Problem 9

Assuming $T(n) = n + 1$ is true

Base Case: $T(0) = 0+1 = 1$

Case 1: If the input is even then the x mod 2 will not be 1 making line 2 false and hence, last line will execute directly, returning x+1 directly which is correct.

Case 2: If the input is odd, i-e 2n+1 then the algorithm will enter IF statement so,

$2 * \text{Increment}(\lfloor(2n+1)/2\rfloor)$

$2 * \text{Increment}(\lfloor(n+0.5)\rfloor)$

$2 * \text{Increment}(n)$

$2 * (n+1)$

$(2n+1) + 1$

Since, $T(2n+1) = (2n+1)+1$, $T(n) = n+1$ is also true for odd numbers

Time complexity: In worst case scenario, the input could be odd number such that it will be divided all the way to 1, in that case, the 3rd line will execute for O(logn) time