

Lab 5

First, problems are from Leetcode.... Then, I have made some stories so it will be harder to find the problem on Leetcode...I will announce the leetcode origin problem number after all...

Problem 1

Yui is at the front of a building with N floors from 1 to N when she loses her way at the shopping street. Before Ui comes to pick her up, she has to do something to kill the time.

Ui will make Omurice for today's dinner, so Yui has bought some eggs. She decides to test the hardness of the eggs.

At first, there should exist a floor F with $0 \leq F \leq N$ such that any egg dropped at a floor higher than F will break, and any egg dropped at or below floor F will not break.

Yui wants to know **with certainty** what the value of F is.

Yui has K eggs. Each egg is identical in function, and if an egg breaks, she cannot use it again.

Each *move*, Yui can take an egg (if you have an unbroken one) and drop it from any floor x (with $1 \leq x \leq N$). If the egg does not break, it will fly back to Yui's bag.

What is the minimum number of moves that Yui needs to know with certainty what F is, regardless of the initial value of F ?

Example 1:

Input: $K = 1, N = 2$

Output: 2

Explanation:

Drop the egg from floor 1. If it breaks, she knows with certainty that $F = 0$.

Otherwise, drop the egg from floor 2. If it breaks, she knows with certainty that $F = 1$.

If it didn't break, then with certainty $F = 2$.

Hence, Yui needed 2 moves in the worst case to know what F is with certainty.

Example 2:

Input: $K = 2, N = 6$

Output: 3

Example 3:

Input: $K = 3$, $N = 14$

Output: 4

Problem 2

Narancia is learning maths, but Fugo wants to go out for a drink. He left with an array of integers, telling Narancia to pick out some of the integers (it could be all the integers) and calculate their sum. Fugo wants Narancia to find the max possible sum that can be divided by three, or Narancia will have to do all the chords today. Please help Narancia.

Example 1:

Input: `nums = [3,6,5,1,8]`

Output: 18

Explanation: Pick numbers 3, 6, 1 and 8 their sum is 18 (maximum sum divisible by 3).

Example 2:

Input: `nums = [4]`

Output: 0

Explanation: Since 4 is not divisible by 3, do not pick any number.

Example 3:

Input: `nums = [1,2,3,4,4]`

Output: 12

Explanation: Pick numbers 1, 3, 4 and 4 their sum is 12 (maximum sum divisible by 3).

Constraints:

- `1 <= nums.length <= 4 * 10^4`
- `1 <= nums[i] <= 10^4`

Problem 3

Here is an update about Nanana's collection. We find a lot of keys that only one of them may be related for this treasure. Each has the same appearance and a unique integer as its id.

Nanana spell a magic and places all the keys into a matrix. This matrix has the following properties:

- Keys are sorted with their integer id in each row in ascending order from left to right.
- Keys are sorted with their integer id in each column in ascending order from top to bottom.

The game rule is that Nanana will announce an integer. If this integer `n` is in this matrix, then the key with id `n` will be the expected key, return `true`. If `n` is not in this matrix, the true key is in Nanana's hand. The player has to return `false` and then reach Nanana for the true key.

Please write an algorithm that searches for this integer `n` as far as possible in this `m x n` matrix

Example :

```
[
  [1, 4, 7, 11, 15],
  [2, 5, 8, 12, 19],
  [3, 6, 9, 16, 22],
  [10, 13, 14, 17, 24],
  [18, 21, 23, 26, 30]
]
```

Example:

Consider the following matrix:

```
[
  [1, 4, 7, 11, 15],
  [2, 5, 8, 12, 19],
  [3, 6, 9, 16, 22],
  [10, 13, 14, 17, 24],
  [18, 21, 23, 26, 30]
]
```

Given target = `5`, return `true`.

Given target = `20`, return `false`.

Problem 4

Finding the longest substring without duplication (one character should appear only once in this substring).

Example 1:

Input: abcabcbb

Output: abc with length 3

Example 2:

Input: ??????

Output: ? with length 1

Example 3:

Input: sllktt

Output: lkt with length 3