

6. Homework

Due: Tuesday 10/19/10 before class

Justify all your answers.

1. Decision tree (9 points)

Below is the code for *Bubble Sort*:

```
void bubbleSort(int A[1..n]){
  for(int i=1; i <= n; i++)
    for(int j=n; j >= i+1; j--)
      if(A[j]<A[j-1])
        swap(A[j],A[j-1]);
}
```

Draw the decision tree for Bubble Sort for an array $A[1..3]$ of $n = 3$ elements. Annotate the decision tree with comments as to which algorithm part a comparison belongs to.

2. Comparing sorting algorithms (9 points)

Given n numbers between 0 and $f(n) - 1$. Please give the runtimes for merge sort, for counting sort, and for radix sort (with optimized r) for each of the functions $f(n)$ below, and state which of the three sorting algorithms is faster in each case.

a) $f(n) = n^3$

b) $f(n) = 2^n$

c) $f(n) = n!$

3. Multi-min (9 points)

Consider the following task: Given an unsorted array of n numbers, find the k smallest numbers and output them in sorted order.

Describe three inherently different algorithms that solve this problem. One of your algorithms has to use a version of the SELECT algorithm.

Analyze their runtimes in terms of n and k (so you should have n and k in the big-Oh notation). Try to find the fastest possible algorithm. Which of your algorithms is the fastest?