

## Problem D: Generalized Roman Numerals

The ancient Romans developed a terrible numbering system in which I, V, X, L and C stood for 1, 5, 10, 50 and 100, respectively. So XXXVII represents 37 ( $10+10+10+5+1+1$ ). They typically wrote the numerals in non-increasing order. However, when a single Roman numeral is written before one that is larger, we subtract the smaller from the larger. So we can write IV and IX to represent 4 and 9 (subtracting 1), or XL and XC to represent 40 and 90 (subtracting 10). To represent 94, we would write XCIV.

VIC is generally not considered a traditional Roman numeral, but we can interpret this as another representation of 94: VI is 6, so VIC is  $100-6$ . In general, if we have two expressions  $a$  and  $b$  representing values  $v(a)$  and  $v(b)$ , then we say that  $v(ab)$  is  $v(a) + v(b)$  if  $v(a) \geq v(b)$ , and  $v(b) - v(a)$  otherwise.

Unfortunately, this generalization introduces some ambiguity, since different orders of evaluation may result in different values. For example, consider IVX: IV is 4 and X is 10, so by that reasoning IVX is 6. However, I is 1 and VX is 5, so this suggests that IVX is actually 4. To remedy this ambiguity, we allow the addition of parentheses. The question arises: for a given string of Roman numeral characters, how many different values can be obtained using different placements of parentheses?

**Input**                      **Time Limit: 3 secs, No. of Test Cases: 33, Input File Size 0.678K**

Each test case consists of a single string containing only the characters I, V, X, L and C. The length of this string will be  $\leq 50$ . A line containing of a single 0 will terminate input.

### Output

For each test case, output all possible distinct values that can be represented by the string via the addition of parentheses. Display these values in increasing order.

### Sample Input

```
IVX
XIXIX
0
```

### Sample Output

```
Case 1: 4 6
Case 2: 8 10 28 30 32
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