Printed Pages – 6 Roll No. : 30001282 1045

C127532(022)

B. Tech. (Hon's) (Fifth Semester) Examination, Nov.-Dec. 2023

(Artificial Intelligence)

COMPUTATIONAL COMPLEXITY

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 40

Note : *Attempt all questions. All question carries equal marks.*

Unit-I

1. (a) Explain the concept of polynomial time in the context of computational complexity. 4

(b) Write a non-deterministic algorithm to search an element from a given set of elements. 8

(c) Discuss the concept of reduction in the context of NP-completeness. Explain how a problem is reduced to another problem and how this relates to NP-complete problems? 8

Unit-II

2. (a) Consider a scenario where you have a knapsack with a maximum weight capacity of W and a set of N items, each with a weight ($w[i]$) and a value ($v[i]$). You are asked to maximize the total value of items that you can place in the knapsack without exceeding its weight capacity. 4

(i) Write the dynamic programming algorithm to solve the 0/1 knapsack.

(ii) Provide the time and space complexity of your algorithm.

(b) Calculate the minimum no. of multiplication and placing of parenthesis for the given chain matrix multiplication. $A1 = 2 \times 4$, $A2 = 4 \times 6$, $A3 = 6 \times 7$, $A4 = 7 \times 8$. 8

(c) Write Huffman code algorithm and solve the given problem $A : 20$, $B : 13$, $C : 45$, $D : 34$, $E : 16$, $F : 27$, $G : 19$. 8

Unit-III

3. (a) Define Finger printing algorithm with an example. 4

(b) (i) Define the concept of randomized algorithms and explain why they are used in computational problems.

(ii) Describe at least two de-randomization techniques, such as the method of conditional probabilities and pseudo random generators. Provide a step-by-step explanation of how these techniques work.

(iii) Discuss the advantages and limitations of de-randomization in the context of algorithm design and analysis. 8

(c) Briefly describe about Algebraic methods with examples. 8

Unit-IV

each step, including the residual graph and the evolving flow.

(ii) Discuss the concep of minimum cut in the context of flow netw rks. Identify the minimum cut in the provided fl v network and explain its significance. 8

Unit-V

5. (a) Explain the concept of decision trees in machine learning. 4

(b) Illustrate the Red Black Tree property and using the following elements create a Red Black Tree. 8

(c) Explain the concept of Fibonacci Heaps in detail.

(i) Define the structure and properties of Fibonacci Heaps, including the concept of nodes, key values, and the potential degrees of nodes.

(ii) Describe the Fibonacci Heap operations, specifically the processes of insertion, union, decrease key, and extract minimum. Provide a step-by-step walk through for each operation. 8