



**Bridgewater**  
High School

# Unit 7.2 – Computer Systems and Computational Thinking

**Name:**

**Target:**

A definition of a Computer System is

# How you will be assessed

- Your teacher will look at your workbook and leave comments regarding the completion of your work.
- You will have regular questioning and quick fire questions at the beginning of lessons.
- You will sit a mid unit and end of unit test to assess your knowledge.
- You will produce work which your teacher will assess.

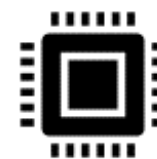
# Unit 7.2 Assessment Grid

	ADVANCED	INTERMEDIATE	FOUNDATION
Lesson 1	I can identify and explain how different components of a computer system operate in everyday devices.	I can explain how different components of a computer system operate in devices.	I can demonstrate basic knowledge on how computer systems work.
Lesson 2 & 3	I can describe how a computer uses binary to store data and instructions.	I can demonstrate knowledge of how a computer uses binary to store data and instructions.	I can provide a simple explanation of how a computer uses binary.
Lesson 3, 4 & 6	I can accurately calculate and solve problems using binary, denary and binary addition.	I can calculate and solve some problems using binary, denary and binary addition.	I can calculate and solve some problems using binary and denary/
Lesson 7, 8 & 9	I can explain all methods of computational thinking and apply them precisely when problem solving.	I can identify methods of computational thinking and apply them when problem solving.	I can identify and use some methods of computational thinking.

Computer Systems		
1	<b>Computer System</b>	A device that consists of input, process, output and storage.
2	<b>Input</b>	Provides data to a computer system. e.g. keyboard.
3	<b>Output</b>	Used to communicate the results of data that has been processed, e.g. monitor.
4	<b>Process</b>	A calculation is carried out on input to turn it into meaningful output.
5	<b>Storage</b>	Used to store data, e.g. a USB stick.

Computers and Binary		
1	<b>Instructions</b>	A single action that can be performed by a computer processor.
2	<b>Data</b>	Units of information given to a computer system.
3	<b>Central Processing Unit (CPU)</b>	Central Processing Unit (CPU) is the brain of the computer that processes program instructions.
4	<b>Transistors</b>	Devices that open and close circuits to communicate electrical signals. CPUs contain millions of transistors.
5	<b>Boolean Logic</b>	A form of logical algebra which work only with two values, true or false.
6	<b>AND</b>	Has two inputs. The inputs must be 1 (ON) in order for the output to be 1 (ON).
7	<b>OR</b>	Has two inputs. Either of the inputs have to be 1 (ON) in order for the output to be 1 (ON), otherwise the output is 0 (OFF).
8	<b>NOT</b>	Has one input. The input has to be 0 (OFF) for the output to be 1 (ON), otherwise the output is 0 (OFF).
9	<b>Binary</b>	A number system that contains two symbols, 0 and 1. Also known as base 2.
10	<b>Denary</b>	The number system most commonly used by people. It contains 10 unique digits 0 to 9. Also known as decimal or base 10.

Computer Systems		
1	<b>Computational Thinking</b>	Allows a complex problem to be taken, understood and a solution is developed. The solutions can be presented in a way that a computer, a human or both can understand.
2	<b>Abstraction</b>	Focusing on the important information only, ignoring irrelevant detail.
3	<b>Decomposition</b>	Breaking down a complex problem or system into smaller, more manageable parts.
4	<b>Pattern Recognition</b>	Looking for similarities among and within problems.
5	<b>Algorithms</b>	Developing a step-by-step solution to the problem, or the rules to follow to solve the problem.



Command Words		
1	<b>Identify</b>	Recognise, list, name or otherwise characterise.
2	<b>Explain</b>	Make an idea, situation or problem clear by describing it in detail revealing relevant facts or data.
3	<b>Describe</b>	Give an account in words of someone or something including all of the relevant characteristics.
4	<b>Calculate</b>	Generate a numerical answer, with workings shown.
5	<b>Demonstrate</b>	Show in an explicit way.
6	<b>Solve</b>	Find an answer to, explanation for, or means of effectively dealing with a problem.



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# Lesson 1 – How Computers Work

- Be able to provide a definition of a computer system
- Be able to identify examples of input and output methods
- Be able to describe how a computer system works

**Task 1: Using the Internet find 3 devices each for input, storage and output. Describe what each device does and how it could be used in school.**

**Input Device 1:**

**Describe what it does:**

**Where could it be used in school?**

**Input Device 2:**

**Describe what it does:**

**Where could it be used in school**

**Input Device 3:**

**Describe what it does:**

**Where could it be used in school**

**...Continued Task 1: Using the Internet find 3 devices each for input, storage and output. Describe what each device does and how it could be used in school.**

**Storage Device 1:**

**Describe what it does:**

**Where could it be used in school?**

**Storage Device 2:**

**Describe what it does:**

**Where could it be used in school**

**Storage Device 3:**

**Describe what it does:**

**Where could it be used in school**

**...Continued Task 1: Using the Internet find 3 devices each for input, storage and output. Describe what each device does and how it could be used in school.**

**Output Device 1:**

**Describe what it does:**

**Where could it be used in school?**

**Output Device 2:**

**Describe what it does:**

**Where could it be used in school**

**Output Device 3:**

**Describe what it does:**

**Where could it be used in school**



**Next steps** : Find the device responsible for **processing** in a computer. Create a fact file which includes the following:

**Name:**

**What does it do in a computer system?**

**What human body part is it referred to?**

**Why is this component so important to a computer system?**



**IMAGE**



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# Lesson 2 – The CPU and Boolean Logic

- Understand how instructions are stored and executed using the Central Processing Unit (CPU)
- Explain how transistors use Boolean logic to create computer systems
- Identify uses of the Boolean logic operators: AND, OR and NOT in everyday systems

## Quick Fire Questions



1. A computer system is...
2. The four parts of a computer system are:
  - 1.
  - 2.
  - 3.
  - 4.
3. An example of a computer system would be...

**Task 1: Fill in the definitions for the key terms covered so far, using your knowledge organiser.**

Key Term	Definition
Computer System	
Input	
Output	
Process	
Storage	
CPU	
Transistor	
Binary	

**...Continued Task 1: Using the Internet find examples of devices that use the Boolean logic gates. Try to find at least two examples for each.**

**AND**

**Example 1**

**Example 2**

**OR**

**Example 1**

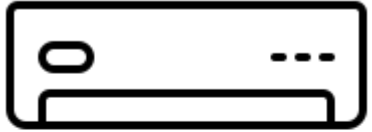
**Example 2**

**NOT**

**Example 1**

**Example 2**

**Next steps** : Think about the different computer systems that are used around school, e.g. the air conditioning unit. Explain which Boolean Logic gates have been used to create them and why.



## EXAMPLE

Air conditioning unit

**AND**

Is the device on? **AND**  
has the remote button  
been pressed?



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## Lesson 3 – Denary and Binary

- Understand why all data is represented in binary in a computer
- Identify the numbers in the binary and denary systems
- Calculate and convert binary numbers to denary

## Quick Fire Questions



1. CPU means...
2. The body part a CPU is referred to is...
3. A CPU is important to a computer system because...
4. The three Boolean Logic gates are:
  - 1.
  - 2.
  - 3.



## **Task 1: Answer the questions based on the numbering systems, you must use key words in your answers.**

- 1. What numbers are used in the denary number system?**
- 2. Who is most likely to use denary?**
- 3. Explain what is meant by base 10.**
- 4. What numbers are used in the binary number system?**
- 5. Who is most likely to use binary?**
- 6. Explain what is meant by base 2.**
- 7. How is data represented in binary?**

...Continued Task 1: Using the example calculate and convert the numbers.

8	4	2	1		Denary Number
0	1	0	1	=	5
0	0	0	0	=	
0	0	1	1	=	
0	0	0	1	=	
0	1	1	1	=	
0	0	1	0	=	
1	0	0	0	=	
0	1	0	0	=	
0	1	1	0	=	
1	0	0	1	=	
1	1	1	1	=	

# Lesson 3

**Next steps** : Continue to calculate and convert the numbers. Create calculations for a friend to figure out.

Write a description of the numbering systems, include key words and full sentences.

128	64	32	16	8	4	2	1		Denary Number
1	0	0	0	0	1	1	1	=	135
0	1	0	0	0	1	1	0	=	
0	0	1	0	0	0	1	1	=	
0	0	0	1	1	0	1	1	=	
1	1	1	0	1	0	1	0	=	
1	1	1	1	1	1	1	1	=	
0	1	0	1	1	0	0	1	=	
1	0	1	0	0	0	1	1	=	
1	1	1	1	0	0	0	0	=	

Binary number system is...

Denary number system is...



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## Lesson 4 – Binary and Denary

- Identify the numbers in the binary and denary systems
- Calculate and convert denary numbers to binary numbers
- Demonstrate understanding of the numbering systems by solving calculations

## Quick Fire Questions

1. Denary uses the numbers...
2. Binary uses the numbers...
3. Explain how to convert denary numbers to binary:



**Task 1: Using the example calculate and convert the numbers.**

8	4	2	1		Denary Number
0	1	1	1	=	7
				=	15
				=	10
				=	0
				=	3
				=	1
				=	14
				=	12
				=	8
				=	7
				=	4



**Next steps** : When computers use binary they do not just use numbers, they convert data into letters, symbols and other commands. Using the Internet research what is ASCII and find out how this related to Binary.

ASCII is...

My name using the ASCII table is...





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## Lesson 5 – Mid-Unit Assessment

- Identify the AWOL statements you have achieved so far in line with your target
- Complete the mid-unit assessment tasks
- Continue completing the tasks covered in previous lessons

**Task 1:** Click the link to complete your mid-unit assessment. Once complete fill in the targets you think you have achieved with green.

**Mid Unit  
Assessment Link:**

**My Score:**

	ADVANCED	INTERMEDIATE	FOUNDATION
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	I can describe how a computer uses binary to store data and instructions.	I can demonstrate knowledge of how a computer uses binary to store data and instructions.	I can provide a simple explanation of how a computer uses binary.
	I can accurately calculate and solve problems using binary, denary and binary addition.	I can calculate and solve some problems using binary, denary and binary addition.	I can calculate and solve some problems using binary and denary/
	I can explain all methods of computational thinking and apply them precisely when problem solving.	I can identify methods of computational thinking and apply them when problem solving.	I can identify and use some methods of computational thinking.

**Next steps** : Look through your peer's work and mark each section identifying if you think criteria has been met (YES or NO).

For each section provide a suggestion which will help improve their progress.

Once complete finish off any outstanding work.

Criteria	Y/N	Suggested improvements
All quick fire questions completed?		
Key terms used?		
Each lesson task completed?		
Final thoughts completed?		
Overall feedback		
<u>Peer Feedback completed by:</u>		
<u>Date:</u>		



# Lesson 6 – Binary Addition

- Identify the numbers in the binary and denary systems
- Calculate and solve problems using binary addition
- Demonstrate understanding of the numbering systems by solving calculations

## Quick Fire Questions

1. Base 2 means...
2. What are the numbers used in binary?
3. Explain what the numbers used in binary mean to a computer...



## Task 1: Complete the calculations using your binary, denary and binary addition knowledge.

For each of the binary values below, write down the denary equivalent:

1. 101 =
2. 1 0111 =
3. 11 1011 =
4. 1100 1010 =
5. 1000 0001 =
6. 1010 1010 =
7. 1111 1111 =

For each of the denary values below, write down the binary equivalent:

1. 14 =
2. 51 =
3. 101 =
4. 150 =
5. 174 =
6. 255 =



## ...Continued Task 1: Complete the calculations using your binary, denary and binary addition knowledge.

	8	4	2	1			Denary
	1	0	1	1	=		11
+	0	0	1	0	=	+	2
=	1	1	0	1	=		13
		1					

	1	0	1	1	=		
+	0	0	1	1	=	+	
=					=		

						1	1	1	1	=			
+						1	0	1	1	=	+		
=										=			

			1	0	0	0	1	1	=				
+			0	1	1	0	1	0	=	+			
=									=				

	1	1	0	1	1	0	1	1	=				
+	0	0	0	1	1	0	1	0	=	+			
=									=				

### Binary addition rules:

$$0 + 0 = 0$$

$$0 + 1 = 1$$

$$1 + 0 = 1$$

$$1 + 1 = 0 \text{ Carry } 1 = 10$$

$$1 + 1 + 1 = 1 \text{ Carry } 1 = 11$$



**Next steps** : Match the key terms with the phrases below to help embed your subject knowledge.  
**Finish off any outstanding tasks.**

**Computer System**

A calculation is carried out on input to turn it into meaningful output.

**Process**

A number system that contain two symbols, 0 and 1. Also known as base 2.

**Binary**

A number system most commonly used by people. It contain 10 unique digits 0 to 9. Also known as decimal or base 10.

**Denary**

Has two inputs. Either one of the input have to be 1 (ON) in order for the output to be 1 (ON), otherwise the output is 0 (OFF).

**AND**

Has two inputs. The inputs must be 1 (ON) in order for the output to be 1 (ON).

**OR**

A device that consists of input, process, output and storage.



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# Lesson 7 – Computational Thinking

- Demonstrate an understanding of computational thinking
- Describe how people use computational thinking and decomposition when problem solving
- Identify problems and solve them using decomposition

## Quick Fire Questions



1. Binary only uses two numbers?  
**True / False**

2. Denary uses nine numbers?  
**True / False**

3. What are the rules when adding numbers in binary?

## Task 1: Complete the tasks and explain how you have used decomposition to come up with a solution. How did you break the problem down?

How would you decompose the following tasks?

**Brushing your teeth?**

- Which toothbrush to use
- 
- 
- 
- 
- 
- 
- 

**Going to your next lesson in school?**

- 
- 
- 
- 
- 
- 
- 
- 

**Creating a new app for a phone?**

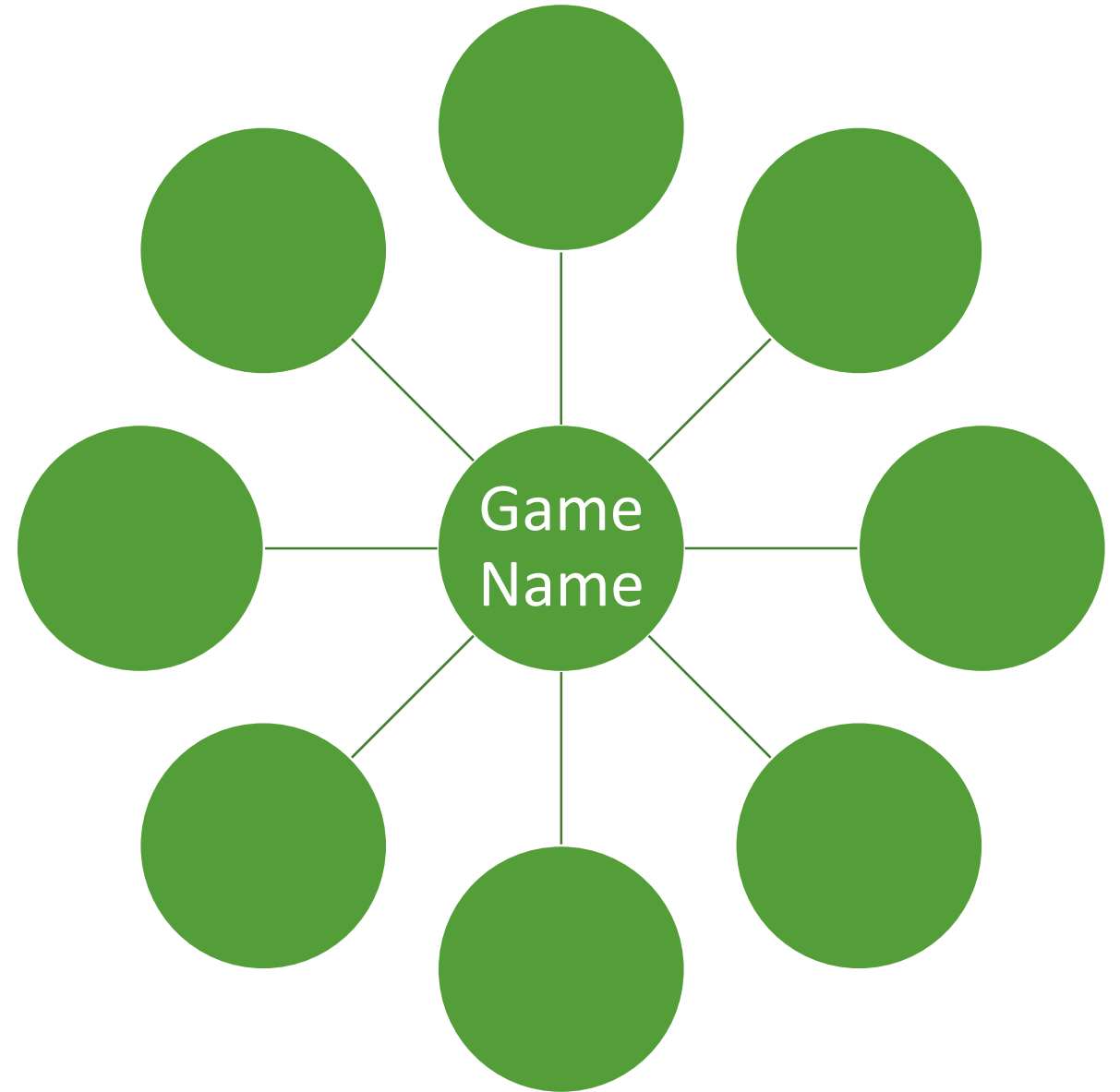
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- 
- 
- 
- 
- 
- 
- 

One finished click the [link for the River Crossing Challenges](#), how many levels can you complete?

**Next steps** : Create an arcade game of your choice, e.g. Pacman. How can you break this down? Write down key elements you will need.

My game idea is...

I will need to....





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## Lesson 8 – Abstraction and Pattern Recognition

- Demonstrate an understanding of computational thinking
- Describe how people use computational thinking and apply it during problem solving
- Solve problems using abstraction and pattern recognition techniques

## Quick Fire Questions



1. Computational Thinking means...
2. What are the four branches to computational thinking?
  - 1.
  - 2.
  - 3.
  - 4.
3. Why is decomposition important to us when problem solving?

## Task 1: Complete the tasks using abstraction and pattern recognition knowledge.

**Abstraction means...**

**Example of abstraction being used:**

**Pattern recognition means...**

**Example of pattern recognition being used:**

Click the link to play the [Minesweeper game](#), can you figure out the patterns needed to complete the game successfully? Write down the patterns you can see.



**Next steps** : Using the Internet find an image of a real aeroplane and a paper aeroplane. Identify the necessary features needed to create the paper aeroplane, e.g. wings.

Can you identify the unnecessary features that have not been used, e.g. windows.

Image of paper  
aeroplane

Image of real aeroplane

### Necessary Features

- Wings
- 
- 
- 
- 
- 
- 
- 

### Unnecessary Features

- Wings
- 
- 
- 
- 
- 
- 
-



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# Lesson 9 – Algorithms

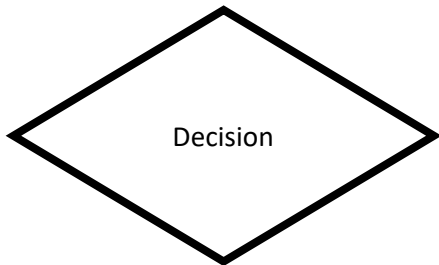
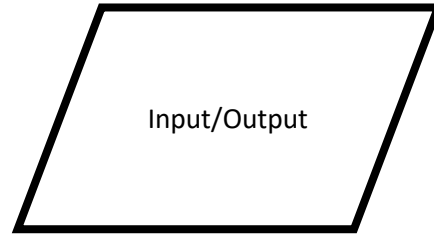
- Demonstrate an understanding of computational thinking
- Describe how people problem solve using algorithms
- Solve problems using flow diagrams

## Quick Fire Questions

1. Abstraction filters out the unnecessary details?  
**True / False**
2. Why do we look for patterns in problems?
3. Computational thinking is important because...



**Task 1:** Label each flow diagram symbol and explain what the symbol is used to represent in the box provided.



**...Continued Task 1: Using the symbols from the previous slide create a flow diagram to demonstrate how to make a cheese sandwich.**

Print screen of your flow diagram here.

**Next steps** : Create a flow diagram using the website [www.draw.io](http://www.draw.io) for one of the following tasks: Making a cup of tea, walking to school or logging on to a computer.

Print screen of your flow diagram here.



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## Lesson 10 – End of Unit Assessment

- Identify the AWOL statements you have achieved so far in line with your target
- Complete the end of unit assessment tasks
- Continue completing the tasks covered in previous lessons

# Lesson 10

**Task 1:** Click the link to complete your end of unit assessment. Once complete fill in the targets you think you have achieved with green.

**End of Unit Assessment Link:**

**My Score:**

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