# Expressions


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# Definition

## What is expression?

In mathematics, an expression or mathematical expression is a finite combination of symbols that is well-formed according to rules that depend on the context.
Mathematical symbols can designate numbers (constants), variables, operations, functions, punctuation, grouping, and other aspects of logical syntax.

For easier I define expression as sequence of operators and operands.

| 2 | $*$ | ( | 3 | $-$ | 5 | ) |
|---|---|---|---|---|---|---|
| operand | operator | operator | operand | operator | operand | operator |

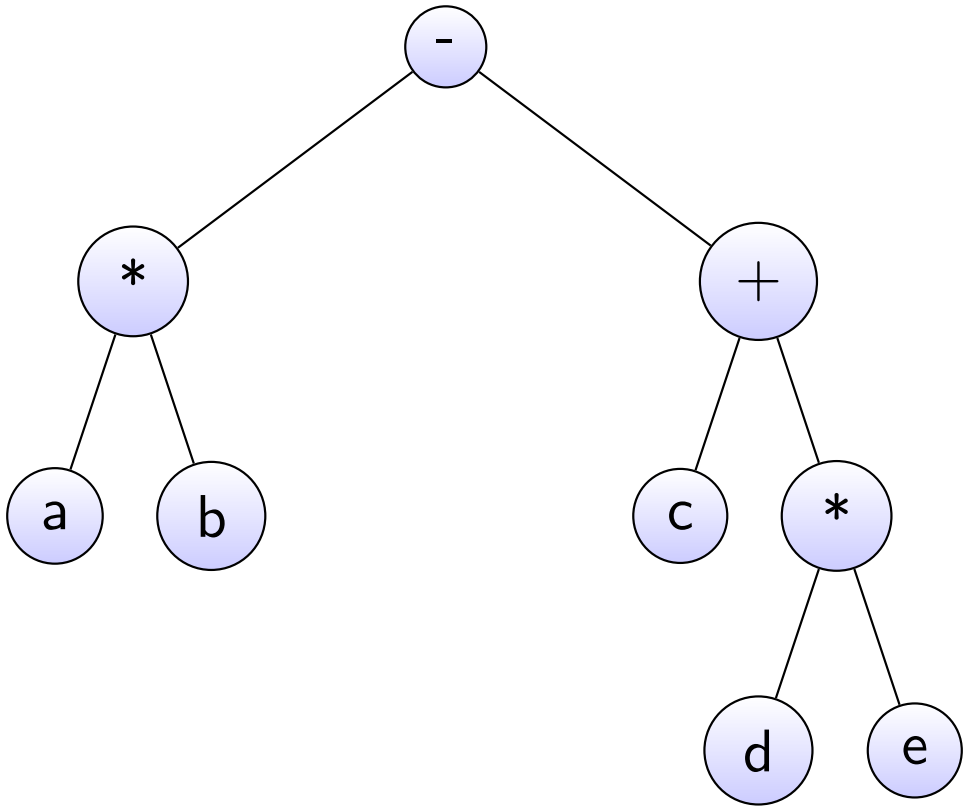
# Representation&Examples

For representing have 4 base ways:

- Tree/Recursively
- Normal/Standart Way - Suffix Notation
- Reverse Polish Notation - Prefix Notation
- Polish Notation - Postfix Notation

# Tree

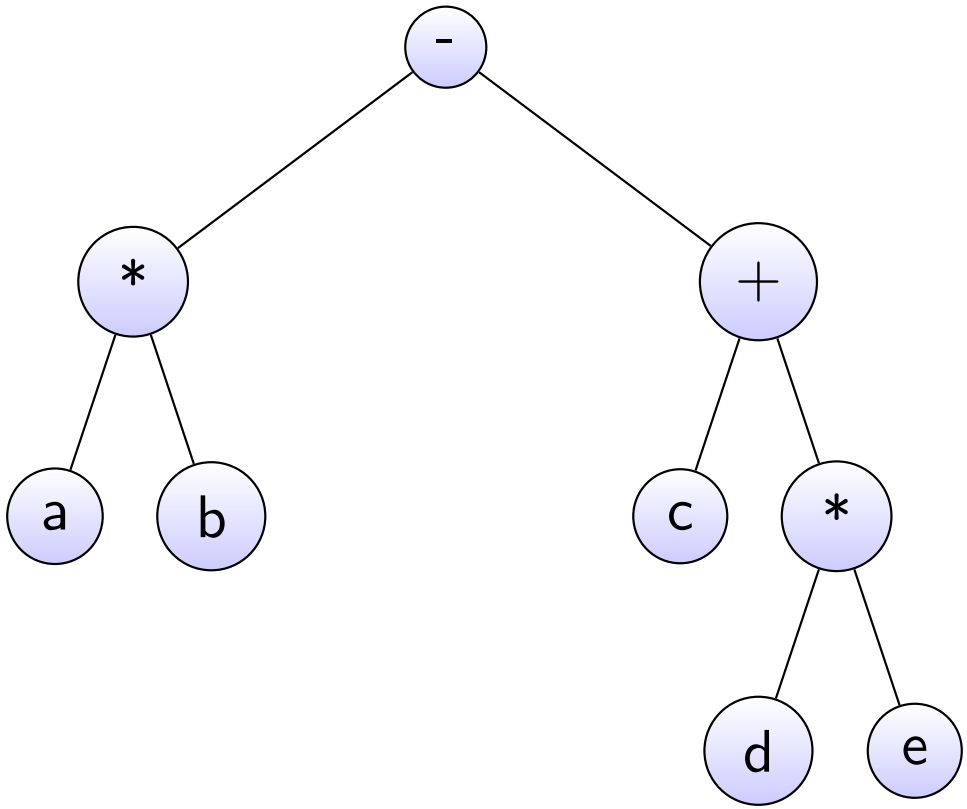
$$a * b - (c + d * e)$$



# Normal/Standart Way - Suffix Notation

When we travel the tree in inorder (left-root-right), we generate the Suffix Notation.

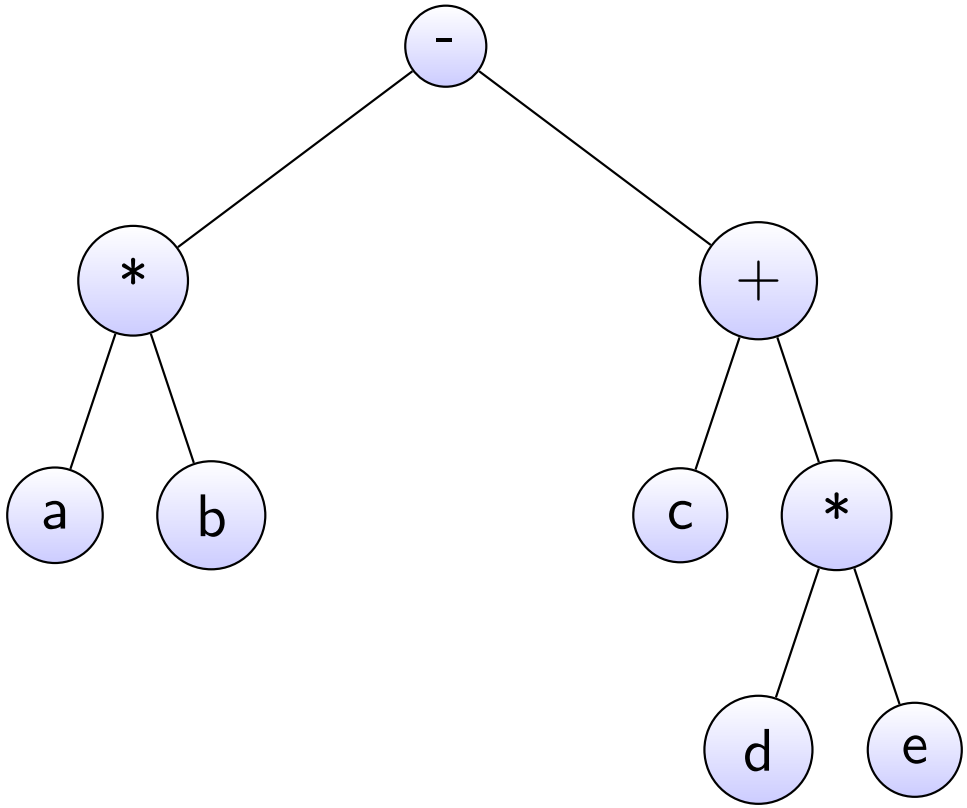
In this case Suffix Notation is $a * b - (c + d * e)$



# Reverse Polish Notation - Postfix Notation

When we travel the tree in postorder (root-left-right), we generate the Postfix Notation.

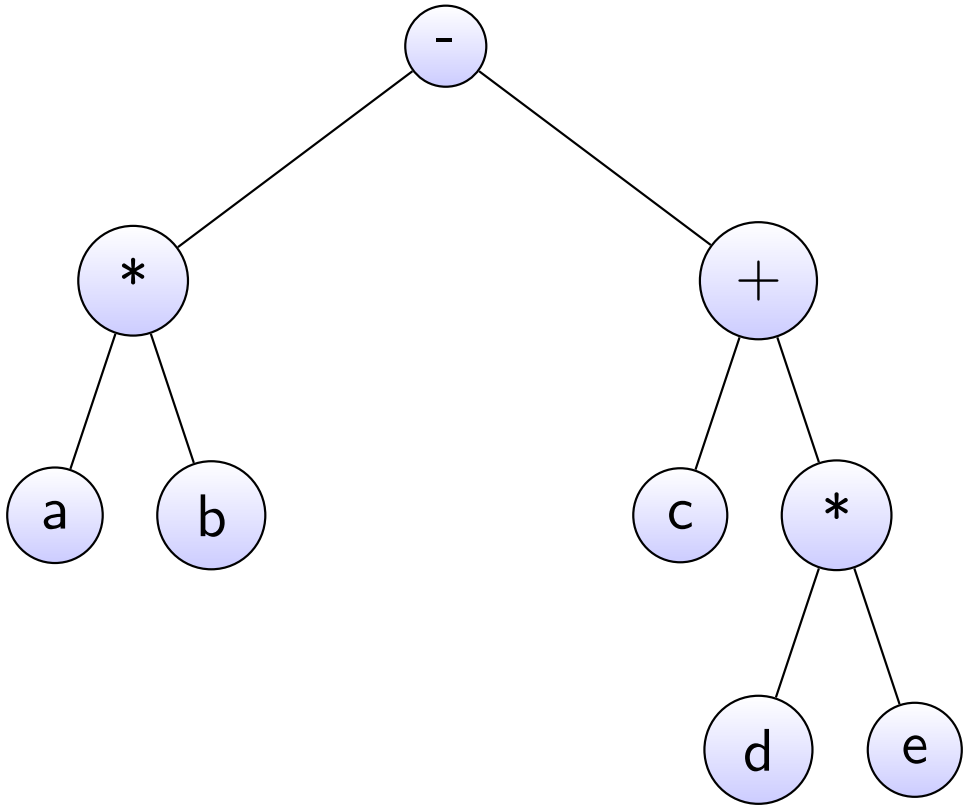
In this case Postfix Notation is $- * ab + c * de$



# Polish Notation - Prefix Notation

When we travel the tree in postorder (right-left-root), we generate the Prefix Notation.

In this case Prefix Notation is $de * c + ab * -$



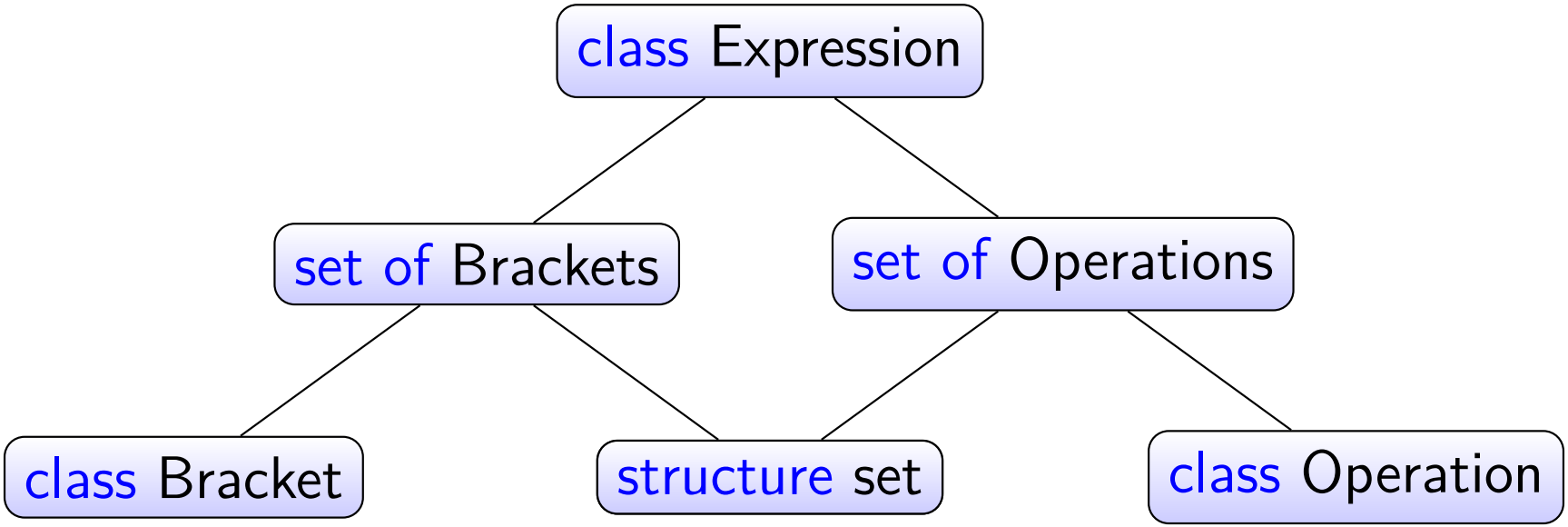
# Comparing

| | Pre- | Post- | In- |
|---|---|---|---|
| Pre- | | | |
| Post- | | | |
| In- | | | |

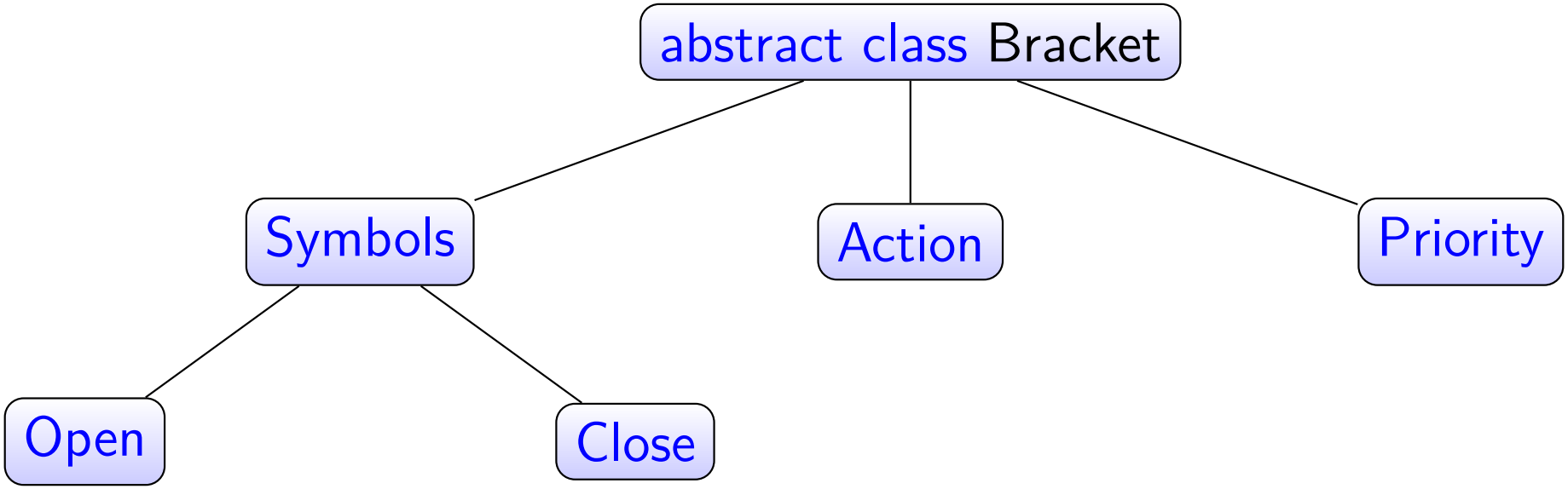
# Aim

I want to solve expression with unreal (defined by user) operators where the solving function doesn't now for any operators.
For these aim I must make schema for data structuring of program and I must think for abstract algorithms. Let's start!

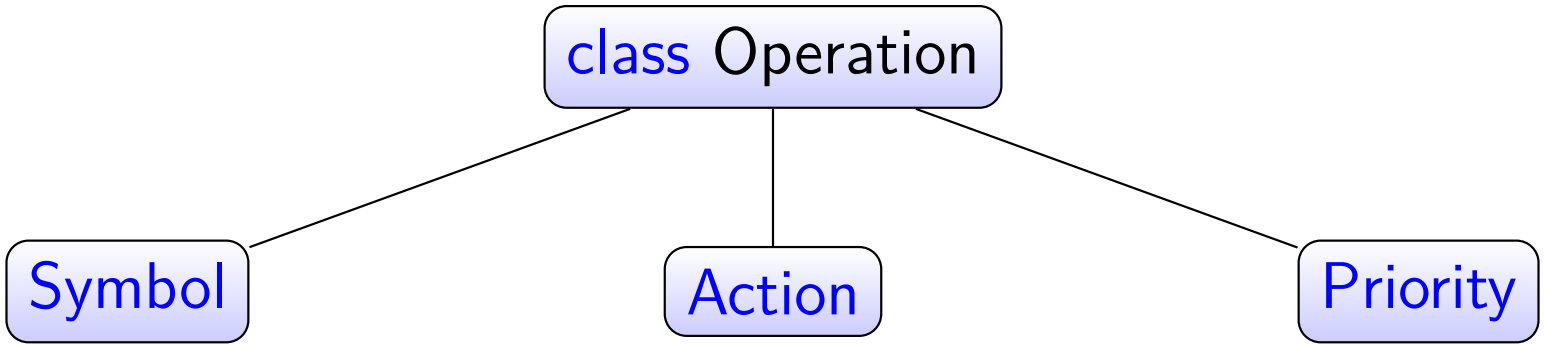
# First step


class Expression
set of Brackets
set of Operations
class Bracket
structure set
class Operation

# I divide the problem, can I divide more?



# And more?



# OK, this divide is enough! But how can I continue?

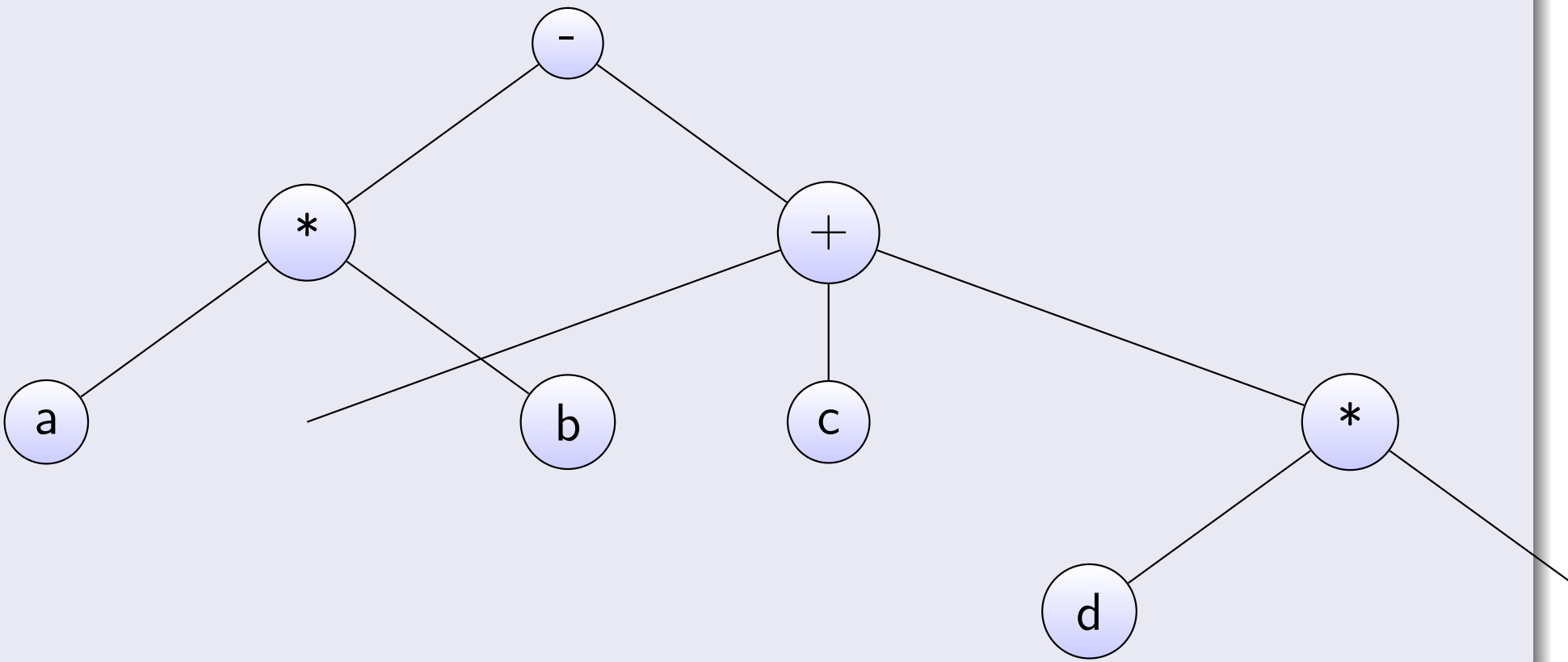
Now we must think on algorithms!
How to calculate the expression?

# What is the tree of expression?

## example

a*b-(c+d*e)

## tree of expression



# Analyze to find the best

We analyzed expressions and we understand

**the standard way to represent expression is not effectively!**

What next?

First 2 ways to solve the expression which we found are:

- Reverse Polish Notation
- By Recursively

# Reverse Polish Notation

## example

a * b - (c + d * e) (in Suffix notation, normal way)

- * a b + c * d e (in Prefix notation, Reverse Polish notation)

# Resources