Module 4 Graded Assignment and Quiz

Due Oct 8, 2021 at 11:59pm **Points** 4 **Questions** 4
Available Sep 25, 2021 at 12am - Feb 8 at 11:59pm 5 months
Time Limit None

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	2,318 minutes	4 out of 4

Score for this quiz: **4** out of 4
Submitted Oct 8, 2021 at 3:26pm
This attempt took 2,318 minutes.

Question 1

1 / 1 pts

Show how to multiply the complex numbers a+bi and c+di using only three real multiplications. The algorithm should take a, b, c, d as input and produce the real component ac−bd and the imaginary component ad+bc separately.

Now, identify the correct formulation of the product of two complex numbers a+bi and c+di using only three real multiplications.

- ab-cd+i[(a+c)(b+d)-bc-ab]
- (a+c)(b+d)-cd-ab+i[ab-cd]
- ac-bd+i[(a+b)(c+d)-bd-ac] **Correct!**
- (a+b)(c+d)-bd-ac+i[ac-bd]

Question 2

1 / 1 pts

Modify the closest pair of points algorithm so that the separating line L now separates the first n/4 points (sorted according to their x coordinates) from the remaining 3n/4 points. Write the recurrence relation that gives the running time of the modified algorithm. Is the running time of your algorithm still O(nlogn)? Specify the best asymptotic running time you can get for your algorithm and briefly justify.

Now, given the modified version of the closest pair of points algorithm, identify the best asymptotic running time you can get for this algorithm.

- $O(log_3^4(n))$
- $O(log_4^3(n))$

Correct!

- $O(nlog(n))$
- $O(n^2)$

Question 3

1 / 1 pts

Now let the line L separate the first $\sqrt{n}$ points (according to their x-coordinates) from the remaining $n - \sqrt{n}$ points. Write the recurrence relation that gives the running time of this modification of the algorithm. Is the running time of your algorithm stil O(nlogn)? If your answer is yes, provide a brief justification; if your answer is no, provide a (asymptotic) lower bound on the running time of the modified algorithm that should be enough to justify your answer.

Now, given the modified version of the closest pair of points algorithm, identify the highest asymptotic lower bounds for this algorithm from the following list:

- $\Omega(n^2)$

- $\Omega(nlog(n))$
- $\Omega(\sqrt{n})$

Correct!

- $\Omega(n\sqrt{n})$

Question 4

1 / 1 pts

You are interested in analyzing some hard-to-obtain data from two separate databases. Each database contains n numerical values—so there are 2n values total—and you may assume that no two values are the same. You'd like to determine the median of this set of 2n values, which we will define here to be the nth smallest value. However, the only way you can access these values is through queries to the databases. In a single query, you can specify a value k to one of the two databases, and the chosen database will return the kth smallest value that it contains. Since queries are expensive, you would like to compute the median using as few queries as possible. Give a recursive algorithm that finds the median value using at most O(logn) queries.

Now, explain why your algorithm only requires at most O(log(n)) queries to locate the median.

- The number of queries cannot be O(log(n)) because the $SELECT$ algorithm requires time complexity $O(n^2)$.

Correct!

- The algorithm eliminates roughly half the data with each recursive call.
- The algorithm separates the data into two roughly equally sized sets with each recursive call and finds the median of each of these sets.

Quiz Score: **4** out of 4