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CSED261: Discrete Mathematics for Computer Science
Homework 4: Algorithms

Question 1. Use the bubble sort to sort 6, 2, 3, 1, 5, 4, showing the lists obtained at each step.

Solutions

Question 2. Compare the number of comparisons used by the insertion sort and the binary insertion sort to sort the list 7, 4, 3, 8, 1, 5, 4, 2.

Solutions

Question 3. Show that each of these pairs of functions are of the same order.

1. $3x + 7, x$
2. $\log(x^2 + 1), \log_2 x$

Solutions

Question 4. An algorithm is called optimal for the solution of a problem with respect to a specified operation if there is no algorithm for solving this problem using fewer operations.

Algorithm 1 Finding the Maximum Element in a Finite Sequence

```
procedure max(a_1, a_2, ..., a_n: integers)
    max := a_1
    for i := 2 to n do
        if max < a_i then
            max := a_i
        end if
    end for
    return max                                  ▷ max is the largest element
end procedure
```

1. Show that Algorithm 1 is an optimal algorithm with respect to the number of comparisons of integers.
2. Is the linear search algorithm optimal with respect to the number of comparisons of integers?

Solutions