



Data Structure and Algorithm Training Program

Week 2: Practice Problems

Practice Problem Level : Easy

	Problem Description	Expected Time Complexity	Examples/Test Cases
Problem 1	For the given two integers x and n, Write a program to compute the value of power function x^n . Here n is a non-negative integer.	$O(\log n)$	Example 1 Input : x=1, n=3, Output= 1 Example 2 Input : x= -4, n=2, Output=16 Example 3 Input : x= 2, n=4, Output= 16 Example 4 Input : x= -3, n=5, Output= -243 Example 5 Input : x= 3, n=1, Output= 3 Example 6 Input : x= 4, n=0, Output= 1
Problem 2	Fixed point in an array is an index where $A[i]=i$. Write a program to Find a fixed point in an Array. Return the fixed point if there is any fixed point present in the array otherwise return -1. All values are distinct integers(Can be negative) sorted in ascending order.	$O(\log n)$	Example 1 Input : $A[] = \{-8, -6, 1, 3, 7\}$, Output = 3 [Because $A[3]=3$] Example 2 Input : $A[] = \{-4, -2, 0, 5, 8, 9\}$, Output = -1 [No fixed point] Example 3 Input : $A[] = \{0, 3, 5, 8, 9\}$, Output=0 Example 4 Input : $A[] = \{-6, -4, -1, 2, 4\}$, Output=4
Problem 3	Write a program to find the maximum value in the array which is first increasing and then decreasing.	$O(\log n)$	Example 1 Input : $A[] = \{3, 4, 6, 7, 8, 9, 1, 2\}$, Output : 9 Example 2 Input : $A[] = \{6, 7, 5, 4, 3, 2, 1\}$, Output: 7 Example 3 Input : $A[] = \{1, 2, 3, 4, 5\}$, Output: 5 Example 4 Input : $A[] = \{6, 5, 3, 2, 1\}$, Output : 6
Problem 4	Write a program to return the square root of a given integer k. Here k must be non-negative. If k is not a perfect square then truncate the decimal digits and only return the integer part of the result.	$O(\log k)$	Example 1 Input : x=9, Output= 3 Example 2 Input : x= 12, Output= 3 [The square root of 12 is 3.464 which is not a perfect square. After removing decimal digits the output is 3] Example 3 Input : x=1, Output= 1

Practice Problem Level : Medium

	Problem Description	Expected Time Complexity	Examples/Test Cases
Problem 5	Two sorted array of size m and n are given. Write a program to find the kth smallest element after the merging both the sorted array.	$O(\log k)$	Example 1 Input : A[]={1,6,8}, B[]={2,4,7,9} and k=4 Output : 6 [After Merging A[] and B[], the final sorted order is : {1,2,4,6,7,8,9}. The fourth smallest element is 6] Example 2 Input : A[]={1,5}, B[]={4} and k=2, Output : 4 Example 3 Input : A[]={1,3,8}, B[]={2,6,9} and k=6, Output : 9
Problem 6	Two array A[] and B[] of size m and n are given where $m > n$. Write a program to check whether array B[] is subset of A[] or not. Array B[] is subset of array A[] if each element of B[] is present in the A[]. Assume that all the values in both the arrays are distinct.	$O(m \log m + n \log n)$ [Note: Efficient Solution of this problem is $O(n)$ via hashing]	Example 1 Input : A[]={1,3,9,5,8,6}, B[]={8,3,9} , Output : True Example 2 Input : A[]={1,3,9,5,8,6}, B[]={8,4,9}, Output : False Example 3 Input : A[]={0,6,8,3,1}, B[]={1,0}, Output : True Example 4 Input : A[]={4,3}, B[]={3}, Output : True
Problem 7	Given an array of integers A[] and a number K. Write a program to check for pair in A[] with sum equal to K. Return true if pair is present otherwise return false. Elements in array can be both positive and negative.	$O(n \log n)$ [Note : Efficient Solution of this problem is $O(n)$ via hashing]	Example 1 Input : A[]={-8,0,5,-3,6,9,-1}, K= 4, Output : True Example 2 Input : A[]={2,5,1,7}, K= 4, Output : False Example 3 Input : A[]={-2,-1,3}, K= 1, Output : True

Practice Problem Level : Difficult

	Problem Description	Expected Time Complexity	Examples/Test Cases
Problem 8	Inversion Count in an Array Let $A[]$ be an array of n distinct integers. If $i < j$ and $A[i] > A[j]$, Then pair (i, j) is called an inversion of $A[]$. Write a program to find all the inversion count in the array.	$O(n \log n)$	Example 1 Input : $A[] = \{3, 1, 2, 6, 5, 4\}$, Output : 5 [Given sequence has 5 inversions : (3,1), (3,2), (6,5), (6,4), (5,4)] Example 2 Input : $A[] = \{1, 2, 3, 5, 4\}$, Output : 1 [Only one inversion which is : (5,4)] Example 3 Input : $A[] = \{5, 4, 3, 2, 1\}$, Output : 10 Example 4 Input : $A[] = \{1, 2, 3, 4, 5\}$, Output : 0 Example 5 Input : $A[] = \{3, 2\}$, Output : 1
Problem 9	Maximum Subarray Sum You have an array $A[]$ of n integers. Write a program to find the sum of contiguous subarray of numbers which has the largest sum. Integers can be positive or negative.	$O(n \log n)$ [Note: The efficient solution of this problem is $O(n)$ via Dynamic Programming]	Example 1 Input : $A[] = \{-2, -3, 4, -1, -2, 1, 5, -3\}$, Output : 7 [The contiguous subarray of maximum sum is highlighted here : -2, -3, 4, -1, -2, 1, 5, -3] Example 2 Input : $A[] = \{1, 2, -3, -4, 2, 7, -2, 3\}$, Output : 10 [The contiguous subarray of maximum sum is highlighted here : 1, 2, -3, -4, 2, 7, -2, 3] Example 3 Input : $A[] = \{3, 2, 1, 5, 6\}$, Output : 17 [Sum of all the Values because all the elements are positive] Example 4 : Input : $A[] = \{-4, -2, -3, 1, -1\}$, Output : 1 [Except 1, all the values in the subsequence are negative]
Problem 10	Finding Celebrity Puzzle : In a party on N people, There is celebrity. A celebrity is a person who knows nobody but is known by everyone else. The task is to identify a celebrity by only asking questions to people present in the party : Does person A know B? Design a strategy to find the celebrity in minimum number of questions or determine that the group has no such person.		

Enjoy Algorithms!

Thank You.