DSA Assignment 3

(Sorting and Searching) 9th Aug 2023

Note: For all the below given problems, write the space and time complexity.
Note: Do not use inbuilt functions.

Problem 1: (10M)

Given a non-negative integer `x`, return *the square root of* `x` *rounded down to the nearest integer*. The returned integer should be **non-negative** as well.

You **must not use** any built-in exponent function or operator.

- For example, do not use `pow(x, 0.5)` in c++ or `x ** 0.5` in python.

Example 1:

Input: x = 4 **Output:** 2
Explanation: The square root of 4 is 2, so we return 2.

Example 2:

Input: x = 8 **Output:** 2
Explanation: The square root of 8 is 2.82842..., and since we round it down to the nearest integer, 2 is returned.

Constraints:

- $0 <= x <= 2^{31} - 1$
- Try to solve in most optimized way possible.

Problem 2: (10M)

You are given two sorted arrays. You need to merge these two arrays such that the initial numbers (after complete sorting) are in the first array and the remaining numbers are in the second array. **(Instruction : optimise the algorithm)**

Example 1:

Input: arr1[ ] = {1, 5, 9, 10, 15, 20}, arr2[ ] = {2, 3, 8, 13}

Output: arr1[ ] = {1, 2, 3, 5, 8, 9}, arr2[ ] = {10, 13, 15, 20}

Problem 3: **(10M)**

Given the arrival and departure times of all trains that reach a railway station, the task is to find the minimum number of platforms required for the railway station so that no train waits. You are given two arrays that represent the arrival and departure times of trains that stop.
(Instruction : optimise the algorithm)

Input:
arr[ ] = {9:00, 9:40, 9:50, 11:00, 15:00, 18:00},
dep[ ] = {9:10, 12:00, 11:20, 11:30, 19:00, 20:00}
Output: 3
Explanation: There are at-most three trains at a time (time between 9:40 to 12:00)

Input:
arr[ ] = {9:00, 9:40},
dep[ ] = {9:10, 12:00}
Output: 1
Explanation: Only one platform is needed.