

CS330 Homework 3*

1. (2 points) Describe an algorithm to find the longest word in an English sentence (where a sentence is a sequence of symbols, either a letter or a blank, which can then be broken into alternating words and blanks).
2. (2 points) The ternary search algorithm locates an element in a list of increasing integers by successively splitting the list into three sub-lists of equal (or as close to equal as possible) size, and restricting the search to the appropriate piece. Specify the steps of this algorithm.
3. (2 points) Use the definition of Big- O to show that $(x^3 + 2x) / (2x + 1)$ is $O(x^2)$.
4. (2 points) Show that $x \log x$ is $O(x^2)$ but that x^2 is not $O(x \log x)$.
5. (4 points) Show that each of these pairs of functions are of the same order.
 - a. $\log(x^2 + 1)$, $\log_2 x$
 - b. $\log_{10} x$, $\log_2 x$
6. (2 points) Given a real number x and a positive integer k , determine the number of multiplications used to find starting with x and successively squaring (to find x^2 , x^4 , x^8 , and so on). Is this a more efficient way to find $x^{(2^k)}$ (where $^$ means exponentiation) than by multiplying x by itself the appropriate number of times?
7. (2 points) Determine the least number of comparisons (the best-case performance) needed
 - a. To find the maximum of a sequence of n integers.
 - b. To locate an element in a list of n terms using a binary search.
8. (4 points) Describe how the number of comparisons used in the worst case changes when the size of the list to be sorted doubles from n to $2n$, where n is a positive integer when these sorting algorithms are used.
 - a. The selection sort begins by finding the least element in the list. This element is swapped to the front. Then the least element among the remaining elements is found and swapped into the second position. This procedure is repeated until the entire list has been sorted.
 - b. The binary insertion sort is a variation of the insertion sort that uses a binary search technique rather than a linear search technique to identify the location to insert the i 'th element in the correct place among the previously sorted elements.

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