

CS200 - Worksheet 3

1. Create a recurrence relation for the worst case runtime of the following algorithm for binary search when $f - s + 1 = n$. You may assume n is a power of 2. Use the iterative method to solve the recurrence relation.

Algorithm 1: BinarySearch(A, x, s, f)

Input : Sorted (in increasing order) array of integers A , an integer x that occurs in the array, a starting index s and an ending vertex f

Output: An index i such that $A[i] = x$.

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1 if  $s == f$  then
2   | return  $s$ ;
3 end
4  $mid = \lfloor (s + f)/2 \rfloor$ ;
5 if  $A[mid] < x$  then
6   | return BinarySearch( $A, x, mid + 1, f$ )
7 else
8   | return BinarySearch( $A, x, s, mid$ )
9 end
```

2. Let $K(n)$ be the size of the set of n -digit numbers that have an even number of 0's. Create a recurrence relation for $K(n)$. What is $K(3)$? (Hint 0: remember zero is even. Hint 1: think about the possible options for the value of the final digit. of the number. Hint 2: The size of the set of numbers that *don't* have an even number of 0's is the total number of elements minus the set of numbers that *do* have an even number of 0's.)
3. Create a recurrence relation for the number of ways a person can climb n stairs if the person can take one stair or two stair at a time. How many ways can this person climb a flight of 8 stairs?