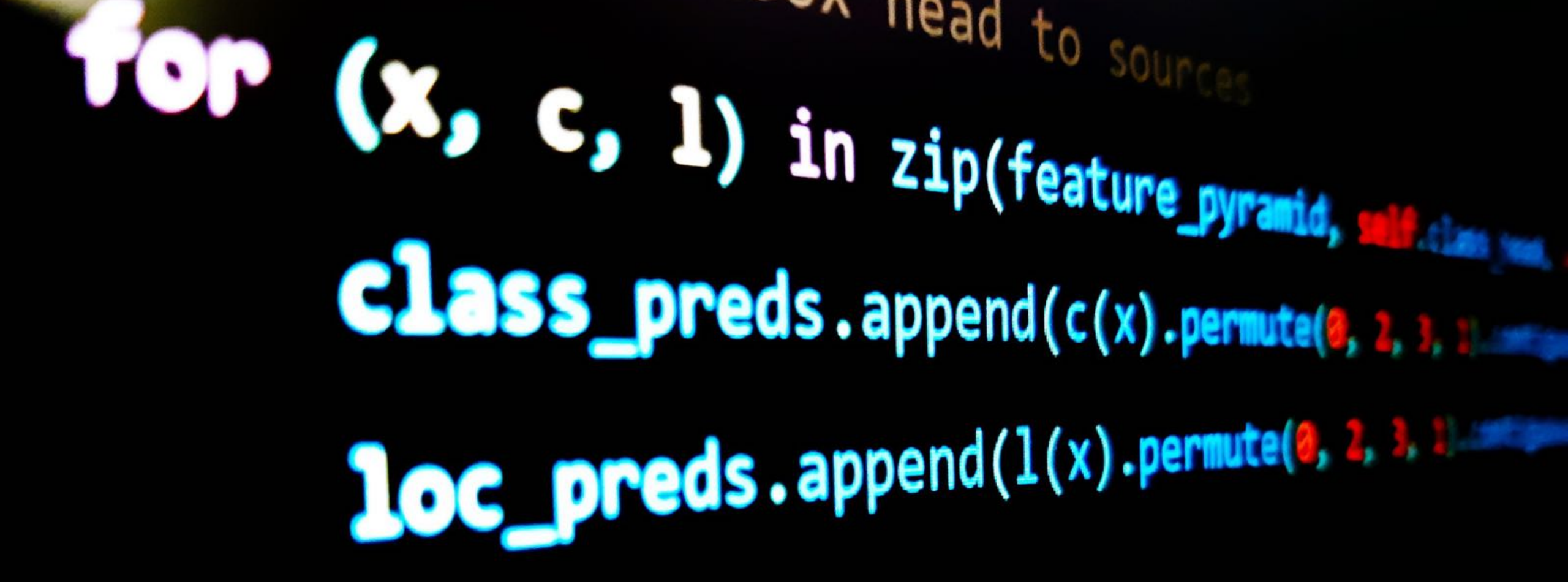


INFIX TO POSTFIX

CCDSALG T2 AY 2020-2021

ARITHMETIC EXPRESSION

What is the value of the following expression?

$$1 + 2 * 3 + 4$$

a) 13

b) 11

c) 72

ARITHMETIC EXPRESSION

What is the value of the following expression?

$$1 + 2 * 3 + 4$$

a) 13

b) **11**

c) 72

ARITHMETIC EXPRESSION

What is the value of the following expression?

$$(1 + 2) * 3 + 4$$

a) 13

b) 11

c) 72

ARITHMETIC EXPRESSION

What is the value of the following expression?

$$(1 + 2) * 3 + 4$$

a) **13**

b) 11

c) 72

ARITHMETIC EXPRESSION

- Made up tokens
- Tokens are classified as:
  - Operand (numbers, variables)
  - Operator (unary and binary operators)
  - Grouping symbols (left and right parentheses)

ARITHMETIC EXPRESSION

- **Infix expression** (operator “in”-between operands)

  <operand 1> <operator> <operand 2>

  Example: 1 + 2

- **Postfix expression** (operator “after” operands)

  <operand 1> <operand 2> <operator>

  Example: 1 2 +

- **Prefix expression** (operator “before” operands)

  <operator> <operand 1> <operand 2>

  Example: + 1 2

ARITHMETIC EXPRESSION

Infix: $1 + 2 * 3 + 4$

Postfix: $1\ 2\ 3 * + 4 +$

Prefix: $+ + 1 * 2\ 3\ 4$

ARITHMETIC EXPRESSION

Infix: $(1 + 2) * 3 + 4$

Postfix: $1\ 2 + 3\ *\ 4\ +$

Prefix: $+\ *\ +\ 1\ 2\ 3\ 4$

IMPORTANT:

- Operands appear In the same sequence in all notations, i.e., 1, 2, 3 and 4
- There is no need for grouping symbols in postfix and prefix

INFIX TO POSTFIX

1. Parse the infix expression into tokens from left to right.
2. If the token is an operand, output it.

INFIX TO POSTFIX

3. If the token is an operator
    a. If the stack is empty, push it
    b. If top of the stack contains ‘(’, push it.
    c. If the precedence of the scanned operator is greater than the precedence of the operator in the top of the stack, push it
    d. Else, pop all the operators from the stack which are greater than or equal to in precedence than that of the scanned operator. Then, push the scanned operator in the stack.

INFIX TO POSTFIX

4. If the token is a ‘(’, push it to the stack.
5. If the token is a ‘)’, pop the stack and output it until a ‘(’ is encountered, and discard both parentheses.
6. Repeat until all tokens in the infix expression are processed.

INFIX TO POSTFIX

Example 1:

Infix: $1 + 2 * 3 + 4$

Stack:

Postfix:

INFIX TO POSTFIX

Example 1:

Infix: 1 + 2 * 3 + 4

Stack:

Postfix: 1

INFIX TO POSTFIX

Example 1:

Infix: $1 + 2 * 3 + 4$

Stack: $+$

Postfix: 1

INFIX TO POSTFIX

Example 1:

Infix: 1 + 2 * 3 + 4

Stack: +

Postfix: 1 2

INFIX TO POSTFIX

Example 1:

Infix: 1 + 2 * 3 + 4

Stack: + *

Postfix: 1 2

INFIX TO POSTFIX

Example 1:

Infix: 1 + 2 * 3 + 4

Stack: + *

Postfix: 1 2 3

INFIX TO POSTFIX

Example 1:

Infix: 1 + 2 * 3 + 4

Stack: +

Postfix: 1 2 3 *

INFIX TO POSTFIX

Example 1:

Infix: $1 + 2 * 3 + 4$

Stack:

Postfix: $1\ 2\ 3\ *\ +$

INFIX TO POSTFIX

Example 1:

Infix: $1 + 2 * 3 + 4$

Stack: $+$

Postfix: $1\ 2\ 3\ *\ +$

INFIX TO POSTFIX

Example 1:

Infix: 1 + 2 * 3 + 4

Stack: +

Postfix: 1 2 3 * + 4

INFIX TO POSTFIX

Example 1:

Infix: $1 + 2 * 3 + 4$

Stack:

Postfix: $1\ 2\ 3\ * + 4 +$

INFIX TO POSTFIX

Example 2:

Infix: $3 + 4 * 5 / 6$

Stack:

Postfix:

INFIX TO POSTFIX

Example 2:

Infix: 3 + 4 * 5 / 6

Stack:

Postfix: 3

INFIX TO POSTFIX

Example 2:

Infix: 3 + 4 * 5 / 6

Stack: +

Postfix: 3

INFIX TO POSTFIX

Example 2:

Infix: 3 + 4 * 5 / 6

Stack: +

Postfix: 3 4

INFIX TO POSTFIX

Example 2:

Infix: 3 + 4 * 5 / 6

Stack: + *

Postfix: 3 4

INFIX TO POSTFIX

Example 2:

Infix: 3 + 4 * 5 / 6

Stack: + *

Postfix: 3 4 5

INFIX TO POSTFIX

Example 2:

Infix: $3 + 4 * 5 / 6$

Stack: $+$

Postfix: $3\ 4\ 5\ *$

INFIX TO POSTFIX

Example 2:

Infix: $3 + 4 * 5 / 6$

Stack: $+ /$

Postfix: $3\ 4\ 5 *$

INFIX TO POSTFIX

Example 2:

Infix: 3 + 4 * 5 / 6

Stack: + /

Postfix: 3 4 5 * 6

INFIX TO POSTFIX

Example 2:

Infix: $3 + 4 * 5 / 6$

Stack: $+$

Postfix: $3\ 4\ 5 * 6\ /$

INFIX TO POSTFIX

Example 2:

Infix: $3 + 4 * 5 / 6$

Stack:

Postfix: $3\ 4\ 5 * 6 / +$

INFIX TO POSTFIX

Example 3:

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

Stack:

Postfix:

INFIX TO POSTFIX

Example 3:

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

Stack: (

Postfix:

INFIX TO POSTFIX

Example 3:

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

Stack: $($

Postfix: 300

INFIX TO POSTFIX

Example 3:

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

Stack: $(+$

Postfix: 300

INFIX TO POSTFIX

Example 3:

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

Stack: $(+$

Postfix: $300\ 23$

INFIX TO POSTFIX

Example 3:

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

Stack: (

Postfix: $300\ 23\ +$

INFIX TO POSTFIX

Example 3:

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

Stack:

Postfix: $300\ 23\ +$

INFIX TO POSTFIX

Example 3:

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

Stack: $*$

Postfix: $300\ 23\ +$

INFIX TO POSTFIX

Example 3:

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

Stack: $* ($

Postfix: $300\ 23\ +$

INFIX TO POSTFIX

Example 3:

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

Stack: $* ($

Postfix: $300\ 23 + 43$

INFIX TO POSTFIX

Example 3:

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

Stack: $* (-$

Postfix: $300\ 23 + 43$

INFIX TO POSTFIX

Example 3:

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

Stack: $* (-$

Postfix: $300\ 23 + 43\ 21$

INFIX TO POSTFIX

Example 3:

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

Stack: $* ($

Postfix: $300\ 23 + 43\ 21 -$

INFIX TO POSTFIX

Example 3:

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

Stack: $*$

Postfix: $300\ 23 + 43\ 21 -$

INFIX TO POSTFIX

Example 3:

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

Stack:

Postfix: $300\ 23 + 43\ 21 - *$

INFIX TO POSTFIX

Example 3:

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

Stack: $/$

Postfix: $300\ 23 + 43\ 21 - *$

INFIX TO POSTFIX

Example 3:

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

Stack: / (

Postfix: $300\ 23 + 43\ 21 - *$

INFIX TO POSTFIX

Example 3:

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

Stack: $/ ($

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

INFIX TO POSTFIX

Example 3:

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

Stack: $/ (+$

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

INFIX TO POSTFIX

Example 3:

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

Stack: $/ (+$

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

INFIX TO POSTFIX

Example 3:

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

Stack: / (

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

INFIX TO POSTFIX

Example 3:

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

Stack: $/$

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

INFIX TO POSTFIX

Example 3:

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

Stack:

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

INFIX TO POSTFIX

Example 4:

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

Stack:

Postfix:

INFIX TO POSTFIX

Example 4:

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

Stack: (

Postfix:

INFIX TO POSTFIX

Example 4:

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

Stack: (

Postfix: 4

INFIX TO POSTFIX

Example 4:

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

Stack: $($ $+$

Postfix: 4

INFIX TO POSTFIX

Example 4:

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

Stack: $($ $+$

Postfix: $4\ 8$

INFIX TO POSTFIX

Example 4:

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

Stack: (

Postfix: $4\ 8\ +$

INFIX TO POSTFIX

Example 4:

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

Stack:

Postfix: $4\ 8\ +$

INFIX TO POSTFIX

Example 4:

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

Stack: $*$

Postfix: $4\ 8\ +$

INFIX TO POSTFIX

Example 4:

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

Stack: $* ($

Postfix: $4\ 8\ +$

INFIX TO POSTFIX

Example 4:

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

Stack: $* ($

Postfix: $4\ 8 + 6$

INFIX TO POSTFIX

Example 4:

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

Stack: $* (-$

Postfix: $4\ 8 + 6$

INFIX TO POSTFIX

Example 4:

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

Stack: $* (-$

Postfix: $4\ 8 + 6\ 5$

INFIX TO POSTFIX

Example 4:

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

Stack: $* ($

Postfix: $4\ 8 + 6\ 5 -$

INFIX TO POSTFIX

Example 4:

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

Stack: $*$

Postfix: $4\ 8 + 6\ 5 -$

INFIX TO POSTFIX

Example 4:

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

Stack:

Postfix: $4\ 8 + 6\ 5 - *$

INFIX TO POSTFIX

Example 4:

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

Stack: $/$

Postfix: $4\ 8 + 6\ 5 - *$

INFIX TO POSTFIX

Example 4:

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

Stack: / (

Postfix: $4\ 8 + 6\ 5 - *$

INFIX TO POSTFIX

Example 4:

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

Stack: / ((

Postfix: $4\ 8 + 6\ 5 - *$

INFIX TO POSTFIX

Example 4:

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

Stack: / ((

Postfix: $4\ 8 + 6\ 5 - * 3$

INFIX TO POSTFIX

Example 4:

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

Stack: $/ ((-$

Postfix: $4\ 8 + 6\ 5 - * 3$

INFIX TO POSTFIX

Example 4:

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

Stack: $/ ((-$

Postfix: $4\ 8 + 6\ 5 - * 3\ 2$

INFIX TO POSTFIX

Example 4:

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

Stack: / ((

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 -$

INFIX TO POSTFIX

Example 4:

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

Stack: / (

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 -$

INFIX TO POSTFIX

Example 4:

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

Stack: $/ (*$

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 -$

INFIX TO POSTFIX

Example 4:

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

Stack: $/ (* ($

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 -$

INFIX TO POSTFIX

Example 4:

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

Stack: $/ (* ($

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 - 2$

INFIX TO POSTFIX

Example 4:

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

Stack: $/ (* (+$

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 - 2$

INFIX TO POSTFIX

Example 4:

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

Stack: $/ (* (+$

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 - 2\ 2$

INFIX TO POSTFIX

Example 4:

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

Stack: $/ (* ($

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 - 2\ 2 +$

INFIX TO POSTFIX

Example 4:

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

Stack: / (*

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 - 2\ 2 +$

INFIX TO POSTFIX

Example 4:

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

Stack: / (

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 - 2\ 2 + *$

INFIX TO POSTFIX

Example 4:

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

Stack: /

Postfix: $4\ 8 + 6\ 5 - * 3\ 2 - 2\ 2 + *$

INFIX TO POSTFIX

Example 4:

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

Stack:

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

INFIX TO POSTFIX

Example 5: Exponentiation

Infix: $1 + 2 \text{ ^ } 3$

Stack:

Postfix:

INFIX TO POSTFIX

Example 5: Exponentiation

Infix: 1 + 2 ^ 3

Stack:

Postfix: 1

INFIX TO POSTFIX

Example 5: Exponentiation

Infix: 1 + 2 ^ 3

Stack: +

Postfix: 1

INFIX TO POSTFIX

Example 5: Exponentiation

Infix: 1 + 2 ^ 3

Stack: +

Postfix: 1 2

INFIX TO POSTFIX

Example 5: Exponentiation

Infix: $1 + 2 \text{ ^ } 3$

Stack: $+ \text{ ^}$

Postfix: $1\ 2$

INFIX TO POSTFIX

Example 5: Exponentiation

Infix: 1 + 2 ^ 3

Stack: + ^

Postfix: 1 2 3

INFIX TO POSTFIX

Example 5: Exponentiation

Infix: $1 + 2 \text{ ^ } 3$

Stack: $+$

Postfix: $1\ 2\ 3 \text{ ^}$

INFIX TO POSTFIX

Example 5: Exponentiation

Infix: $1 + 2 \text{ ^ } 3$

Stack:

Postfix: $1\ 2\ 3 \text{ ^ } +$

INFIX TO POSTFIX

Example 5: Exponentiation (right to left associativity)

Infix: $x \text{ ^ } y \text{ ^ } z$ (note: x^{y^z})

Stack:

Postfix:

INFIX TO POSTFIX

Example 5: Exponentiation (right to left associativity)

Infix: x ^ y ^ z

Stack:

Postfix: x

INFIX TO POSTFIX

Example 5: Exponentiation (right to left associativity)

Infix: x ^ y ^ z

Stack: ^

Postfix: x

INFIX TO POSTFIX

Example 5: Exponentiation (right to left associativity)

Infix: x ^ y ^ z

Stack: ^

Postfix: $x\ y$

INFIX TO POSTFIX

Example 5: Exponentiation (right to left associativity)

Infix: x ^ y ^ z

Stack: ^ ^

Postfix: $x\ y$

INFIX TO POSTFIX

Example 5: Exponentiation (right to left associativity)

Infix: x ^ y ^ z

Stack: ^ ^

Postfix: $x\ y\ z$

INFIX TO POSTFIX

Example 5: Exponentiation (right to left associativity)

Infix: x ^ y ^ z

Stack: ^

Postfix: x y z ^

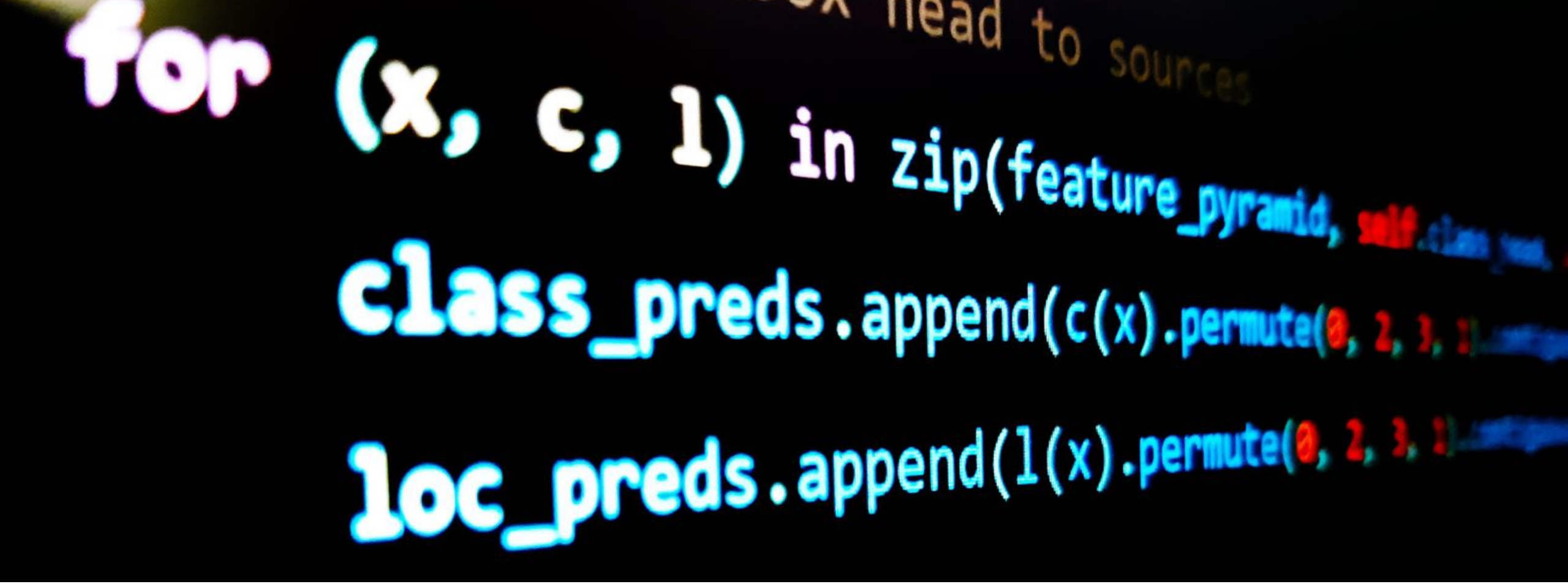
INFIX TO POSTFIX

Example 5: Exponentiation (right to left associativity)

Infix: x ^ y ^ z

Stack:

Postfix: $x\ y\ z$ ^^



INFIX TO POSTFIX

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