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 $A[i] = x$.

1. if $s == f$ then
2. return $s$;
3. end
4. mid = [(s + f)/2];
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?