

Exercise 9 *

Wednesday, September 14, 2022 4:15 PM

1.3.9 Write a program that takes from standard input an expression without left parentheses and prints the equivalent infix expression with the parentheses inserted. For example, given the input:

$1 + 2) * 3 - 4) * 5 - 6))$

your program should print

$((1 + 2) * ((3 - 4) * (5 - 6)))$

Warning:

You always tend to store the entire stream (input) into a stack and think for a solution from there. This is wrong!

When seeing a complicated problem. First identify the different components of it, and observe how these components are linked together to form this giant and complex problem.

Decompose the problem step by step, until you reached the smallest unit of the problem.

Problem solving procedure:

$1 + 2) * 3 - 4) * 5 - 6))$

Components: parentheses, numbers, operators

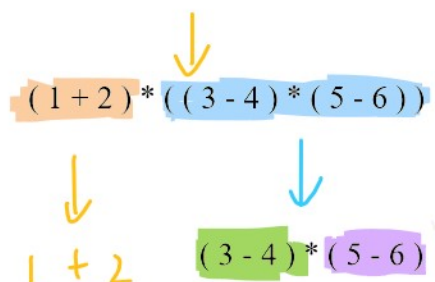
How these components are attached together: $((1 + 2) * ((3 - 4) * (5 - 6)))$

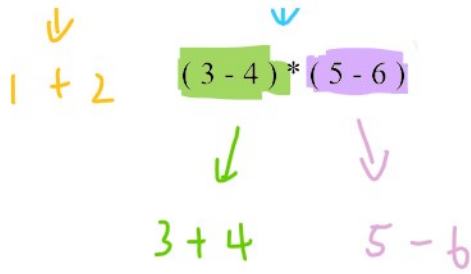
Two numbers are linked by an operator.

A parenthesis is used when an arithmetic expression is presented, such as $1 + 2$.

Decomposition of the problem:

$((1 + 2) * ((3 - 4) * (5 - 6)))$





Observation:

This entire expression is made of just three components: numbers, parentheses, and operators. Inside of a parenthesis can also seem as a number, its just that the number is evaluated by other numbers with an operator. Therefore, we can say, the whole expression is made of smaller arithmetic expressions and each expression is composed of two numbers and one operator

Thoughts:

Now the problem is how to use stack to perform the above process.

Since this is **a recursive problem**, I'm supposed to start from solving the smallest piece of problem.

Identify **the smallest piece of the problem**: The expression that only **involves two numbers and one operator**. Expressions in nested parenthesis should not be considered so far.

When a ") " is detected, there must be a " (" before the arithmetic expression (which is composed of two numbers and one operator)

A recursive problem **repeats the same operations for x times**, eventually, encapsulated in a giant entity.

Therefore, in our program, we should perform this recursive process. The operations should be repeated are just attaching numbers with an operator and encasulate them in a parenthesis to form a valid arithmetic expression. And this expression **can also be seemed as a number or a numerical value**.