Problem 1. Find constants $a$ and $b$ such that $\sum_{k=0}^{\lfloor \lg n \rfloor} \lceil n/2^k \rceil = \Theta(n^a \lg n)$.

Problem 2. [Exercise 4.1-5] Show that the solution to $T(n) = 2T(\lfloor n/2 \rfloor + 17) + n$ is $O(n \lg n)$.

Problem 3. [Problem 4-2] An array $A[1..n]$ contains all the integers from 0 to $n$ except one. The elements of the array are represented in binary, and the only operation we can use to access them is “fetch the $j$th bit of $A[i]$,” which takes constant time. (So fetching an entire integer $A[i]$ takes $O(\lg n)$ time.)

Show that if we use only this operation, we can determine the missing integer in $O(n)$ time. (If you use an auxiliary array, you may assume that reading an integer from this array, or writing an integer to it, takes $O(1)$ time.)