

2074

M.E. (Computer Science and Engineering)

First Semester

CS-8101: Advance Algorithms

(Common with CSN 8101)

(For UIET Only)

Time allowed: 3 Hours

Max. Marks: 50

**NOTE:** Attempt five questions in all, including Question No. 1 (Section-A) which is compulsory and selecting two questions from each Section B-C.

x-x-x

| Section-A |  |             |
|-----------|--|-------------|
| Q1.       | a) Explain key features of the PRAM model and how it is used in algorithm analysis.<br>b) Define implicit and explicit constraints for 8-queen's problem<br>c) Define P and NP class of problems.<br>d) Greedy Algorithms always provide an optimal solution. Comment<br>e) Partial solutions obtained during Kruskal's algorithm are also trees. Justify your answer.   | 10          |
| Section-B |  |             |
| Q2.       | a) Justify the big Theta of $2n^4+5n^3+10n^2+3$<br>b) Explore the time and space complexity of the Strassen's matrix multiplication algorithm in comparison to standard matrix multiplication algorithm. Provide insights into scenarios where one may be preferred over the other.  | 4<br>6      |
| Q3.       | a) Apply the Quick Sort algorithm to an array with duplicate elements, such as {3, 1, 4, 1, 5, 9, 2, 6, 5}.<br>b) Discuss how handling duplicates affects the algorithm's performance and analyze its time complexity.<br>c) How can the performance of quick sort is affected by selection of pivot? Can it be improved?  | 4<br>3<br>3 |
| Q4.       | a) What is multistage graph problem? What is the time complexity of multistage graph? Explain<br>b) Formulate the 0-1 Knapsack problem and describe how it can be solved using the Branch-and-Bound technique. Provide the pseudocode for the algorithm and discuss its time complexity.   | 4<br>6      |
| Section-C |  |             |
| Q5.       | a) Can n queen problem be solved using backtracking? Justify your answer.<br>b) You are given the daily stock prices of a company for <b>n days</b> . Design a dynamic programming algorithm to find the maximum profit that can be obtained by buying and selling the stock, with the constraint that you can't sell a stock before buying it. Make suitable assumptions yourself.  | 4<br>6      |
| Q6.       | a) Given a directed graph with the following edge length matrix:<br>$\begin{matrix} 0 & 8 & 6 & 5 \\ 7 & 0 & 9 & 7 \\ 6 & 10 & 0 & 8 \\ 4 & 5 & 3 & 0 \end{matrix}$ Solve the Travelling Salesperson Problem using the dynamic programming method. Specify the time complexity of your solution and provide a step-by-step explanation of the decision-making process in constructing the dynamic programming table.<br>b) Show that job sequence with deadline is NP-hard problem | 7<br>3      |
| Q7.       | a) Given a text $T = "abababcbababcbabababc"$ and a pattern $P = "ababcab"$ , apply the Knuth-Morris-Pratt algorithm to find all occurrences of the pattern in the text. Provide the failure function values for each position in the pattern and the final matching positions.<br>b) Given a decision problem Q that is NP-complete and a new problem R. R is reducible to Q, explain whether R is also NP-complete or not. Provide a brief justification for your answer.        | 6<br>4      |

x-x-x