Exercises

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(1) Compare and contrast the `linearSearch` and `binarySearch` algorithms by searching for numbers 45 and 54 in the following list: $(3, 8, 12, 34, 54, 84, 91, 110)$.

(2) Consider an array A of n elements, $a[0]...a[n-1]$ and the pseudocode for `bubbleSort` discussed in class:

```
for k = 1 to n-1 do

     for i = 0 to n-1-k
            if (A[i] > A[i+1])    swap A[i] and A[i+1]
```

(a) Describe what happens when you bubblesort an array A that is already sorted. How many swaps are performed by the inner loop each time? How many times is the outer loop executed?
(b) Show how you can change the code so that it exits the loop early if the inner loop performs no swap. Try to add as little extra code as possible. You can change the `if` to a `while`, or, you can look into exiting a loop using `break`.

(3) You are playing a game where your task is to guess the value of a hidden number that is one of n integers between 0 and $n-1$. For simplicity, we'll asume that n is a power of 2. Each time you make a guess, you are told whether your guess is too high or too low.
One strategy for playing this game is to guess 0, then 1, then 2, then 3, and so on, until hitting the hidden number. How long would it take you to guess the hidden number, in the worst case?
Describe a better strategy for playing this game and analyse it.

(4) Given an array of n real numbers, sketch how you'd find the pair of numbers that are closest in value.

(5) Same problem as above, but find the pair of numbers that are farthest apart in value.