

Robot Path Decoding

Problem

Your country's space agency has just landed a rover on a new planet. The planet's surface can be thought of as a grid of squares containing 10^9 columns (numbered starting from 1 from west to east) and 10^9 rows (numbered starting from 1 from north to south). Let (w, h) denote the square in the w -th column and the h -th row. The rover begins on the square $(1, 1)$.

The rover can be maneuvered around on the surface of the planet by sending it a *program*, which contains a string of characters representing movements in the four cardinal directions. The robot executes each character of the string in order. The rover moves according to the following rules:

- N: Move one unit north.
- S: Move one unit south.
- E: Move one unit east.
- W: Move one unit west.

There is also a special instruction $X(Y)$, where X is a number between 2 and 9 (inclusive) and Y is a non-empty subprogram. This denotes that the robot should repeat the subprogram Y a total of X times. For example:

- $2(NWE)$ is equivalent to `NWENWE`.
- $3(S2(E))$ is equivalent to `SEEESEESEE`.
- `EEEE4(N)2(SS)` is equivalent to `EEEENNNNSSSS`.

Since the planet is a spheroid, the first and last columns are adjacent, so moving east from column 10^9 will move the rover to column 1 and moving south from row 10^9 will move the rover to row 1. Similarly, moving west from column 1 will move the rover to column 10^9 and moving north from row 1 will move the rover to row 10^9 . Given a program that the robot will execute, determine the final position of the robot after it has finished all its movements.

Input

The first line of the input gives the number of test cases, T . T lines follow. Each line contains a single string: the program sent to the rover.

Output

For each test case, output one line containing `Case #x: w h`, where x is the test case number (starting from 1) and $w\ h$ is the final square (w, h) the rover finishes in.

Limits

Time limit: 10 seconds.

Memory limit: 1 GB.

$1 \leq T \leq 100$.

The string represents a valid program.

The length of each program is between 1 and 2000 characters inclusive.

Test Set 1

The total number of moves the robot will make in a single test case is at most 10^4 .

Test Set 2

No additional constraints.

Sample

| Sample Input | Sample Output |
|--|---|
| 4 SSSEEE N N3 (S) N2 (E) N 2 (3 (NW) 2 (W2 (EE) W)) | Case #1: 4 4 Case #2: 1 1000000000 Case #3: 3 1 Case #4: 3 999999995 |

In Sample Case #1, the rover moves three units south, then three units east.

In Sample Case #2, the rover moves one unit north. Since the planet is a torus, this moves it into row 10^9 .

In Sample Case #3, the program given to the rover is equivalent to NSSSNEEN.

In Sample Case #4, the program given to the rover is equivalent to
NWNWNWEEEEWEEEEWNWNWNWEEEEWEEEEW.