

Class Test (Set-03)
Course Title: Computer Algorithms

Time: 30 minutes

Marks: 10

1. a) 3

The VU Library is arranging 50 rare manuscripts placed in random order. The librarian sorts them by repeatedly selecting the earliest year and placing it at the correct position.

Select the appropriate algorithm for sorting the manuscripts here and asymptotically determine its time and space complexity.

- b) Consider the following equations representing recurrence relation of different algorithms: 4

$$\text{i) } T(n) = \begin{cases} 1, & \text{if } n = 1 \\ \frac{216}{125}T\left(\frac{5n}{6}\right) + \theta(n^3 \log n), & \text{if } n > 1 \end{cases}$$

$$\text{ii) } T(n) = \begin{cases} 1, & \text{if } n = 1 \\ 4T\left(\frac{n}{3}\right) + O(n^3), & \text{if } n > 1 \end{cases}$$

Determine the time complexity of each algorithm and rank them by efficiency.

- c) In Binary Search Algorithm, the array is typically divided into two subgroups. If it were divided into four subgroups, would it affect the time complexity? Justify your answer with a mathematical explanation. 3

Class Test (Set-04)
Course Title: Computer Algorithms

Time: 30 minutes

Marks: 10

1. a) 3

The VU Library has a digital catalog of 10,000 books sorted by publication year. A student wants to check if a book with a given year exists. The librarian decides to use a method that repeatedly halves the search range.

Select the appropriate algorithm to help the librarian and asymptotically determine its time and space complexity.

- b) Consider the following equations representing recurrence relation of different algorithms: 4

$$\text{i) } T(n) = \begin{cases} 1, & \text{if } n = 1 \\ \frac{64}{49}T\left(\frac{7n}{8}\right) + \theta(n^2 \log n), & \text{if } n > 1 \end{cases}$$

$$\text{ii) } T(n) = \begin{cases} 1, & \text{if } n = 1 \\ 11T\left(\frac{n}{3}\right) + O(n^3), & \text{if } n > 1 \end{cases}$$

Determine the time complexity of each algorithm and rank them by efficiency.

- c) Suppose you are given an array that is already sorted except for one element that is out of place. Analyze which of these algorithms (Selection Sort, Bubble Sort, Insertion Sort) would handle this case most efficiently, and explain your reasoning. 3

