Odwrócona notacja polska (ONP, RPN)

In [1]:
```
from lab3.rpn.reverse_polish_notation import ReversePolishNotation
```

In [2]:
```
help(ReversePolishNotation)
```

```
Help on class ReversePolishNotation in module lab3.rpn.reverse_polish_notation:

class ReversePolishNotation(builtins.object)
 |  ReversePolishNotation - class converting and explaining convert between standard math notation
 |  and reverse polish notation
 |  author:
 |      Pawel Zabczynski
 |
 |  Methods defined here:
 |
 |  __init__(self, expresion:str)
 |      Initialize self.  See help(type(self)) for accurate signature.
 |
 |  calculate(self, explain=False) -> float
 |      Calculate given algebraic expresion
 |      :param explain: if set to `True` then will print step by stem explanation
 |      :return: result after calculation expresion
 |
 |  convert(self, explain=False) -> str
 |      Convert `self.expresion` into expresion
 |      Do not support unary operations
 |      :param explain: boolean set to true to see in output explain each step
 |      Returns:
 |          :return: str
 |      Raises:
 |           ValueError: If `self.expresion` is not valid math expresion.
 |
 |  explain(self) -> str
 |      Print all steps as values stored in que and stack
 |      Returns:
 |          :return: explanation as string
 |      Raises:
 |           ValueError: If `self.expresion` is not valid math expresion.
 |
 |  ----------------------------------------------------------------------
 |  Data descriptors defined here:
 |
 |  __dict__
 |      dictionary for instance variables (if defined)
 |
 |  __weakref__
 |      list of weak references to the object (if defined)
 |
```

```
|  ----------------------------------------------------------------------
|  Data and other attributes defined here:
|
|  LEFT_P = {'(', '[', '{'}
|
|  RIGHT_P = {')', ']', '}'}
```

1) Wyrażenie: 3+5-2

In [3]:
```
ReversePolishNotation('3+5-2').calculate(explain=True)
```

```
|Step  |Input            |Operation|Stack
-------------------------------------
0      |, 3              |[Empty] |-
1      |, 3              |, +     |-
2      |, 3, 5           |, +     |-
3      |, 3, 5, +        |, -     |-
4      |, 3, 5, +, 2     |, -     |-
5      |, 3, 5, +, 2, -  |[Empty] |-

|Step  |Input     |Operation|Stack
-------------------------------
0      |[Empty]    |, 3      |-
1      |[Empty]    |, 3, 5   |-
2      |, [Empty]  |, 8.0    |-
3      |[Empty]    |, 8.0, 2 |-
4      |, [Empty]  |, 6.0    |-
```

Out[3]:
```
6.0
```

2) Wyrażenie: 3*8-6/3

In [4]:
```
ReversePolishNotation('3 * 8 - 6 / 3').calculate(explain=True)
```

```
|Step  |Input                  |Operation|Stack
-----------------------------------------
0      |, 3                    |[Empty] |-
1      |, 3                    |, *     |-
2      |, 3, 8                 |, *     |-
3      |, 3, 8, *              |, -     |-
4      |, 3, 8, *, 6           |, -     |-
5      |, 3, 8, *, 6           |, -, /  |-
6      |, 3, 8, *, 6, 3        |, -, /  |-
7      |, 3, 8, *, 6, 3, /     |, -     |-
8      |, 3, 8, *, 6, 3, /, -  |[Empty] |-

|Step  |Input      |Operation|Stack
-----------------------------------
0      |[Empty]     |, 3          |-
1      |[Empty]     |, 3, 8       |-
2      |, [Empty]   |, 24.0       |-
3      |[Empty]     |, 24.0, 6    |-
4      |[Empty]     |, 24.0, 6, 3 |-
5      |, [Empty]   |, 24.0, 2.0  |-
6      |, [Empty]   |, 22.0       |-
```

Out[4]: 22.0

3) Wyrażenie (3*(2+2)-9)^2

In [5]:
```
ReversePolishNotation('(3*(2+2)-9)^2').calculate(explain=True)
```

```
|Step|Input                          |Operation|Stack
-----------------------------------------------------
0  |[Empty]                          |, (          |-
1  |, 3                              |, (          |-
2  |, 3                              |, (, *       |-
3  |, 3                              |, (, *, (    |-
4  |, 3, 2                           |, (, *, (    |-
5  |, 3, 2                           |, (, *, (, + |-
6  |, 3, 2, 2                        |, (, *, (, + |-
7  |, 3, 2, 2, +                     |, (, *       |-
8  |, 3, 2, 2, +, *                  |, (, -       |-
9  |, 3, 2, 2, +, *, 9               |, (, -       |-
10 |, 3, 2, 2, +, *, 9, -           |[Empty]      |-
11 |, 3, 2, 2, +, *, 9, -           |, ^          |-
12 |, 3, 2, 2, +, *, 9, -, 2        |, ^          |-
13 |, 3, 2, 2, +, *, 9, -, 2, ^     |[Empty]      |-

|Step  |Input  |Operation|Stack
----------------------------
0      |[Empty] |, 3       |-
1      |[Empty] |, 3, 2    |-
2      |[Empty] |, 3, 2, 2 |-
3      |, [Empty]|, 3, 4.0  |-
4      |, [Empty]|, 12.0    |-
5      |[Empty] |, 12.0, 9 |-
6      |, [Empty]|, 3.0     |-
7      |[Empty] |, 3.0, 2  |-
8      |, [Empty]|, 9.0     |-
```

Out[5]: 9.0

4) Wyrażenie {[(9-7)+(2+3)]-(7-4)}*[(7-5)*3-2]*

In [6]:
```
ReversePolishNotation('{[(9-7)+(2+3)]-(7-4)}*[(7-5)*3-2]').calculate(explain=True)
```

Step	Input	Operation	Stack
0	[Empty]	,	{
1	[Empty]	,	{, [
2	[Empty]	,	{, [, (
3	, 9	,	{, [, (
4	, 9	,	{, [, (, -
5	, 9, 7	,	{, [, (, -
6	, 9, 7, -	,	{, [
7	, 9, 7, -	,	{, [, +
8	, 9, 7, -	,	{, [, +, (
9	, 9, 7, -, 2	,	{, [, +, (
10	, 9, 7, -, 2	,	{, [, +, (, +
11	, 9, 7, -, 2, 3	,	{, [, +, (, +
12	, 9, 7, -, 2, 3, +	,	{, [, +
13	, 9, 7, -, 2, 3, +, +	,	{
14	, 9, 7, -, 2, 3, +, +	,	{, -
15	, 9, 7, -, 2, 3, +, +	,	{, -, (
16	, 9, 7, -, 2, 3, +, +, 7	,	{, -, (
17	, 9, 7, -, 2, 3, +, +, 7	,	{, -, (, -
18	, 9, 7, -, 2, 3, +, +, 7, 4	,	{, -, (, -
19	, 9, 7, -, 2, 3, +, +, 7, 4, -	,	{, -
20	, 9, 7, -, 2, 3, +, +, 7, 4, -, -	[Empty]	
21	, 9, 7, -, 2, 3, +, +, 7, 4, -, -	,	*
22	, 9, 7, -, 2, 3, +, +, 7, 4, -, -	,	*, [
23	, 9, 7, -, 2, 3, +, +, 7, 4, -, -	,	*, [, (
24	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7	,	*, [, (
25	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7	,	*, [, (, -
26	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7, 5	,	*, [, (, -
27	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7, 5, -	,	*, [
28	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7, 5, -	,	*, [, *
29	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7, 5, -, 3	,	*, [, *
30	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7, 5, -, 3, *	,	*, [, -
31	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7, 5, -, 3, *, 2	,	*, [, -
32	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7, 5, -, 3, *, 2, -	,	*
33	, 9, 7, -, 2, 3, +, +, 7, 4, -, -, 7, 5, -, 3, *, 2, -, *	[Empty]	

Step	Input	Operation	Stack
0	[Empty]	, 9	
1	[Empty]	, 9, 7	
2	, [Empty]	, 2.0	
3	[Empty]	, 2.0, 2	

```
4  |[Empty]     |, 2.0, 2, 3   |-
5  |, [Empty]   |, 2.0, 5.0    |-
6  |, [Empty]   |, 7.0         |-
7  |[Empty]     |, 7.0, 7      |-
8  |[Empty]     |, 7.0, 7, 4   |-
9  |, [Empty]   |, 7.0, 3.0    |-
10 |, [Empty]   |, 4.0         |-
11 |[Empty]     |, 4.0, 7      |-
12 |[Empty]     |, 4.0, 7, 5   |-
13 |, [Empty]   |, 4.0, 2.0    |-
14 |[Empty]     |, 4.0, 2.0, 3 |-
15 |, [Empty]   |, 4.0, 6.0    |-
16 |[Empty]     |, 4.0, 6.0, 2 |-
17 |, [Empty]   |, 4.0, 4.0    |-
18 |, [Empty]   |, 16.0        |-
```

Out[6]: 16.0

5) Wyrażenie [(9-2)*3-(9-3)^2/(23)]*(6-4)

In [7]:
```
ReversePolishNotation('[(9-2)*3-(9-3)^2/(2*3)]*(6-4)').calculate(explain=True)
```

Step	Input	Operation	Stack
0	[Empty]		[
1	[Empty]		[, (
2	, 9		[, (
3	, 9		[, (, -
4	, 9, 2		[, (, -
5	, 9, 2, -		[
6	, 9, 2, -		[, *
7	, 9, 2, -, 3		[, *
8	, 9, 2, -, 3, *		[, -
9	, 9, 2, -, 3, *		[, -, (
10	, 9, 2, -, 3, *, 9		[, -, (
11	, 9, 2, -, 3, *, 9		[, -, (, -
12	, 9, 2, -, 3, *, 9, 3		[, -, (, -
13	, 9, 2, -, 3, *, 9, 3, -		[, -
14	, 9, 2, -, 3, *, 9, 3, -		[, -, ^
15	, 9, 2, -, 3, *, 9, 3, -, 2		[, -, ^
16	, 9, 2, -, 3, *, 9, 3, -, 2, ^		[, -, /
17	, 9, 2, -, 3, *, 9, 3, -, 2, ^		[, -, /, (
18	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2		[, -, /, (
19	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2		[, -, /, (, *
20	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3		[, -, /, (, *
21	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *		[, -, /
22	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *, /, -		[Empty]
23	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *, /, -		, *
24	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *, /, -		, *, (
25	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *, /, -, 6		, *, (
26	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *, /, -, 6		, *, (, -
27	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *, /, -, 6, 4		, *, (, -
28	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *, /, -, 6, 4, -		, *
29	, 9, 2, -, 3, *, 9, 3, -, 2, ^, 2, 3, *, /, -, 6, 4, -, *		[Empty]

Step	Input	Operation	Stack
0	[Empty]	, 9	
1	[Empty]	, 9, 2	
2	, [Empty]	, 7.0	
3	[Empty]	, 7.0, 3	
4	, [Empty]	, 21.0	
5	[Empty]	, 21.0, 9	
6	[Empty]	, 21.0, 9, 3	
7	, [Empty]	, 21.0, 6.0	

```
8  |[Empty]     |, 21.0, 6.0, 2     |-
9  |, [Empty]   |, 21.0, 36.0       |-
10 |[Empty]     |, 21.0, 36.0, 2    |-
11 |[Empty]     |, 21.0, 36.0, 2, 3 |-
12 |, [Empty]   |, 21.0, 36.0, 6.0  |-
13 |, [Empty]   |, 21.0, 6.0        |-
14 |, [Empty]   |, 15.0             |-
15 |[Empty]     |, 15.0, 6          |-
16 |[Empty]     |, 15.0, 6, 4       |-
17 |, [Empty]   |, 15.0, 2.0        |-
18 |, [Empty]   |, 30.0             |-
```

Out[7]: 30.0

Inne materiały

- Reverse Polish Notation and The Stack - Computerphile (https://www.youtube.com/watch?v=7ha78yWRDIE)