

CSE 780 Homework 4

Due: Wednesday, October 22 by class time

Midterm Exam I: Wednesday, October 29.

Topics: mathematical foundations + divide-and-conquer.

Closed book, closed notes.

1. Suppose we use n processors to sort an array by mergesort. Assume that it takes $\Theta(n)$ time to merge two sorted arrays of size $n/2$ even with multiple processors. What is the running time of mergesort?
2. Consider the closest-pair algorithm. Suppose we do not sort $A[i..j]$ by y -coordinate in $\text{Closest-Pair}(A[i..j], (p, q), ptr)$, but instead we sort the n points $A[1..n]$ by y into a linked list in the beginning of the algorithm, immediately after they are sorted by x . Does the modified algorithm work correctly? Justify your answer. (If your answer is YES, prove it; if your answer is NO, give a counterexample.)
Note: You have to submit an answer, but it will not be graded. (You will receive full credit as long as you submit an answer.)
3. Whether the above algorithm is correct or not, what is its time complexity?
4. Let $A[1..n]$ be an array of n elements. An element in A is said to be a *majority element* if it appears in A for more than $n/2$ times. Write an $O(n \log n)$ divide-and-conquer algorithm that determines whether or not a given array $A[1..n]$ has a majority element and, if it does, finds the majority element. You cannot sort the array. (Write your algorithm in pseudo-code and explain it in plain English.)