Please Note

1. The labe exam is for 1 hour 45 minutes.

2. Each test case carries equal marks.

3. If you pass all test cases, you will receive a bonus marks.

4. You should not write garbage programs just to pass test cases or copy.

Lab Exam 1

September 16, 2021

1. (5 points + Bonus 2 points) Minimum Sum

   You are given an array of n numbers $- a_1, a_2, \ldots, a_n$. Your job is to find two numbers in this array whose sum is the minimum.

   Input: The first line contains single integer $n(1 \leq n \leq 10000)$— the number of cards in the deck.

   The second line contains a sequence of n integers $a_1, a_2, \ldots, a_n(1 \leq a_i \leq 10000)$

   Output: $\min_{i,j,i\neq j}\{a_i + a_j\}$

Input	:	5
		1 4 3 2 5
Output	:	3

   Explaination: 1+2 = 3 is the minimum sum in this array.

2. (7 points + Bonus 2 points) Subarray

   You are given a permutation of n numbers from $[1, n]$. You have to output the smallest subarray that needs to be sorted in order to sort the array.

   Input: The first input line contain an integer $n(1 \leq n \leq 1000)$. The second line contains the permutation of first n natural numbers.

   Output: The length of the smallest subarray that needs to be sorted.

Input	:	5
		1 4 3 2 5
Output	:	3

   Explaination: The subarray [4 3 2] need to be sorted in order to sort the array.

Input	:	5
		1 2 3 4 5
Output	:	0

   Explaination: The array is already sorted.

3. (10 points + Bonus 3 points) Sorting with cards

   Kiran has n cards numbered from 1 to n. Kiran has come up with the following method to sort cards. The method runs in iteration. At any iteration, Kiran will take the top card of the deck. If the top card is the the minimum of all the cards in the deck, Kiran removes the card from the deck. Else, he places the card at the bottom of the deck. Assume that Kiran always know which is the minimum value card in the deck. Find the number of times, Kiran takes out the top card from the deck.

   Input: The first line contains single integer $n(1 \leq n \leq 10000)$— the number of cards in the deck.

   The second line contains a sequence of n integers $a_1, a_2, \ldots, a_n(1 \leq a_i \leq 10000)$, where a_i is the number written on the i-th from top card in the deck.

   Output: The number of times Kiran takes out the top card from the deck.

Input	:	4
		6 3 1 2
Output	:	7

4. (10 points + Bonus 3 points) Sorting with Books

Neha has n books of k distinct colors. Neha went to to the book shop today and bought k more books of k distinct colors (the colors that she already has with her). When Neha reached her home, she saw some one has messed up with her bookshelf (but all the books are still on the book-shelf). Neha likes to keep all the books with the same color together. So, Neha is now sorting the books in her own peculiar way. At each iteration, Neha picks an arbitrary book(either on the bookshelf or the one she bought just now) and keeps it at the right end of the shelf. However, she is also smart and want to perform this operation minimum number of times. What is the minimum number of operations required to sort the books?

Input: The first line contains single integer $n(1 \le n \le 10000)$— the number books on the shelf.

The second line contains a sequence of n integers $a_1, a_2, \ldots, a_n (1 \le a_i \le 10000)$, where a_i is the the color of the i-th book on the shelf.

Output: The minimum number of times Neha keeps a book at the end of the shelf.

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Input    :   2
             1 2
Output   :   3
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Iteration 1: 1 2 2 (keep the book colored 2 (that Neha has just bought) at the end)
Iteration 2: 1 2 2 1 (keep the book colored 1 (that Neha has just bought) at the end)
Iteration 3: 2 2 1 1 (keep the the first book at the end)