



Assignment

**Course:** Data Structure

**Year:** 2020

**Topic: Infix-Postfix**

1. Convert the following infix expression into the postfix one using stack-queue simulations:

(i) (300+23)\*(43-21)/(84+7)

(ii) (4+8)\*(6-5)/((3-2)\*(2+2))

1. Also evaluate the previously converted postfix expressions (i) and (ii) using the stack-queue operations.

(note: we can derive the simulation using pen & paper and attach the snap-shots in the word file.)

**ANSWER TO THE QUESTION NO 1**

ANS : (i) infix = (300+23)\*(43-21)/(84+7)

Postfix = 300 23 + 43 21 - \* 84 7 + /

(ii) Infix = (4+8)\*(6-5)/((3-2)\*(2+2))

Postfix = 4 8 + 6 5 - \* 3 2 - 2 2 + \* /

**ANSWER TO THE QUESTION NO 2**

1. (300+23)\*(43-21)/(84+7)

**Infix: (300+23)\*(43-21)/(84+7)**

Since **(** is an opening parenthesis, push it to the top of the stack.

Postfix:

**Infix: (300+23)\*(43-21)/(84+7)**

Since **300** is an operand, append it to the postfix expression.

Postfix: 300

**Infix: (300+23)\*(43-21)/(84+7)**

Since **+** is an operator and has greater precedence than the **(** on the top of the stack, push **+** to the top of the stack.

Postfix: 300

**Infix: (300+23)\*(43-21)/(84+7)**

Since **23** is an operand, append it to the postfix expression.

Postfix: 300 23

**Infix: (300+23)\*(43-21)/(84+7)**

Since the **)** is a closing parenthesis, pop each operator from the stack one at a time and append to the postfix expression. Keep popping from the stack until an opening parenthesis is encountered.

Pop **+** from the top of the stack and append to the postfix expression.

Postfix: 300 23 +

Since we are done with the expression inside the current parenthesis, pop the opening parenthesis from the top of the stack and discard.

Postfix: 300 23 +

**Infix: (300+23)\*(43-21)/(84+7)**

Since the **\*** is an operator and the stack is empty, push the **\*** to the stack.

Postfix: 300 23 +

**Infix: (300+23)\*(43-21)/(84+7)**

Since **(** is an opening parenthesis, push it to the top of the stack.

Postfix: 300 23 +

**Infix: (300+23)\*(43-21)/(84+7)**

Since **43** is an operand, append it to the postfix expression.

Postfix: 300 23 + 43

**Infix: (300+23)\*(43-21)/(84+7)**

Since **-** is an operator and has greater precedence than the **(** on the top of the stack, push **-** to the top of the stack.

Postfix: 300 23 + 43

**Infix: (300+23)\*(43-21)/(84+7)**

Since **21** is an operand, append it to the postfix expression.

Postfix: 300 23 + 43 21

**Infix: (300+23)\*(43-21)/(84+7)**

Since the **)** is a closing parenthesis, pop each operator from the stack one at a time and append to the postfix expression. Keep popping from the stack until an opening parenthesis is encountered.

Pop **-** from the top of the stack and append to the postfix expression.

Postfix: 300 23 + 43 21 -

Since we are done with the expression inside the current parenthesis, pop the opening parenthesis from the top of the stack and discard.

Postfix: 300 23 + 43 21 -

**Infix: (300+23)\*(43-21)/(84+7)**

Since **/** is an operator, is left-to-right associative, and has the same precedence as the **\*** at the top of the stack, pop **\*** from the stack and append it to the postfix expression.

Postfix: 300 23 + 43 21 - \*

Push the **/** to the stack.

Postfix: 300 23 + 43 21 - \*

**Infix: (300+23)\*(43-21)/(84+7)**

Since **(** is an opening parenthesis, push it to the top of the stack.

Postfix: 300 23 + 43 21 - \*

**Infix: (300+23)\*(43-21)/(84+7)**

Since **84** is an operand, append it to the postfix expression.

Postfix: 300 23 + 43 21 - \* 84

**Infix: (300+23)\*(43-21)/(84+7)**

Since **+** is an operator and has greater precedence than the **(** on the top of the stack, push **+** to the top of the stack.

Postfix: 300 23 + 43 21 - \* 84

**Infix: (300+23)\*(43-21)/(84+7)**

Since **7** is an operand, append it to the postfix expression.

Postfix: 300 23 + 43 21 - \* 84 7

**Infix: (300+23)\*(43-21)/(84+7)**

Since the **)** is a closing parenthesis, pop each operator from the stack one at a time and append to the postfix expression. Keep popping from the stack until an opening parenthesis is encountered.

Pop **+** from the top of the stack and append to the postfix expression.

Postfix: 300 23 + 43 21 - \* 84 7 +

Since we are done with the expression inside the current parenthesis, pop the opening parenthesis from the top of the stack and discard.

Postfix: 300 23 + 43 21 - \* 84 7 +

Since we are done processing the infix expression, pop the remaining operator from top of the stack and append it to the postfix expression.

Pop **/** from the stack and append it to the postfix expression.

Postfix: 300 23 + 43 21 - \* 84 7 + /

**Completed Conversion:**

|  |  |  |
| --- | --- | --- |
| Infix: | | (300+23)\*(43-21)/(84+7) |
| to | | |
| Postfix: | 300 23 + 43 21 - \*84 7 + / | |
| 1. **Infix = (4+8)\*(6-5)/((3-2)\*(2+2))**   **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **(** is an opening parenthesis, push it to the top of the stack.  Postfix:  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **4** is an operand, append it to the postfix expression.  Postfix: 4  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **+** is an operator and has greater precedence than the **(** on the top of the stack, push **+** to the top of the stack.  Postfix: 4  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **8** is an operand, append it to the postfix expression.  Postfix: 4 8  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since the **)** is a closing parenthesis, pop each operator from the stack one at a time and append to the postfix expression. Keep popping from the stack until an opening parenthesis is encountered.  Pop **+** from the top of the stack and append to the postfix expression.  Postfix: 4 8 +  Since we are done with the expression inside the current parenthesis, pop the opening parenthesis from the top of the stack and discard.  Postfix: 4 8 +  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since the **\*** is an operator and the stack is empty, push the **\*** to the stack.  Postfix: 4 8 +  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **(** is an opening parenthesis, push it to the top of the stack.  Postfix: 4 8 +  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **6** is an operand, append it to the postfix expression.  Postfix: 4 8 + 6  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **-** is an operator and has greater precedence than the **(** on the top of the stack, push **-** to the top of the stack.  Postfix: 4 8 + 6  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **5** is an operand, append it to the postfix expression.  Postfix: 4 8 + 6 5  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since the **)** is a closing parenthesis, pop each operator from the stack one at a time and append to the postfix expression. Keep popping from the stack until an opening parenthesis is encountered.  Pop **-** from the top of the stack and append to the postfix expression.  Postfix: 4 8 + 6 5 -  Since we are done with the expression inside the current parenthesis, pop the opening parenthesis from the top of the stack and discard.  Postfix: 4 8 + 6 5 -  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **/** is an operator, is left-to-right associative, and has the same precedence as the **\*** at the top of the stack, pop **\*** from the stack and append it to the postfix expression.  Postfix: 4 8 + 6 5 - \*  Push the **/** to the stack.  Postfix: 4 8 + 6 5 - \*  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **(** is an opening parenthesis, push it to the top of the stack.  Postfix: 4 8 + 6 5 - \*  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **(** is an opening parenthesis, push it to the top of the stack.  Postfix: 4 8 + 6 5 - \*  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **3** is an operand, append it to the postfix expression.  Postfix: 4 8 + 6 5 - \* 3  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **-** is an operator and has greater precedence than the **(** on the top of the stack, push **-** to the top of the stack.  Postfix: 4 8 + 6 5 - \* 3  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **2** is an operand, append it to the postfix expression.  Postfix: 4 8 + 6 5 - \* 3 2  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since the **)** is a closing parenthesis, pop each operator from the stack one at a time and append to the postfix expression. Keep popping from the stack until an opening parenthesis is encountered.  Pop **-** from the top of the stack and append to the postfix expression.  Postfix: 4 8 + 6 5 - \* 3 2 -  Since we are done with the expression inside the current parenthesis, pop the opening parenthesis from the top of the stack and discard.  Postfix: 4 8 + 6 5 - \* 3 2 -  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **\*** is an operator and has greater precedence than the **(** on the top of the stack, push **\*** to the top of the stack.  Postfix: 4 8 + 6 5 - \* 3 2 -  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **(** is an opening parenthesis, push it to the top of the stack.  Postfix: 4 8 + 6 5 - \* 3 2 -  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **2** is an operand, append it to the postfix expression.  Postfix: 4 8 + 6 5 - \* 3 2 - 2  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **+** is an operator and has greater precedence than the **(** on the top of the stack, push **+** to the top of the stack.  Postfix: 4 8 + 6 5 - \* 3 2 - 2  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since **2** is an operand, append it to the postfix expression.  Postfix: 4 8 + 6 5 - \* 3 2 - 2 2  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since the **)** is a closing parenthesis, pop each operator from the stack one at a time and append to the postfix expression. Keep popping from the stack until an opening parenthesis is encountered.  Pop **+** from the top of the stack and append to the postfix expression.  Postfix: 4 8 + 6 5 - \* 3 2 - 2 2 +  Since we are done with the expression inside the current parenthesis, pop the opening parenthesis from the top of the stack and discard.  Postfix: 4 8 + 6 5 - \* 3 2 - 2 2 +  **Infix: (4+8)\*(6-5)/((3-2)\*(2+2))**  Since the **)** is a closing parenthesis, pop each operator from the stack one at a time and append to the postfix expression. Keep popping from the stack until an opening parenthesis is encountered.  Pop **\*** from the top of the stack and append to the postfix expression.  Postfix: 4 8 + 6 5 - \* 3 2 - 2 2 + \*  Since we are done with the expression inside the current parenthesis, pop the opening parenthesis from the top of the stack and discard.  Postfix: 4 8 + 6 5 - \* 3 2 - 2 2 + \*  Since we are done processing the infix expression, pop the remaining operator from top of the stack and append it to the postfix expression.  Pop **/** from the stack and append it to the postfix expression.  Postfix: 4 8 + 6 5 - \* 3 2 - 2 2 + \* /  **Completed Conversion:**   |  |  | | --- | --- | | Infix: | (4+8)\*(6-5)/((3-2)\*(2+2)) | | to | | | Postfix: | 4 8 + 6 5 - \* 3 2 - 2 2 + \* / | |  | |

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