

Name:

Student ID:

CSE 101 Quiz 2

1. 3 pts Match the sorting algorithm with its worst case running time (Circle one).

a. Insertion sort	$O(\log(n))$	$O(n)$	$O(n\log(n))$	<u>$O(n^2)$</u>
b. Merge sort	$O(\log(n))$	$O(n)$	<u>$O(n\log(n))$</u>	$O(n^2)$
c. Quicksort	$O(\log(n))$	$O(n)$	$O(n\log(n))$	<u>$O(n^2)$</u>

2. 3 pts Given two sets S_1 and S_2 (each of size n), and a number x , describe a $O(n\log(n))$ algorithm for finding whether there exists a pair of elements, one from S_1 and one from S_2 , that add up to x . You need not write pseudocode, but be sure to be clear in your description. Also, provide some reasoning as to why the code runs in time $O(n\log(n))$.

Solution:

First, sort S_1 and S_2 in ascending order. This takes time $O(n\log(n))$. Then let $P1$ point to the first element of S_1 , and $P2$ point to the last element of S_2 .

while $P1$ and $P2$ are within bounds do

Let $M = (\text{element at } P1) + (\text{element at } P2)$.

If $M = x$, return TRUE.

Otherwise, if $M > x$, let $P1$ point at the next element in S_1 .

if $M < x$ let $P2$ point at the previous element in S_2 .

loop

return FALSE

Note that the loop only goes through each list once. So the whole loop can only be $O(n)$.

3. 4 pts The median of a set of numbers is the “middle-most” number. For example, the median of the set $\{1, 17, 21, 5, 2\}$ is 5 because there are an equal number of elements greater than 5 as there are less than 5. Give an $O(n \log(n))$ algorithm to compute the median of a list, assuming the list contains an odd number of elements. You need not write pseudocode, but be sure to be clear in your description. Also, provide some reasoning as to why the code runs in time $O(n \log(n))$.

Solution:

Sort the list (Takes time $O(n \log(n))$).

Return element $(n+1)/2$ in the list (Takes time $O(1)$).