KNOWLEDGE ORGANISER

KS3 COMPUTING: Year 8 Summer Term Unit 1 Computational Thinking

ST IVO ACADEMY
Astrea Academy Trust
INSPIRING BEYOND MEASURE

Overview

KEY WORDS

Computational Thinking	Content (text, audio, images, video) or devices that allow people to share information, communicate, and collaborate over internet or computer networks
Algorithm	An algorithm is a set of instructions for solving a problem or completing a task
Abstraction	To remove unnecessary information in order to solve a problem
Decomposition	Decomposition involves breaking down a large problem into smaller sub-problems
Pseudocode	A simplified programming language, used in program design
Flowcharts	A diagram of the sequence of movements or actions of people or things involved in a complex system or activity
Logic Gates	**Logic gates** are the building blocks of digital circuits. **Logic gates** have one or two inputs that can be turned on or off
Binary	**Binary** is a number system that only uses two digits: 1 and 0. All information that is processed by a computer is in the form of a sequence of 1s and 0s.
Hexidecimal	The **hexadecimal** numeral system, often shortened to "hex", is a numeral system made up of 16 symbols (base 16))
ASCII Code	ASCII is a 7-**bit** code, meaning that 128 characters (27) are defined

Software and resources that will be used:

- Microsoft Teams
- Internet Explorer/Chrome
- Microsoft Word/Powerpoint

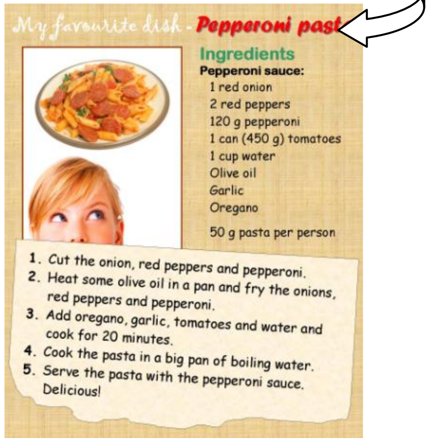
Key Learning that will take place in this unit

Understand computational thinking including

- abstraction
- decomposition
- algorithmic thinking

What is an Algorithm?

An algorithm is a set of instructions to be followed in order to complete a task. For example, when cooking, we follow a set of instructions (the recipe) in a logical order in order to create the final dish.



My favourite dish - Pepperoni past

Ingredients

Pepperoni sauce:

1 red onion
2 red peppers
120 g pepperoni
1 can (450 g) tomatoes
1 cup water
Olive oil
Garlic
Oregano

50 g pasta per person

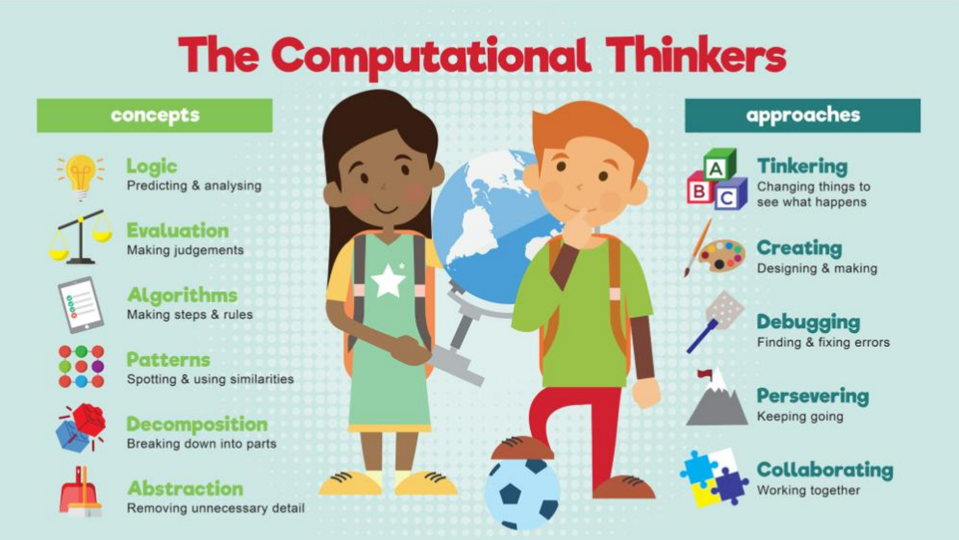
1. Cut the onion, red peppers and pepperoni.
2. Heat some olive oil in a pan and fry the onions, red peppers and pepperoni.
3. Add oregano, garlic, tomatoes and water and cook for 20 minutes.
4. Cook the pasta in a big pan of boiling water.
5. Serve the pasta with the pepperoni sauce. Delicious!

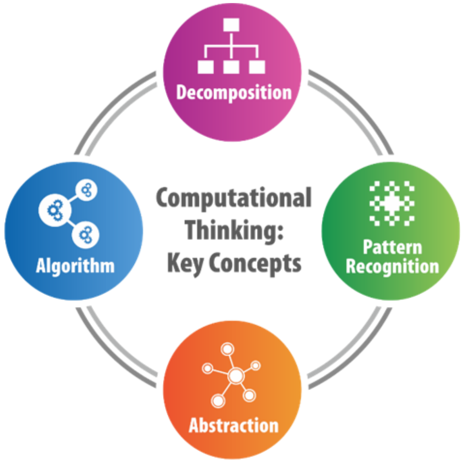
Computational Thinking

The day to day life of a computer is to analyse and carry out millions and billions of instructions. In order to do so, it has to plan, sequence and carry out these instructions in a logical manner.

Abstraction

Carrying out abstraction is to remove unnecessary information in order to solve a problem. This helps to simplify the problem. The most common example to explain abstraction is the map of the London Underground compared to the actual map of London. The underground map removes all the unnecessary information such as names of roads, distance, bus stops and names of buildings.





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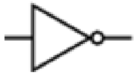
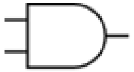
Logic Gates

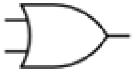
Logic gates are the building blocks of digital circuits. **Logic gates** have one or two inputs that can be turned on or off.



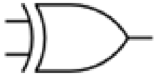
NOT – exactly opposite to the input



AND – both inputs must be on to work



OR – either input needs to be ON or both to work



XOR – either input needs to be on but not both to get it to work

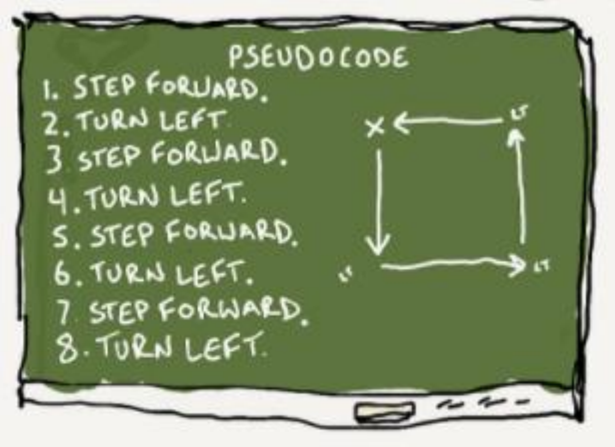
Decomposition

This is a vital concept in computational thinking. This is the process of breaking the problem down into smaller 'problems' thus making the overall solution easier to solve. This could also be breaking the task down into subtasks.

One of the benefits of decomposition is that you may identify a task that can be repeated in order to complete other parts of the problem.

Pseudocode

Before starting a complex coding project, it is vital you plan. Writing out the solution in Pseudocode is a vital step. Writing in Pseudocode is similar to the actual code but in a far more simple method.



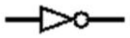
PSEUDOCODE

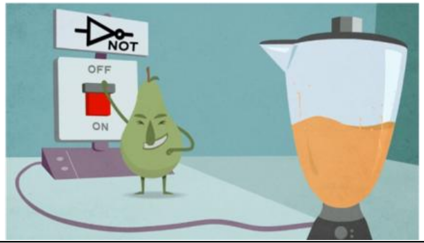
```
1. STEP FORWARD.
2. TURN LEFT
3 STEP FORWARD.
4. TURN LEFT.
5. STEP FORWARD.
6. TURN LEFT.
7 STEP FORWARD.
8. TURN LEFT.
```

Example of Logic Gates

NOT

- A NOT gate will output the opposite to the input.

NOT 



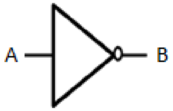
The switch is set to OFF. Will the blender work or stay turned off?

Truth Tables

NOT - Truth Table

A	B
ON	OFF
OFF	ON

Exactly opposite to the input



A **truth table is** a mathematical **table used** to determine if a compound statement **is** true or false

In this example of a NOT gate, we know that if A, which is the INPUT is set to ON, the OUTPUT B will be the opposite, so we fill in OFF for B. If the INPUT of A is set to OFF, then the OUTPUT of B is set to ON.

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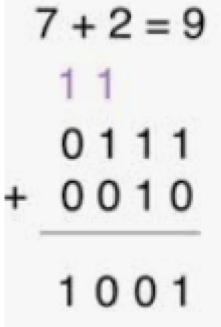
Binary Addition

There are four rules that need to be followed when adding two binary numbers. These are:

- 0 + 0 = 0
- 1 + 0 = 1
- 1 + 1 = 10 (binary for 2)
- 1 + 1 + 1 = 11 (binary for 3)



```
7 + 2 = 9
 1 1
  0 1 1 1
+ 0 0 1 0
  -------
  1 0 0 1
```

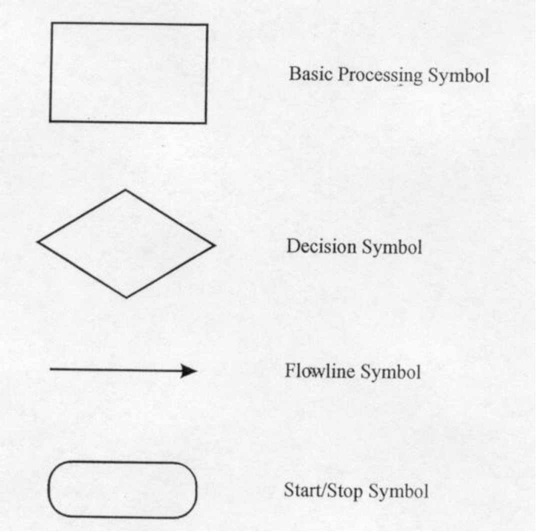
Binary numbers are written from 1 bit to 8 bit. These are a combination of 0s and 1s

This is an 8 digital binary number

128	64	32	16	8	4	2	1
0	**1**	**0**	**0**	**1**	**0**	**0**	**1**

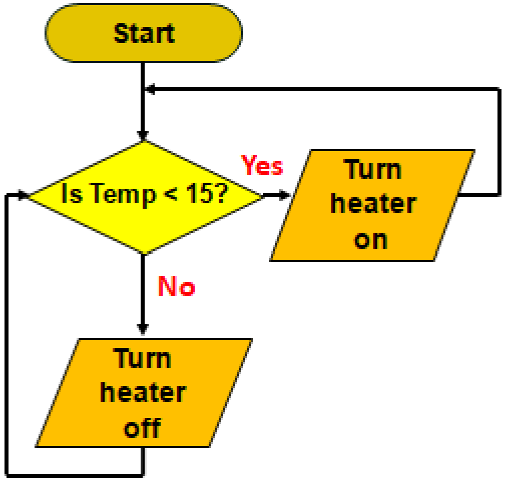
This is written as 0100 1001. To find out the DENARY value, we add up all the 1s and their values so we have 64+8+1 which means that Binary 01001001 as a Denary is 73

Flowcharts



Example Flow Chart

What is happening in this flowchart?



Useful Links

GCSE Bitesize

https://www.bbc.co.uk/bitesize/topics/z7tp34j

Test Yourself

1. **What happens if the switch is ON using a NOT gate?**
2. **What is the symbol for a Decision in a flowchart?**
3. **What is an algorithm? Explain using an example**
4. **What is the benefit of carrying out decomposition on a task?**

At Home

Create a flowchart for a computer system at home. An example could be a washing machine cycle. What are the inputs when setting up your washing machine?