Starter

Evaluate the following RPN expressions on paper. Show your working!

1. 3 8 5 2 + −+
2. 5 7 + 2 * 8 −
3. 2 3 8 + * 2 4 − *
4. 4 8 6 2 3 − +/ *
5. 4 5/2 6 − 3 2 − − *

Starter

Evaluate the following RPN expressions on paper. Show your working!

1. 3 8 5 2 + −+ 4
2. 5 7 + 2 * 8 −
3. 2 3 8 + * 2 4 − *
4. 4 8 6 2 3 − +/ *
5. 4 5/2 6 − 3 2 − − *

Starter

Evaluate the following RPN expressions on paper. Show your working!

1. 3 8 5 2 + −+ — 4
2. 5 7 + 2 * 8 − — 16
3. 2 3 8 + * 2 4 − *
4. 4 8 6 2 3 − +/ *
5. 4 5/2 6 − 3 2 − − *

Starter

Evaluate the following RPN expressions on paper. Show your working!

1. 3 8 5 2 + −+ — 4
2. 5 7 + 2 * 8 − — 16
3. 2 3 8 + * 2 4 − * — −44
4. 4 8 6 2 3 − +/ *
5. 4 5/2 6 − 3 2 − − *

Starter

Evaluate the following RPN expressions on paper. Show your working!

1. 3 8 5 2 + −+ — 4
2. 5 7 + 2 * 8 − — 16
3. 2 3 8 + * 2 4 − * — −44
4. 4 8 6 2 3 − +/ * — 6.4
5. 4 5/2 6 − 3 2 − − *

Starter

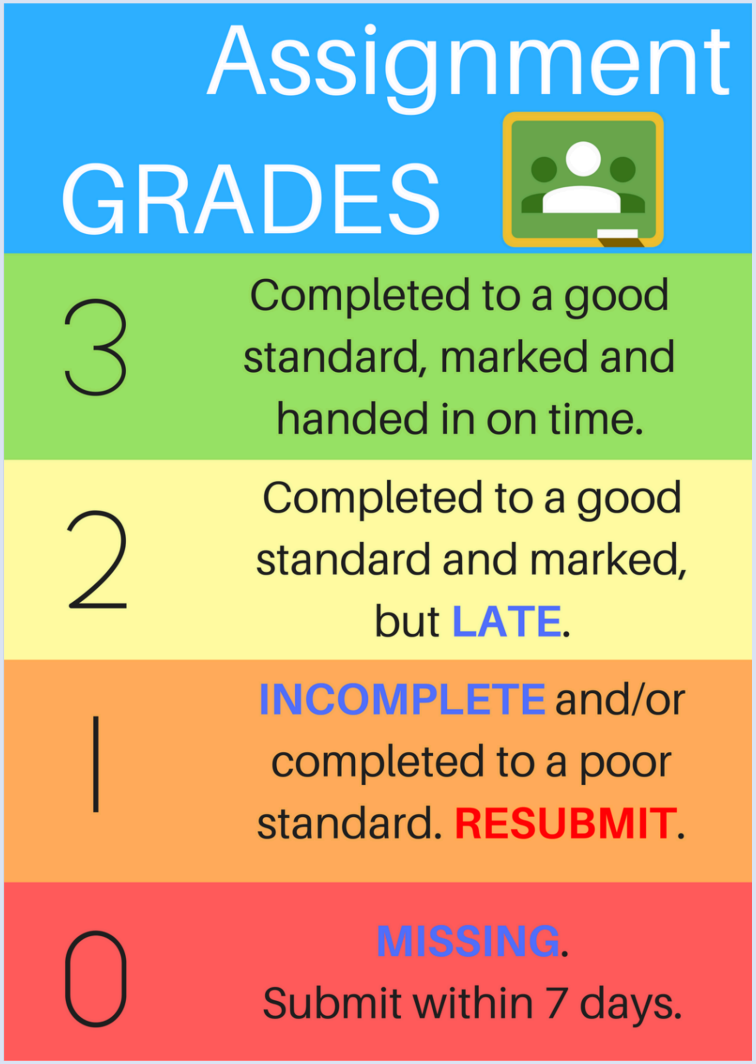
Evaluate the following RPN expressions on paper. Show your working!

1. 3 8 5 2 + −+	4
2. 5 7 + 2 * 8 −	16
3. 2 3 8 + * 2 4 − *	−44
4. 4 8 6 2 3 − +/ *	6.4
5. 4 5/2 6 − 3 2 − − *	−4

Weekly assignments

- Set **every Wednesday morning** on Google Classroom
- Due the following **Tuesday at 16:30**
- As a minimum, you are expected each week to
  - Complete 1 hour of on-going revision using provided flashcards
    - This will not start until week 5
    - Until then, you will be expected to complete the programming worksheets instead
  - Answer theory questions
  - Complete practical programming work and submit code and testing screenshots
  - Self-mark your answers
  - Reflect and make notes on improvement

Assignment grades



Lunchtime workshops

Monday	Tuesday	Wednesday	Thursday	Friday
Tristan – N10	Alex – N10	Isabel – N10		

12:00pm - 12:45pm (drop in for as long as you like in this time)

- You're welcome to bring your (cold) lunch and log into a computer – don't worry if the teacher is a bit late
- Starting w/b 15th September
- There will be student mentors running the workshops
- Teachers will be there to assist with any particularly tricky questions

Lunchtime workshops

Monday	Tuesday	Wednesday	Thursday	Friday
Tristan – N10	Alex – N10	Isabel – N10		

- Every Tuesday, Wednesday and Thursday lunchtime (starting next week)
  - 12:00–12:45
  - Drop in for as long as you like during this time
- Reasons to come to workshop include
  - To get help with a difficult topic from a recent lesson
  - To revise a topic from a while ago
  - To get help with a weekly assignment
  - To get advice about future plans (UCAS, university, apprenticeships, personal statements etc.)
  - To discuss something interesting related to computer science
  - For a quiet place to work on a PC at lunchtime

Converting between infix and postfix

Recap

- Notation

Recap

- Notation
  - **Operators**: `+`, `-`, `*`, `/`

Recap

- Notation
  - **Operators**: `+`, `-`, `*`, `/`
  - **Operands**: 3, 4, 5

Recap

- Notation
  - **Operators**: `+`, `-`, `*`, `/`
  - **Operands**: 3, 4, 5
- **Infix**

Recap

- Notation
  - **Operators**: `+`, `-`, `*`, `/`
  - **Operands**: 3, 4, 5
- **Infix** is the notation you are most familiar with
  - Operators are placed between operands
  - e.g. 2 + 2
  - Requires BIDMAS (or other rules) to evaluate

Recap

- Notation
  - **Operators**: `+`, `-`, `*`, `/`
  - **Operands**: 3, 4, 5
- **Infix** is the notation you are most familiar with
  - Operators are placed between operands
  - e.g. 2 + 2
  - Requires BIDMAS (or other rules) to evaluate
- **Postfix/reverse polish notation**

Recap

- Notation
  - **Operators**: +, −, *, /
  - **Operands**: 3, 4, 5
- **Infix** is the notation you are most familiar with
  - Operators are placed between operands
  - e.g. 2 + 2
  - Requires BIDMAS (or other rules) to evaluate
- **Postfix/reverse polish notation** is the notation we introduced last lesson
  - Operators are placed after operands
  - e.g. 2 2 +

Evaluating postfix

3 4 5 + −

Evaluating postfix

3 4 5 + −

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Apply the operator to the previous two **operands**
3. Repeat until the expression is fully evaluated

3 4 5 + −

Evaluating postfix

3 4 5 + –

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Apply the operator to the previous two **operands**
3. Repeat until the expression is fully evaluated

3 4 5 + –

3 9 –

Evaluating postfix

3 4 5 + –

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Apply the operator to the previous two **operands**
3. Repeat until the expression is fully evaluated

3 4 5 + –

3 9 –

–6

Advantages of postfix

Discuss: Why might postfix be be better for computers than infix?

Advantages of postfix

Discuss: Why might postfix be be better for computers than infix?

- There is no need for an order of precedence of operations (e.g. BIDMAS)
  - This is because postfix expressions can be evaluated left-to-right
- A computer can evaluate a postfix expression faster than the same expression in infix
- There is no need for brackets

Converting infix to postfix

$$6 + 7 * 3$$

1. Fully bracket the expression
2. Move operators to right of *their* bracket
3. Remove the brackets

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$$6\ 7\ 3\ * +$$

Converting infix to postfix

$$6 + 7 * 3$$

1. Fully bracket the expression
2. Move operators to right of *their* bracket
3. Remove the brackets

$$6\ 7\ 3\ *\ +$$

Warning

Two expressions can have the same value without being the same expression.

Examples

1. Fully bracket the expression
2. Move operators to right of *their* bracket
3. Remove the brackets

1. $(2 + 5)/6$

Tip: Operands maintain the same *relative* order

Examples

1. Fully bracket the expression
2. Move operators to right of *their* bracket
3. Remove the brackets

1. (2 + 5)/6 2 5 + 6/

Tip: Operands maintain the same *relative* order

Examples

1. Fully bracket the expression
2. Move operators to right of *their* bracket
3. Remove the brackets

1. $(2 + 5)/6$ — 2 5 + 6/
2. $4 + (9/3 + 2)$

Tip: Operands maintain the same *relative* order

Examples

1. Fully bracket the expression
2. Move operators to right of *their* bracket
3. Remove the brackets

1. (2 + 5)/6
2. 4 + (9/3 + 2)

2 5 + 6/

4 9 3/2 + +

Tip: Operands maintain the same *relative* order

Practice

Convert

$8 + 2 * 5$

into postfix notation

Practice

Convert

$8 + 2 * 5$

into postfix notation

$8\ 2\ 5\ *\ +$

Practice

Convert

$9 - (4 + 2) * 2$

into postfix notation

Practice

Convert

$9 - (4 + 2) * 2$

into postfix notation

$9\ 4\ 2\ +\ 2\ *\ -$

Practice

Convert

7 – 6/2 + 5

into postfix notation

Practice

Convert

7 – 6/2 + 5

into postfix notation

7 6 2/ – 5 +

Practice

Convert

7 – 6/2 + 5

into postfix notation

7 6 2/ – 5 +

or 7 6 2/5 + –

Converting postfix to infix

3 4 + 2 *

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Move the operator between the previous two **operands** and surround with brackets
3. Repeat until the expression is fully evaluated

In this case, bracketed expressions count as operands!

Converting postfix to infix

$$3\ 4\ +\ 2\ *$$

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Move the operator between the previous two **operands** and surround with brackets
3. Repeat until the expression is fully evaluated

In this case, bracketed expressions count as operands!

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

Using a stack

- A stack is a special way of storing data
- Much like a stack of books, you can place values on top of the stack and take them off, but you can't access the middle of the stack

3 4 + 2 *

Examples

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Move the operator between the previous two **operands** and surround with brackets
3. Repeat until the expression is fully evaluated

1. 6 2 7 / –

Tip: Bracketed expressions count as operands

Examples

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Move the operator between the previous two **operands** and surround with brackets
3. Repeat until the expression is fully evaluated

1. 6 2 7 / –

6 – 2 / 7

Tip: Bracketed expressions count as operands

Examples

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Move the operator between the previous two **operands** and surround with brackets
3. Repeat until the expression is fully evaluated

1. 6 2 7 / –
2. 8 3 5 + 2 / *

6 – 2 / 7

Tip: Bracketed expressions count as operands

Examples

Starting at the leftmost part of the expression,

1. Move right until you reach an **operator**
2. Move the operator between the previous two **operands** and surround with brackets
3. Repeat until the expression is fully evaluated

1. 6 2 7 / –
2. 8 3 5 + 2 / *

6 – 2 / 7

8 * (3 + 5) / 2

Tip: Bracketed expressions count as operands

Practice

Convert

8 2 3 * -

into infix notation

Practice

Convert

8 2 3 * –

into infix notation

8 – 2 * 3

Practice

Convert

3 5 + 2 /

into infix notation

Practice

Convert

3 5 + 2 /

into infix notation

(3 + 5) / 2

Practice

Convert

8 5 2 + 2 * –

into infix notation

Practice

Convert

8 5 2 + 2 * –

into infix notation

8 – (5 + 2) * 2

Exercise

1. 4 + 2 * 9
2. (8 – 5)/3
3. 4 + 7 – 2 * 3
4. (9 – 2)/((3 + 9)/4)

1. 4 9 5 + *
2. 3 6 2 1 + * –
3. 6 8 + 2/3 +
4. 8 3 6 + 3/ + 9 4 – * 5 –

Exercise

1. 4 + 2 * 9	4 2 9 * +
2. (8 – 5)/3	8 5 – 3/
3. 4 + 7 – 2 * 3	4 7 + 2 3 * –
4. (9 – 2)/((3 + 9)/4)	

1. 4 9 5 + *	4 * (9 + 5)
2. 3 6 2 1 + * –	3 – 6 * (2 + 1)
3. 6 8 + 2/3 +	(6 + 8)/2 + 3
4. 8 3 6 + 3/ + 9 4 – * 5 –	

Exercise

1. 4 + 2 * 9	4 2 9 * +
2. (8 – 5)/3	8 5 – 3/
3. 4 + 7 – 2 * 3	4 7 + 2 3 * –
4. (9 – 2)/((3 + 9)/4)	9 2 – 3 9 + 4/ /

1. 4 9 5 + *	4 * (9 + 5)
2. 3 6 2 1 + * –	3 – 6 * (2 + 1)
3. 6 8 + 2/3 +	(6 + 8)/2 + 3
4. 8 3 6 + 3/ + 9 4 – * 5 –	(8 + (3 + 6)/3) * (9 – 4) – 5

Exam question

0 5 `(3 + 4) * 5` is an example of an infix expression. The same expression has been represented in a different expression format in **Figure 2**.

Figure 2

```
3 4 + 5 *
```

0 5 . 1 What is the name of the expression format used in **Figure 2**?

[1 mark]

0 5 . 2 Represent the infix expression `5 + 2 * 3 + 4` in the same expression format used in **Figure 2**.

[2 marks]

Exam question (mark scheme)

Question			Marks
05	1	**Mark is for AO1 (understanding)** Reverse Polish (Notation) // RPN; **A.** Postfix	1
05	2	**All marks AO2 (apply)** `523*+4+;;` **Mark as follows:** **1 mark:** `23*` in expression; **1 mark:** correct order of operands with `+` symbols either side of the `4`; **Max 1 mark if any errors**	2

Selection

Recap

Discuss:

What is a variable?

What does every variable have?

Practice

Write the line of code required to create a variable called `name` that stores the name of the person sitting next to you.

Practice

Write the line of code required to create a variable called `name` that stores the name of the person sitting next to you.

```
string name = "Alex";
```

Practice

Write the line of code required to create a variable called `lessons` that stores the number of lessons you have today.

Practice

Write the line of code required to create a variable called `lessons` that stores the number of lessons you have today.

```
int lessons = 3;
```

Practice

Write the line of code required to create a variable called `bestSubject` that stores a value input by the user.

Practice

Write the line of code required to create a variable called `bestSubject` that stores a value input by the user.

```
string bestSubject = Console.ReadLine();
```

Practice

Write the line of code required to create a variable called `mealDealPrice` that stores the value 3.5

Practice

Write the line of code required to create a variable called `mealDealPrice` that stores the value 3.5

```
double mealDealPrice = 3.5;
```

Practice

Write the line of code required to create a variable called `isWarmToday` that stores either true or false.

Practice

Write the line of code required to create a variable called `isWarmToday` that stores either true or false.

```
bool isWarmToday = true; // hopefully!
```

Selection & if statements

- **Selection** is the programming concept by which we choose a path in the code to take depending on a condition

Selection & if statements

- **Selection** is the programming concept by which we choose a path in the code to take depending on a condition
- A **condition** is an expression that evaluates to true or false
  - e.g. `isWarmToday`
  - e.g. `age > 18`

Selection & if statements

- **Selection** is the programming concept by which we choose a path in the code to take depending on a condition
- A **condition** is an expression that evaluates to true or false
  - e.g. `isWarmToday`
  - e.g. `age > 18`
- An **if statement** is a form of selection
  - A block of code runs only if a specified condition is true

Conditions

- A condition is an expression that evaluates to a boolean (true or false)
- Comparisons are a form of condition

<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to
!=	Not equal to
==	Equal to

Comparisons practice

Let $A = 1$, $B = -2$, $C = 3$, $D = 4$, E = 'S' and F = 'J'.

State whether the following conditions are true or false.

1. `A == B`
2. `A > B`
3. `(A < C) and (B > D)`
4. `(A < C) and (B < D)`
5. `(A < B) or (C < D)`
6. `E > F`
7. `((A + C) > (B - D)) and ((B + C) < (D - A))`

Comparisons practice

Let $A = 1$, $B = -2$, $C = 3$, $D = 4$, E = 'S' and F = 'J'.

State whether the following conditions are true or false.

1. `A == B` **False**
2. `A > B` **True**
3. `(A < C) and (B > D)` **False**
4. `(A < C) and (B < D)` **True**
5. `(A < B) or (C < D)` **True**
6. `E > F` **True**
7. `((A + C) > (B - D)) and ((B + C) < (D - A))` **True**

Demo

```
int num;

Console.Write("Enter number: ");
num = int.Parse(Console.ReadLine());

if (num > 0)
{
    Console.WriteLine(num + " is positive");
}
else
{
    Console.WriteLine(num + " is negative");
}
```

Logical operators

- We can combine conditions with **logical operators**
- `&&` is used for logical AND
- `||` is used for logical OR

```
int x = 5;

if (x >= 1 && x <= 10)
{
    Console.WriteLine("x is in range!");
}
```

Worksheet

W101 - C# If