Expressions V2

HackerRank

Once Kazama had written a basic calculator, he read further about other operators and operator precedence. Now he is writing a new calculator with following details:

- *Binary addition:* $x + y$.
- *Binary subtraction:* $x - y$
- *Multiplication:* $x \times y$
- *Division:* $\frac{x}{y}$
- *Unary operators:* $+x$ and $-x$
- *Brackets:* $(\ldots)$

Operator precedence

$(Unary\ Operators, Brackets) > (Multiplication, Division) > (Binary\ \ addition, Binary\ subtraction)$

Associativity

Now all operators are *right associative*. That is $p - q - r \equiv p - (q - r)$, or $p/q/r \equiv p/(q/r)$

Formally it has following grammar:

```
Expression ::= Term [+-] Expression
             | Term

Term       ::= Factor [*/] Term
             | Factor

Factor     ::= Number
             | [+-] Factor
             | '(' Expression ')'
```

He needs your help to verify it. He wants you to solve some expressions for him using the above grammar and he will cross check the results. Since you are also lazy, you will write another computer program which will solve the expressions. Since the output value can be too large, you have to tell output modulo $1000000007 (= 10^9 + 7)$.

Note:

- $10^9 + 7$ is a prime.
- $1/b \equiv b^{-1} \equiv b^{p-2} (mod\ p), where\ p\ is\ prime\ and\ b < p$

Input Format

Input will contain a valid expression.

Constraints

- Length of expression will not exceed 10^5.
- $1 \leq number \leq 10^9$
- There can be 0 or more whitespaces between operators/operands.
- Tests are designed such that there will be no *divide by zero* case.
- Each factor will be accompanied by at-most one unary operator. That is "$- + -4$" is an invalid case.

Output Format

Print the result of expression modulo $(10^9 + 7)$

Sample Input 0

```
22 * 79 - 21
```

Sample Output 0

```
1717
```

Sample Input 1

```
4/-2/2 + 8
```

Sample Output 1

```
4
```

Sample Input 2

```
55+3-45*33-25
```

Sample Output 2

```
999998605
```

Sample Input 3

```
4/-2/(2 + 8)
```

Sample Output 3

```
999999987
```

Explanation

Sample Case 0:

$22 * 79 - 21 = 1738 - 21 = 1717.$

Sample Case 1:

$$\begin{aligned} 4/-2/2+8 &= (4/((-2)/2))+8 \\ &= (4/(-1))+8 \\ &= (-4)+8 \\ &= 4 \end{aligned}$$

Sample Case 2:

$$\begin{aligned} 55+3-45*33-25 &\equiv 55+3-(45*33)-25 \pmod{p} \\ &\equiv 55+3-1485-25 \pmod{p} \\ &\equiv 55+(3-(1485-25)) \pmod{p} \\ &\equiv 55+(3-1460) \pmod{p} \\ &\equiv 55+(-1457) \pmod{p} \\ &\equiv -1402 \pmod{p} \\ &\equiv 999998605 \pmod{p} \\ ,\, where\ p = 10^9+7 \end{aligned}$$

Sample Case 3:

$$\begin{aligned} 4/-2/(2+8) &\equiv 4/-2/10 \pmod{p} \\ &\equiv 4/((-2)/10) \pmod{p} \\ &\equiv 4/(-2*10^{p-2}) \pmod{p} \\ &\equiv 4/(-2*700000005) \pmod{p} \\ &\equiv 4/(-1400000010) \pmod{p} \\ &\equiv 4/(-400000003) \pmod{p} \\ &\equiv 4/600000004 \pmod{p} \\ &\equiv 4*600000004^{p-2} \pmod{p} \\ &\equiv 4*1000000002 \pmod{p} \\ &\equiv 4000000008 \pmod{p} \\ &\equiv 999999987 \pmod{p} \\ ,\, where\ p = 10^9+7 \end{aligned}$$