علوم راهبردی

به نام خداوند بخشنده مهریان

تمرین شماره دو درس طراحی الگوریتم ها

مهلت تحویل تمرین: ۸/۹/۱۳۸۷ ساعت ۲۳:۵۹

ملاحظات:

- پاسخ های خود را در قالب یک فایل فشرده به نام subject که به آدرس yourID-hw2.zip به آدرس dahw87.1@gmail.com می‌کشید.
- به همچنین، کارهای غیر اخلاقی مانند روتینی و... پذیرفته نیست. در صورت مشاهده تنها در نظر گرفته می‌شود.
- به همچنین, وجه زمان تحویل تمرین, تمدید نخواهد شد.
- در صورت تأخیر در فرستادن:
  • تا دو ساعت اول ۵ درصد از نمره کل شما کسر خواهد شد.
  • تأخیر کمتر از یک روز ۱۰ درصد از نمره کل شما کسر خواهد شد.
  • تأخیر کمتر از دو روز ۲۰ درصد از نمره کل شما کسر خواهد شد.
  • تأخیر کمتر از سه روز ۳۰ درصد از نمره کل شما کسر خواهد شد.
  • به تمرین با بیش از سه روز تأخیر نمره ای تعیق نمی‌گردد.

هر گونه سوال و مشکل با ابرادی را می‌توانید با mahdi.oraei@gmail.com در مян یک‌گذرانید.
1. You are given an array A with n values. You are told that the array A had previously been sorted, before it was rotated by some unknown number of positions. Provide an O(lg n)-time divide-and-conquer algorithm that determines both the minimum and maximum values in the array. Also trace your algorithm for this array A, where n=17. [Here A was rotated 6 positions left or 11 positions right, but assume this is unknown.]

| A | 17 | 19 | 23 | 29 | 31 | 37 | 41 | 43 | 47 | 53 | 59 | 2 | 3 | 5 | 7 | 11 | 13 |

2. Let A[1...n] be an array of n distinct numbers. If i < j and A[i] > a[j], then the pair(i,j) is called an inversion of A. Give an algorithm that determines the number of inversions in any permutation on n elements in O(n lg n) worst-case time.

3. A climatologist has a large data set of temperatures recorded daily for more than a century. To study global warming trend, he would like to find a period during which the daily average temperature was increased the most. Specifically, he has an array of average temperatures t = [t₁, t₂, . . . , tₙ], where tᵢ is the average temperature of the ith day on record. He would like to find a pair of day (i, j) for which i < j and tₖ−tᵢ is the largest among all such pairs. Help him design an O(n lg n)-time divide-and-conquer algorithm to find such a pair.

4. Given an array of n numbers, we would like to find an ordered subset of the elements of the array which are in increasing order. Among all such subsets we are interested in the largest. Design and analyze an O(n²) divide and conquer algorithms that finds the size of the largest such subset.

5. A directed graph G = (V, E) is singly connected if implies that there is at most one simple path from u to v for all vertices u, v in V. Give an efficient algorithm to determine whether or not a directed graph is singly connected.

6. The diameter of a tree T = (V, E) is given by: max δ(u,v) that is, the diameter is the largest of all shortest-path distances in the tree. Give an efficient algorithm to compute the diameter of a tree, and analyze the running time of your algorithm.

7. A directed graph G = (V, E) is said to be semiconnected if, for all pairs of vertices u, v in V, we have u → v or v → u. Give an efficient algorithm to determine whether or not G is semiconnected. Prove that your algorithm is correct, and analyze its running time.

8. Problem 22-2 except parts g and h (CLRS)