Homework 2

Name: Jiyang Tang

Netid: jt304

# Written Part

­

## Pseudocode of quicksort:

I used Hoare partition scheme here.

**function** quicksort(A, lo, hi)

**if** lo < hi

p = partition(A, lo, hi)

quicksort(A, lo, p)

quicksort(A, p + 1, hi)

**function** partition(A, lo, hi)

pivot := A[**floor**((hi + lo) / 2)]

i = lo - 1

j = hi + 1

**while true**

**do**

i = i + 1

**while** A[i] < pivot

**do**

j = j - 1

**while** A[j] > pivot

**if** i >= j

**return** j

swap A[i] with A[j]

The worst case occurs when one of the sublists returned by all partitioning routines are of size 2 less than the previous list (minus pivot and one element).

For example, [1, 3, 2, 4, 5] will be partitioned to [] and [3, 2, 4, 5], [3, 2, 4, 5] will be partitioned to [2] and [4, 5], and [4, 5] will be partitioned to [] and [5].

Then the time complexity of the worst case is . Since we need to make partition calls to get a list of size 1, and each partition call has complexity because it iterates through all elements in the list. So the overall time complexity is .

The best case occurs when all sublists returned by all partitioning routines are of size , where is the size of the previous list. That means the number of calls to the partition routine is slightly less than . Similarly, the partition routine has complexity, and the overall time complexity is .

## Problem 7-3 in Intro to Alg

1. Since we assume that all permutations of the input numbers are equally likely, then the probability of an element being chose as the pivot is . Then follows uniform distribution, which means .
2. Let be the running time of a recursive call in which the -th smallest element is chose as the pivot, then

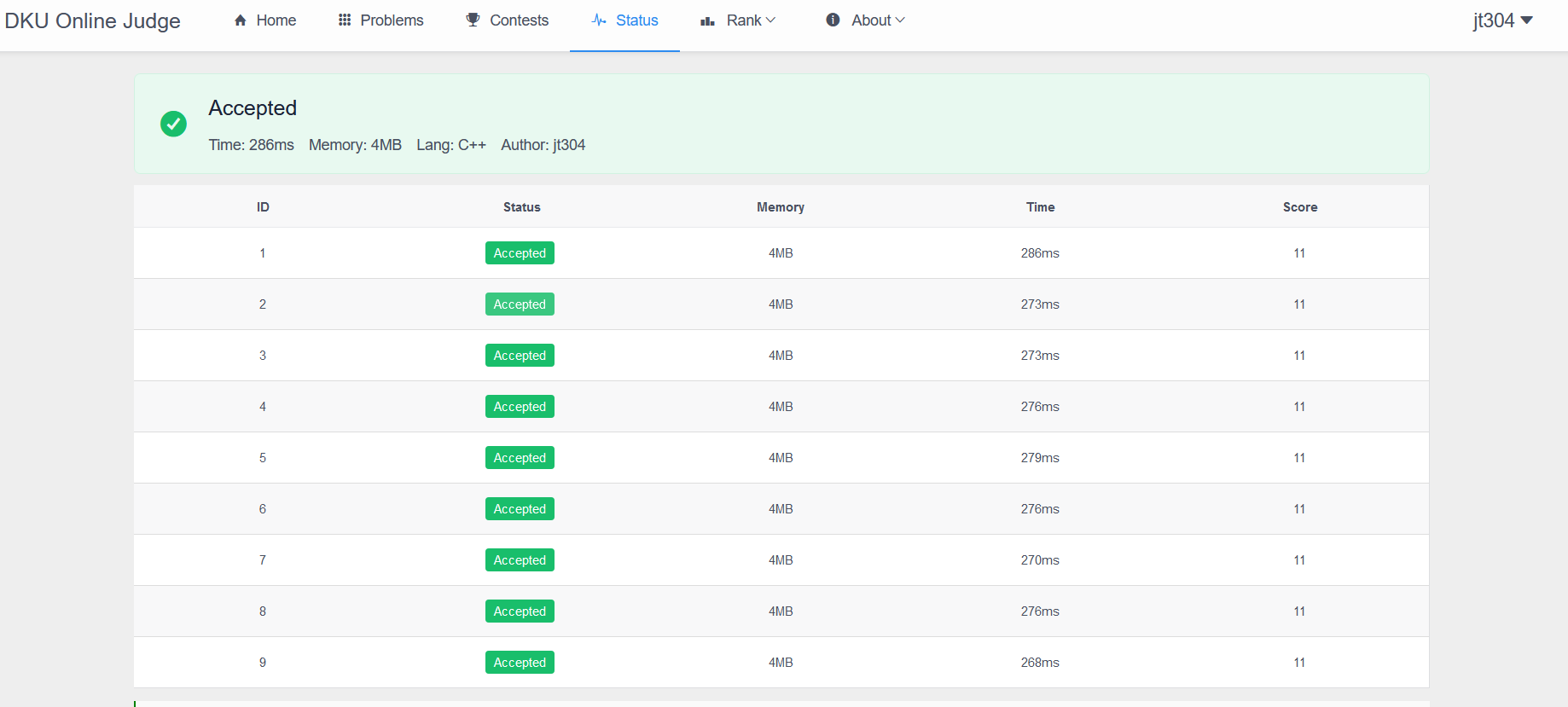
Where is the time of the shorter sublist, and for the other one, while is the time of the partition procedure.

So

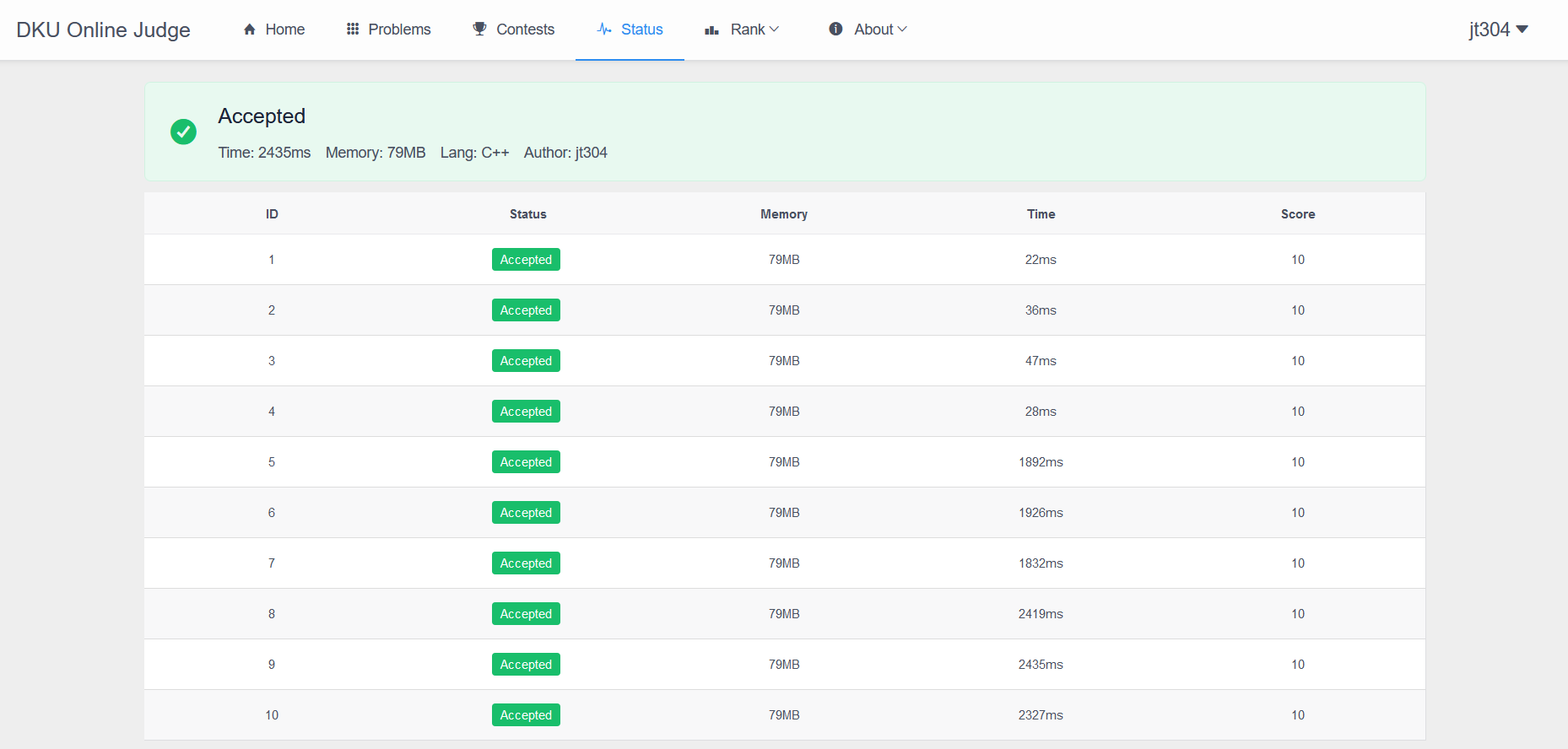
# DKUOJ

NOTE that the submission code is generated using gen\_single\_file\_cpp.sh source\_file generated\_file

Problem 7: Ten Integers



Problem 24: Sum of Three



Problem 25: Ten Integers

