**COMPETITIVE PROGRAMMING WEEK - 4**

**Q 1:** **Binary Gap**

Given a positive integer N, find and return the longest consecutive 1's in the binary representation of N.

If there aren't consecutive 1's, return 0.

**Example:**

**Input:** 22

**Output:** 2

**Explanation:**

22 in binary is 0b10110.

In the binary representation of 22, there are three ones.

The first consecutive pair of 1's have length 2.

The second consecutive pair of 1's have length 1.

The answer is the largest of these two, which is 2.

**Test case: 1**

**Input:** 0

**Output:** 0

**Test case: 2**

**Input:** 55

**Output:** 2

**Test case: 3**

**Input:** -5

**Output:** 2

**Test case: 4**

**Input:** 12354

**Output:** 6

**Test case: 5**

**Input:** 6

**Output:** 1

**Test case: 6**

**Input:** 256

**Output:** 0

**Q 2:** **Counting Bits**

Given a non negative integer number **num**. For every numbers **i** in the range **0 ≤ i ≤ num** calculate the number of 1's in their binary representation and return them as an array.

**Example:**

**Input:** num = 5

**Output:** [0,1,1,2,1,2]

**Explanation:**

The number are 0,1,2,3,4,5

No. of 1’s in 0: 0

No. of 1’s in 1: 1

No. of 1’s in 2: 1

No. of 1’s in 3: 2

No. of 1’s in 4: 1

No. of 1’s in 5: 2

**Test case: 1**

**Input:** n = 15

**Output:** [0, 1, 1, 2, 1, 2, 2, 3, 1, 2, 2, 3, 2, 3, 3, 4]

**Test case: 2**

**Input:** n = 16

**Output:** [0, 1, 1, 2, 1, 2, 2, 3, 1, 2, 2, 3, 2, 3, 3, 4, 1]

**Test case: 3**

**Input:** n = 1

**Output:** [0, 1]

**Test case: 4**

**Input:** n = 25

**Output:** [0, 1, 1, 2, 1, 2, 2, 3, 1, 2, 2, 3, 2, 3, 3, 4, 1, 2, 2,3, 2, 3, 3, 4, 2, 3]

**Test case: 5**

**Input:** n = 5

**Output:** [0, 1, 1, 2, 1, 2]

**Test case: 6**

**Input:** n = 6

**Output:** [0, 1, 1, 2, 1, 2, 2]

**Q 3:** **Number of Atoms**

Given a chemical formula (given as a string), return the count of each atom.

An atomic element always starts with an uppercase character, then zero or more lowercase letters, representing the name.

1 or more digits representing the count of that element may follow if the count is greater than 1. If the count is 1, no digits will follow. For example, H2O and H2O2 are possible, but H1O2 is impossible.

Two formulas concatenated together produce another formula. For example, H2O2He3Mg4 is also a formula.

A formula placed in parentheses, and a count (optionally added) is also a formula. For example, (H2O2) and (H2O2)3 are formulas.

Given a formula, output the count of all elements as a string in the following form: the first name (in sorted order), followed by its count (if that count is more than 1), followed by the second name (in sorted order), followed by its count (if that count is more than 1), and so on.

**Example 1:**

**Input:** formula = "H2O"

**Output:** "H2O"

**Explanation:**

The count of elements are {'H': 2, 'O': 1}.

**Example 2:**

**Input:** formula = "Mg(OH)2"

**Output:** "H2MgO2"

**Explanation:**

The count of elements are {'H': 2, 'Mg': 1, 'O': 2}.

**Test case: 1**

**Input:** H2O

**Output:** H2O

**Test case: 2**

**Input:** Mg(OH)2

**Output:** H2MgO2

**Test case: 3**

**Input:** K4(ON(SO3)2)2

**Output:** K4N2O14S4

**Test case: 4**

**Input:** C10H16O

**Output:** C10H16O

**Test case: 5**

**Input:** Zn(NO3)2

**Output:** N2O6Zn

**Test case: 6**

**Input:** NaOH

**Output:** HNaO

**Test case: 7**

**Input:** F2

**Output:** F2