BM2043 - Algorithms and Data Structures

Exercise - 5

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Write the most efficient algorithm for the following problems in C++ and mention the Time and Space Complexity of your algorithms in the comments (at the end).

HEAPS

1. **Construct a max and min heap using struct or class and implement the following functions:**
   - **Heapify**
   - **Max_element / Min_element**
   - **Insertion**
   - **Deletion**

2. **Find the kth smallest element and kth largest element of an array using heaps.**

   Test Case:

   Input: arr = [1,7,2,3,4,5,6,7,0,13,3] k=2

   Output: 1 and 7.

3. **You are given an array of k linked-lists lists, each linked-list is sorted in ascending order. Merge all the linked-lists into one sorted linked-list and return it.**

   Test Case:

   Input: arr = [[1,4,5],[1,3,4],[2,6]].

   Output: list: 1,1,2,3,4,5,6.

HASH MAPS

1. **Given an unsorted integer array nums, return the smallest missing positive integer. The algorithm should be in O(n) time and O(1) space complexity.**
2. **Create your own hash map based on the data provided. The space efficiency of the hash map should greater than 75%. The time complexity of search operation should be O(1).**