Google Code Jam '16 World Finals Problem A - Integeregex

Time limit: 1.0s **Memory limit:** 64M

In this problem, a valid regular expression is one of the following. In the following descriptions, E_1, E_2, etc. denote (not necessarily different) valid regular expressions.

- A decimal digit: that is, one of $0, 1, 2, 3, 4, 5, 6, 7, 8, 9$.
- Concatenation: E_1E_2.
- Disjunction: $(E_1|E_2|\ldots|E_N)$, for at least two expressions. Note that the outer parentheses are required.
- Repetition: $(E_1)*$. Note that the outer parentheses are required.

For example, `7`, `23`, `(7)*`, `(45)*`, `(1|2|3)`, `((2)*|3)`, `(1|2|3)`, and `((0|1))*` are valid expressions. `(7)`, `4|5`, `4*`, `(1|)`, and `(0|1)*` are not.

We say that an expression E matches a string of digits D if and only if at least one of the following is true:

- $E = D$.
- $E = E_1E_2$ and there exist D_1 and D_2 such that $D = D_1D_2$ and E_i matches D_i.
- $E = (E_1|E_2|\ldots|E_N)$ and at least one of the E_i matches D.
- $E = (E_1)*$ and there exist $D_1, D_2, \ldots, D_N$ for some non-negative integer N such that $D = D_1D_2\ldots D_N$ and E_1 matches each of the D_i.

In particular, note that $(E_1)*$ matches the empty string. For example, the expression `((1|2))*3` matches `3`, `13`, `123`, and `2221123`, among other strings. However, it does not match `1234`, `3123`, `12`, or `33`, among other strings.

Given a valid regular expression R, for how many integers between A and B, inclusive, does R match the integer's base 10 representation (with no leading zeroes)?

Input Specification

The first line of the input gives the number of test cases, T. T test cases follow; each consists of two lines. The first line has two positive integers A and B: the inclusive limits of the integer range we are interested in. The second has a string R consisting only of characters in the set `0123456789()|*`, which is guaranteed to be a valid regular expression as described in the statement above.

Output Specification

For each test case, output one line containing the number of integers in the inclusive range $[A, B]$ that the regular expression R matches.

Limits

$1 \leq T \leq 100$

$1 \leq A \leq B \leq 10^{18}$

$1 \leq |R| \leq 30$

Sample Input

```
8
1 1000
(0)*1(0)*
379009 379009
379009
1 10000
(12)*(34)*
4 5
45
1 100
((0|1))*
1 50
(01|23|45|67|23)
1 1000000000000000000
((0|1|2|3|4|5|6|7|8|9))*
1 1000
1(56|(((7|8))*9)*)
```

Sample Output

```
4
1
5
0
4
2
1000000000000000000
6
```