

# Data Structures and Algorithms

V22.0102

Otávio Braga

# Infix to Postfix Conversion

- We use a stack
- When an operand is read, output it
- When an operator is read
  - Pop until the top of the stack has an element of lower precedence
  - Then push it
- When ) is found, pop until we find the matching (
- ( has the lowest precedence when in the stack
- but has the highest precedence when in the input
- When we reach the end of input, pop until the stack is empty

# Infix to Postfix Conversion

## Example 1

- $3+4*5/6$

# Infix to Postfix Conversion

## Example 1

- 3+4\*5/6
- Stack:
- Output:

# Infix to Postfix Conversion

## Example 1

- $3+4*5/6$
- Stack:
- Output: 3

# Infix to Postfix Conversion

## Example 1

- $3+\underline{4}^*5/6$
- Stack: +
- Output: 3

# Infix to Postfix Conversion

## Example 1

- $3+4*5/6$
- Stack: +
- Output: 3 4

# Infix to Postfix Conversion

## Example 1

- $3+4*\underline{5}/6$
- Stack: + \*
- Output: 3 4



# Infix to Postfix Conversion

## Example 1

- $3+4*5/6$
- Stack: + \*
- Output: 3 4 5

# Infix to Postfix Conversion

## Example 1

- $3+4*5/6$
- Stack: +
- Output: 3 4 5 \*

# Infix to Postfix Conversion

## Example 1

- $3+4*5/\underline{6}$
- Stack: + /
- Output: 3 4 5 \*

# Infix to Postfix Conversion

## Example 1

- $3+4*5/6$
- Stack: + /
- Output: 3 4 5 \* 6

# Infix to Postfix Conversion

## Example 1

- $3+4*5/6$
- Stack: +
- Output: 3 4 5 \* 6 /

# Infix to Postfix Conversion

## Example 1

- $3+4*5/6$
- Stack:
- Output: 3 4 5 \* 6 / +
- Done!

# Infix to Postfix Conversion

## Example 2

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

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack:
- Output:



# Infix to Postfix Conversion

## Example 2

- $(\underline{300}+23)*(43-21)/(84+7)$
- Stack: (
- Output:

# Infix to Postfix Conversion

## Example 2

- $(300_{\underline{+}}23)*(43-21)/(84+7)$
- Stack: (
- Output: 300

# Infix to Postfix Conversion

## Example 2

- $(300+\underline{23})*(43-21)/(84+7)$
- Stack: ( +
- Output: 300

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: ( +
- Output: 300 23

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: (
- Output: 300 23 +

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack:
- Output: 300 23 +

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: \*
- Output: 300 23 +

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(\underline{43}-21)/(84+7)$
- Stack: \* (
- Output: 300 23 +



# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: \* (
- Output: 300 23 + 43

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-\underline{21})/(84+7)$
- Stack: \* ( -
- Output: 300 23 + 43

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: \* ( -
- Output: 300 23 + 43 21

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: \* (
- Output: 300 23 + 43 21 -

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: \*
- Output: 300 23 + 43 21 -

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack:
- Output: 300 23 + 43 21 - \*

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: /
- Output: 300 23 + 43 21 - \*

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(\underline{84}+7)$
- Stack: / (
- Output: 300 23 + 43 21 - \*



# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: / (
- Output: 300 23 + 43 21 - \* 84

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: / ( +
- Output: 300 23 + 43 21 - \* 84

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: / ( +
- Output: 300 23 + 43 21 - \* 84 7

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: / (
- Output: 300 23 + 43 21 - \* 84 7 +

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack: /
- Output: 300 23 + 43 21 - \* 84 7 +

# Infix to Postfix Conversion

## Example 2

- $(300+23)*(43-21)/(84+7)$
- Stack:
- Output: 300 23 + 43 21 - \* 84 7 + /
- Done!

# Infix to Postfix Conversion

## Example 3

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

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack:
- Output:



# Infix to Postfix Conversion

## Example 3

- $(\underline{4}+8)*(6-5)/((3-2)*(2+2))$
- Stack: (
- Output:

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: (
- Output: 4

# Infix to Postfix Conversion

## Example 3

- $(4+\underline{8})*(6-5)/((3-2)*(2+2))$
- Stack: ( +
- Output: 4

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: ( +
- Output: 4 8

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: (
- Output: 4 8 +

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack:
- Output: 4 8 +

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: \*
- Output: 4 8 +

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(\underline{6}-5)/((3-2)*(2+2))$
- Stack: \* (
- Output: 4 8 +



# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: \* (
- Output: 4 8 + 6

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-\underline{5})/((3-2)*(2+2))$
- Stack: \* ( -
- Output: 4 8 + 6

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: \* ( -
- Output: 4 8 + 6 5

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: \* (
- Output: 4 8 + 6 5 -

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: \*
- Output: 4 8 + 6 5 -

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack:
- Output: 4 8 + 6 5 - \*

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: /
- Output: 4 8 + 6 5 - \*

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / (
- Output: 4 8 + 6 5 - \*



# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((\underline{3}-2)*(2+2))$
- Stack: / ( (
- Output: 4 8 + 6 5 - \*

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( (
- Output: 4 8 + 6 5 - \* 3

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-\underline{2})*(2+2))$
- Stack: / ( ( -
- Output: 4 8 + 6 5 - \* 3

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( ( -
- Output: 4 8 + 6 5 - \* 3 2

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( (
- Output: 4 8 + 6 5 - \* 3 2 -

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / (
- Output: 4 8 + 6 5 - \* 3 2 -

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( \*
- Output: 4 8 + 6 5 - \* 3 2 -

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( \* (
- Output: 4 8 + 6 5 - \* 3 2 -



# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( \* (
- Output: 4 8 + 6 5 - \* 3 2 - 2

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+\underline{2}))$
- Stack: / ( \* ( +
- Output: 4 8 + 6 5 - \* 3 2 - 2

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( \* ( +
- Output: 4 8 + 6 5 - \* 3 2 - 2 2

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( \* (
- Output: 4 8 + 6 5 - \* 3 2 - 2 2 +

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / ( \*
- Output: 4 8 + 6 5 - \* 3 2 - 2 2 +

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: / (
- Output: 4 8 + 6 5 - \* 3 2 - 2 2 + \*

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack: /
- Output: 4 8 + 6 5 - \* 3 2 - 2 2 + \*

# Infix to Postfix Conversion

## Example 3

- $(4+8)*(6-5)/((3-2)*(2+2))$
- Stack:
- Output: 4 8 + 6 5 - \* 3 2 - 2 2 + \* /
- Done!