

Birla Institute of Technology and Science, Pilani
Mid-semester examination March 2023 - Question paper

Course name: Data Structures & Algorithmic thinking
Time: 11:00 AM – 12:30 PM (1.5 hours)

Course code: MPBAG537
Total marks: 25

Note: Attempt all the questions

1. Enqueue operation is defined for the following data structure 1
 - a. Stack
 - b. Queue
 - c. Array
 - d. Hash table

2. Stack data structure follows this rule. 1
 - a. LIFO
 - b. FIFO
 - c. FILO
 - d. A & C

3. For an array, $A = [4,9,1,2,6,4,5,3]$, what would be the value of array A after the execution of the third pass-through of the following sorting algorithms 6
 - a. Insertion sort
 - b. Bubble sort
 - c. Selection sort

4. What is the worst-case time complexity of following sorting algorithms in terms of Big-O notation 3
 - a. Insertion sort
 - b. Bubble sort
 - c. Selection sort

5. Write the total number of comparison operations for the bubble sort algorithm. Write your answer in terms of N and its formula where an array contains 'N' elements. 1

6. Write the total number of swapping operations for Bubble sort and Selection sort algorithm for the given array $A = [7,4,3,5,1,9,0,8]$. 3

Note: Selection sort performs no swapping if the value is in its correct place.

7. In the worst-case scenario, how many steps will be taken for the following operations for the given data structure/algorithm? Mention your answer in terms of N, where N is the total number of elements in the array. Please do not use Big-O notation. 5
 - a. Read a value from a given index position in a set

- b. Search for a value in an ordered array using binary search
- c. Insert an element at the beginning of a set
- d. Delete an element at the beginning of an ordered array
- e. Insert an element at the end of an ordered array

8. Selection sort performs less number of operations as compared to bubble sort for arrays such as $A = [5,4,3,2,1]$ (Worst-cases) - Write True/False and briefly explain why. 1
9. What is the maximum number of steps (Binary_search function calls) it would take to perform a binary search on the following array? 3
- $A = [1, 2, 4, 5, 7, 9, 10, 16, 19, 21, 26, 28, 50, 61, 79, 100]$
- Only write the exact number of steps in terms of N , where N is the total number of elements in the array.
- Please do not approximate and do not use Big-O notation.
10. Write the average case time complexity of finding a median value from an unsorted array. Use the Big-O notation 1