2^{n+1} - 1$ for all nonnegative integers n . [5+5]

OR

7.a) List all the steps used to search for 9 in the sequence 1, 3, 4, 5, 6, 8, 9, 11 using (i) a linear search (ii) a binary search.

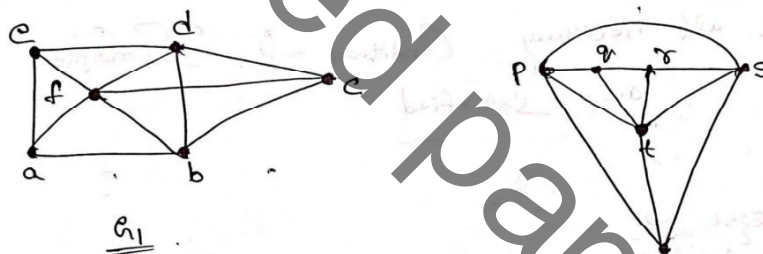
b) Show that whenever $n \geq 3$, $f_n > \alpha^{n-2}$, where $\alpha = (1 + \sqrt{5})/2$. [5+5]

8. State and prove Baye's theorem. [10]

OR

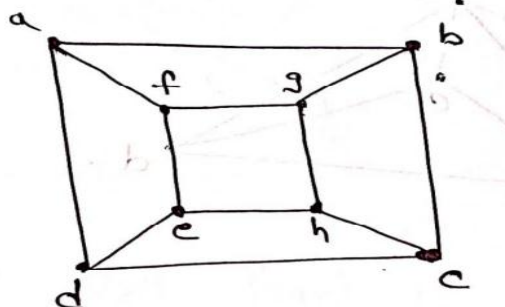
9. Solve the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}$ with initial conditions $a_0 = 1$ and $a_1 = 6$. [10]

10. Show that the following graphs are isomorphic. [10]



OR

11. Discuss DFS and BFS algorithms. Using DFS and BFS algorithms, construct the spanning tree of the following graph. [10]



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