Nesting Depth (5pts, 11pts)

Attempts	Penalties	Penalty Time	Points	Points
1	0	11:36:53	✓	✓

Competitive Submissions

Attempt 1	✓	✓	11:36:53

Last updated: Apr 4 2020, 11:37

Problem

tl;dr: Given a string of digits **S**, insert a minimum number of opening and closing parentheses into it such that the resulting string is balanced and each digit d is inside exactly d pairs of matching parentheses.

Let the *nesting* of two parentheses within a string be the substring that occurs strictly between them. An opening parenthesis and a closing parenthesis that is further to its right are said to *match* if their nesting is empty, or if every parenthesis in their nesting matches with another parenthesis in their nesting. The *nesting depth* of a position p is the number of pairs of matching parentheses m such that p is included in the nesting of m.

For example, in the following strings, all digits match their nesting depth: `0((2)1)`, `(((3))1(2))`, `((((4))))`, `((2))((2))(1)`. The first three strings have minimum length among those that have the same digits in the same order, but the last one does not since `((22)1)` also has the digits 221 and is shorter.

Given a string of digits **S**, find another string S', comprised of parentheses and digits, such that:

- all parentheses in S' match some other parenthesis,
- removing any and all parentheses from S' results in **S**,
- each digit in S' is equal to its nesting depth, and
- S' is of minimum length.

Input

The first line of the input gives the number of test cases, **T**. **T** lines follow. Each line represents a test case and contains only the string **S**.

Output

For each test case, output one line containing `Case #x:` y, where x is the test case number (starting from 1) and y is the string S' defined above.

Limits

Time limit: 20 seconds per test set.
Memory limit: 1GB.
$1 \leq \mathbf{T} \leq 100$.
1 ≤ length of **S** ≤ 100.

Test set 1 (Visible Verdict)