Welcome to Computer Science

Please fill out the Google form before the end of the week so that I can learn a little about you!

The team

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What we expect of you

Punctuality

- Arrive **two minutes early** for lessons
  - Mobile phone in holder; headphones away
  - Get a whiteboard and pen
  - Log in to the computer
  - Be ready with paper and pen for notes

This ensures no time is wasted for you or anyone else.

What we expect of you

Notes

You are expected to take **some** notes in all lessons. Unless you have an access arrangement that allows the use of a word processor, we expect you to do this on paper.

But your first priority should be engaging with the lesson.

What we expect of you

Independent work

Every subject requires **4.5 hours** of independent study.

We will set assignments to complete each week, but more on this next lesson.

100% submission rate is expected.

What we expect of you

Responsibility for your learning

- You will not get a top grade without participating in class discussions
- If you have questions, **ask** – don’t just sit there!
  - During the lesson
  - After the lesson
  - At lunchtime workshops

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- If you have questions, **ask** – don't just sit there!
  - During the lesson
  - After the lesson
  - At lunchtime workshops
- Getting things wrong is the best way to learn

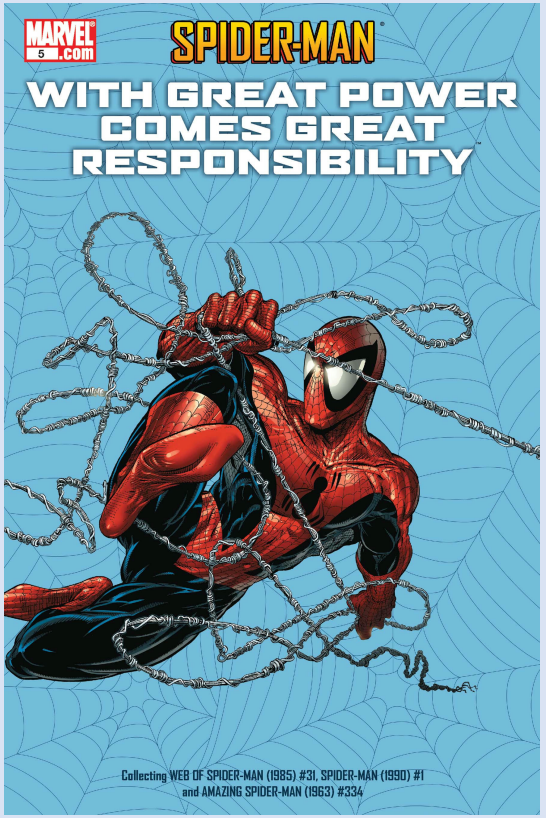
These are useful study skills for the future.

What we expect of you

Screens

- You should only use the computers for what we are working on
  - They’re not for doing homework
  - They’re not for checking your emails
- When we’re doing theory, don’t use the computers for programming

This is so nobody is distracted.



What we expect of you

Missing a lesson

If you miss a lesson (for illness or otherwise):

- Notify your teacher by email
- Get a parent to authorise your absence online
- Catch up with the missed content – your teacher will not teach the same lesson again
- If you're still confused, use Ada Computer Science to search for more information
  - Avoid Google; it doesn't know the specification
- If you're still confused, attend a lunchtime workshop

Resources

There are masses of resources available to you.

- BPCompSci
- Ada Computer Science
- Lunchtime workshops
- Brainscape sets

The course

Computer science is a linear course: all exams are at the end of the two years.

Our exam board is **AQA**.

Paper 1	Paper 2	Non-exam assessment
What's assessed This paper tests a student's ability to program, as well as their theoretical knowledge of computer science from subject content 10–13 above and the skills required from section 22 above.	**What's assessed** This paper tests a student's ability to answer questions from subject content 14–21 above.	**What's assessed** The non-exam assessment assesses student's ability to use the knowledge and skills gained through the course to solve or investigate a practical problem. Students will be expected to follow a systematic approach to problem solving, as shown in section 22 above.
Assessed • On-screen exam: 2 hours 30 minutes • 40% of A-level	**Assessed** • Written exam: 2 hours 30 minutes • 40% of A-level	**Assessed** • 75 marks • 20% of A-level
Questions Students answer a series of short questions and write/adapt/extend programs in an electronic answer document provided by us. We will issue preliminary material, a skeleton program (available in each of the programming languages) and, where appropriate, test data, for use in the exam.	**Questions** Compulsory short-answer and extended-answer questions.	

The course – overview (year 1)

C#

Basics, imperative,
procedural, recursive and
object-oriented programming

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How does a computer work internally? How do the components communicate?

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Basics, imperative, procedural, recursive and object-oriented programming

Networking
How do computers and devices communicate with each other?

Computer Systems
Logic, operating systems, software and hardware

Computer Architecture
How does a computer work internally? How do the components communicate?

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Low-level CPU programming

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The course – extras

- We offer enrichment activities alongside the A-level content
  - British Informatics Olympiad
    - Annual competition in computer programming for sixth form students
    - Very elite!
  - Advent of Code
    - Daily programming challenges through December
  - Bebras Elite Computational Thinking Challenge
    - A computation challenge run by the University of Oxford
  - Cyber Discovery/CyberCenturion
    - Cyber security competitions

Starter

Evaluate

$3 + 4 \times 5$

Starter

Evaluate

$3 + 4 \times 5$

23

Starter

Evaluate

$(3 + 4) \times 5$

Starter

Evaluate

$(3 + 4) \times 5$

35

Starter

Evaluate

$$(3 + 4) \times (5 - 2)$$

Starter

Evaluate

$(3 + 4) \times (5 - 2)$

21

Starter

Evaluate

$2 \times 7 - 10 + 4$

Starter

Evaluate

$2 \times 7 - 10 + 4$

8

Starter

Evaluate

$$3 + 4 \times 5 - 8/(2 + 2)$$

Starter

Evaluate

$3 + 4 \times 5 - 8/(2 + 2)$

21

Starter

Evaluate

$3 - 4 + 2$

Starter

Evaluate

$3 - 4 + 2$

1

The problem with these expressions

- As humans, we have been trained to multiply before adding
  - BIDMAS
  - A computer would need to be programmed with these rules
- We use brackets to clarify exceptions
  - A computer would need to be programmed with these rules too

How can we write expressions in a way that is simpler for computers to understand?

Reverse Polish Notation

Introduction

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

- This is called **infix** notation
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$$3\ 4\ 5\ *\ +8\ 2\ 2\ +\ /\ -$$

- This is called **postfix/reverse polish notation**

Evaluating RPN expressions

3 4 5 * +8 2 2 + / –

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

Practice

Evaluate

6 2 /

Practice

Evaluate

6 2 /

3

Practice

Evaluate

2 9 + 4 *

Practice

Evaluate

2 9 + 4 *

44

Practice

Evaluate

3 6 5 – 2 * +

Practice

Evaluate

3 6 5 – 2 * +

5

Exercise

1. 1 1 -
2. 1 1 - 2 +
3. 1 2 3 * 4 + +
4. 1 3 4 + 2 * 7 / +
5. 9 6 - 4 / 9 +
6. 1 3 3 7 - 2 + -+
7. 6 5 3 / 7 - 2 2 3 * --3 * -

Exercise

1.	1 1 –	0
2.	1 1 – 2 +	2
3.	1 2 3 * 4 + +	11
4.	1 3 4 + 2 * 7 / +	
5.	9 6 – 4 / 9 +	
6.	1 3 3 7 – 2 + –+	
7.	6 5 3 / 7 – 2 2 3 * –– 3 * –	

Exercise

1.	1 1 -	0
2.	1 1 - 2 +	2
3.	1 2 3 * 4 + +	11
4.	1 3 4 + 2 * 7 / +	3
5.	9 6 - 4 / 9 +	9.75
6.	1 3 3 7 - 2 + -+	6
7.	6 5 3 / 7 - 2 2 3 * --3 * -	10

Notation vs. expression

- Using RPN does not change the expression; it only changes the way it is written
- Hence, we can convert between RPN and infix notation, but still be representing the same expression

Advantages of RPN

- 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

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  - 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

C# Programming (Variables)

Getting started

1. Sign in to Google Drive for Desktop and create a folder called “CompSci”
2. Open Visual Studio 2022 Community Edition – not Visual Studio Code
3. Create a new Console App (.NET Framework) project called “L101 Variables”

Data types

Every piece of data that we store/use has a **type**

Data type	Description
`int`	A whole number between ~−2.1bn and ~2.1bn
`byte`	A whole number between 0 and 255 (inclusive)
`float`	A real number
`double`	A real number
`char`	A character (letter, digit, symbol etc.)
`string`	A sequence of characters
`DateTime`	A value storing a date and time
`bool`	`true` or `false`

Variables

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  - We'll look at how this works in future lessons
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- A variable has:
  - Data type
    - We will only use `int` and `string` today
  - Identifier
  - Value

Declaring a variable

- The first step to creating a variable is to **declare** it
- Variable declaration is as simple as stating the type and identifier of the variable

```
string name;
int age;
```

Here, we have declared two variables: `name` and `age`. This is perfectly valid code. Behind the scenes, the program is reserving space in memory for us to store those values.

Variable assignment & initialisation

- We **assign** values to variables – this is known as variable **assignment**
  - e.g. we assign the value 16 to the variable age
- When we assign a variable its first value, we have **initialised** the variable

```
string name;
int age;

name = "Alice"; // Initialisation
age = 16; // Initialisation

age = 17; // Assignment
```

Variable assignment & initialisation

- We can declare and initialise a variable in one line
- This is more common, but it’s useful to know both methods

```
string name = "Alice";
int age = 16;

age = 17; // Assignment
```

Identifiers

- Rules
  - Cannot start with a number
  - Can only contain letters (a-z, A-Z), numbers (0-9) and underscores
- Guidelines
  - Choose sensible identifiers
    - Avoid one-letter identifiers (except in `for` loops, but we'll see those later)
    - Avoid abbreviations
  - Describe what is stored
  - Identifiers are case-sensitive, so choose a sensible capitalisation convention and stick to it

camelCase

- For variable identifiers, it is common practice to use `camelCase`
- This is a capitalisation convention
- The first word starts with a lowercase letter, then all following words start with a capital letter
- Examples:
  - `age`
  - `aReallyLongVariableIdentifier`
  - `birthYear`
- Your code will work if you don't stick to this, but it'll be more readable (and nicer to look at) if you do
  - Any other convention will do too, but this typical for C#

Example 1

```
class Program
{
    static void Main(string[] args)
    {
        string myName = "";

        Console.WriteLine("Enter name: ");
        myName = Console.ReadLine();
        Console.WriteLine("Hello, " + myName);
        Console.ReadKey();
    }
}
```

1. Copy this program from Google Classroom
2. Amend it such that it also asks for the user's surname and displays it after the "Hello" line

Example 2

```
class Program
{
    static void Main(string[] args)
    {
        int num;
        int square;

        num = 5;
        square = num * num;

        Console.Write("The answer is: ");
        Console.WriteLine(square);
    }
}
```

Comments

- Comments allow us to include text in our code that isn't considered to be code
- They can be a form of documentation

```
static void Main()
{
    // This is a comment!
    Console.WriteLine("Hello, world!");
}
```

Constants

- Constants are like variables, except
  - They must be given a value when they are declared
  - Their value cannot be changed (they’re constant!)

```
static void Main(string[] args)
{
    const double pi = 3.14;
}
```

Worksheets

- We have worksheets available for most programming lessons
  - Remember: the best way to learn to program is to practice!
- Start the worksheets in class and complete them at home if you can – the more practice, the better

1. Create a folder in your Google Drive for computer science worksheets
2. Share it with me (with editing permissions)
3. Make a copy of the worksheet in the new folder
4. Copy code solutions into the document

W100 - C# Variables