Reverse Polish Notation (RPN) & Stacks

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Reverse Polish Notation (RPN)

- The stack organization is very effective in evaluating arithmetic expressions. Expressions are usually represented in what is known as **Infix notation**, in which each operator is written between two operands (i.e., A + B).
- the order of operators and operands in an arithmetic expression does not uniquely determine the order in which the operations are to be performed
- **1. Polish notation (prefix notation) –**
  It refers to the notation in which the operator is placed before its two operands. Here no parentheses are required, i.e., +AB
- **2. Reverse Polish notation(postfix notation) –**
  It refers to the analogous notation in which the operator is placed after its two operands. Again, no parentheses is required in Reverse Polish notation, i.e., AB+

The Operational Hierarchy

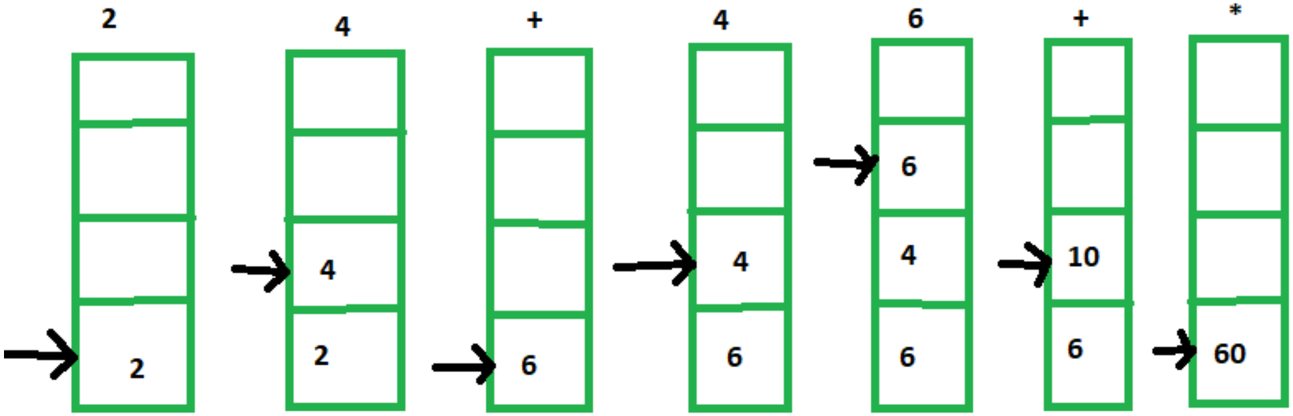
- Stack-organized computers are better suited for post-fix notation than the traditional infix notation. Thus, the infix notation must be converted to the postfix notation. The conversion from infix notation to postfix notation must take into consideration the operational hierarchy.
- There are 3 levels of precedence for 5 binary operators as given below:
- Highest: Exponentiation (^)
- Next highest: Multiplication (*) and division (/)
- Lowest: Addition (+) and Subtraction (-)
- **For example –**
- Infix notation: (A-B)*[C/(D+E)+F]
- Post-fix notation: AB- CDE +/F +*

Calculate the value arithmetic operations by using a stack

- **The procedure for getting the result is:**

1. Convert the expression in Reverse Polish notation(post-fix notation).
2. Push the operands into the stack in the order they appear.
3. When any operator encounters then pop two topmost operands for executing the operation.
4. After execution push the result obtained into the stack.
5. After the complete execution of expression, the final result remains on the top of the stack.

- **For example –**
- Infix notation: (2+4) * (4+6)
- Post-fix notation: 2 4 + 4 6 + *
- Result: 60



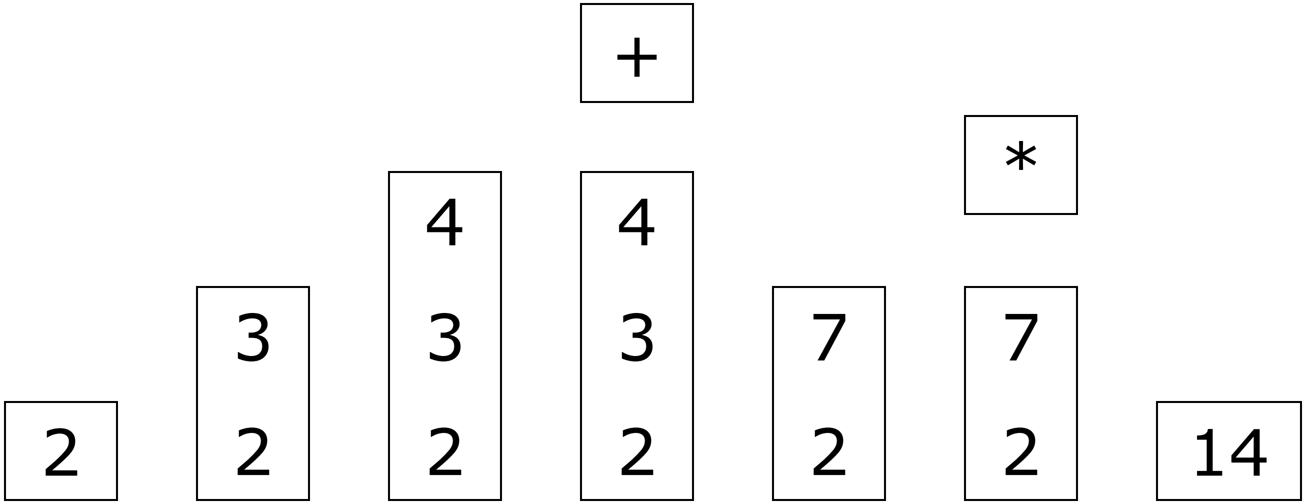
Stack operations to evaluate (2+4)*(4+6)

RPN Example

- Writing a program to parse 2 * (3 + 4)

1. Converted to RPN ⇒ 2 3 4 + *

2.using a stack would work as follows:


2
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