1788B - Sum of Two Numbers

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Tutorial

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Let's assume that there is no carry while adding x and y. Denote $n = a_9 \cdots a_1 a_0$, $x = b_9 \cdots b_1 b_0$, $y = c_9 \cdots c_1 c_0$ in decimal system. The condition can be changed as the following condition.

- $a_i = b_i + c_i$ for all $0 \le i \le 9$. - Sum of b_i and sum of c_i should differ by at most 1.

If a_i is even, let $b_i = c_i = a_i/2$. Otherwise, let b_i and c_i be $\frac{a_i+1}{2}$ or $\frac{a_i-1}{2}$. By alternating between $(b_i, c_i) = (\frac{a_i+1}{2}, \frac{a_i-1}{2})$ and $(b_i, c_i) = (\frac{a_i-1}{2}, \frac{a_i+1}{2})$, we can satisfy the condition where sum of b_i and sum of c_i differ by at most 1.

There is an alternative solution. If n is even, divide it into $(\frac{n}{2}, \frac{n}{2})$. If remainder of n divided by 10 is not 9, divide it into $(\frac{n+1}{2}, \frac{n-1}{2})$. If remainder of n divided by 10 is 9, recursively find an answer for $\lfloor \frac{n}{10} \rfloor$ which is (x', y') and the answer will be $(10x' + 4, 10y' + 5)$ or $(10x' + 5, 10y' + 4)$ depending on what number has a bigger sum of digits.

The following solution has a countertest.

1. Trying to find x and y by bruteforce from $(1, n-1)$. 2. Trying to find x and y by bruteforce from $(\frac{n+1}{2}, \frac{n-1}{2})$

A solution that randomly finds (x, y) passes.