AQA GCSE Computer Science (8520)

Knowledge Organisers

GCSE | **Fundamentals of Algorithms** | Required knowledge

Key terms

|	
Algorithm	A sequence of instructions to be followed (usually by a computer,) to carry out a task.
Computational thinking	A method of solving a problem logically, using abstraction, decomposition, pattern recognition and algorithms.
Abstraction	Focusing on what is important, ignoring the unnecessary.
Decomposition	Breaking something into smaller parts, in order to solve the smaller parts first.
Pseudocode	A notation resembling a simplified programming language, used to create a program design.
Flow Chart	A visual representation of an algorithm, using shapes and arrows to show a clear sequence of instructions.
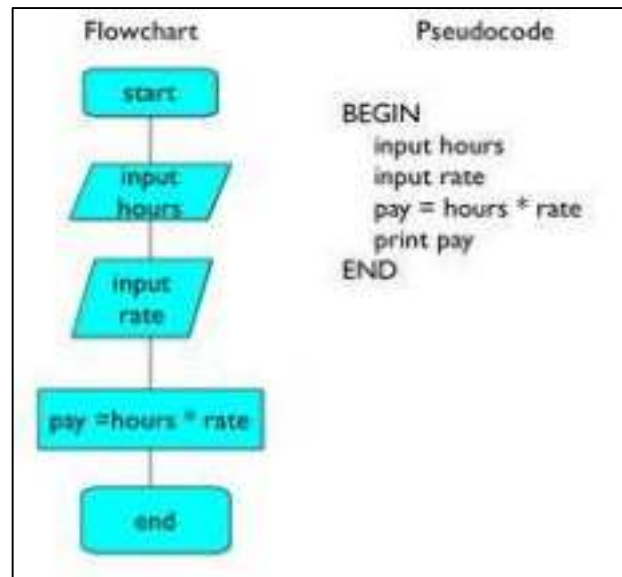
Types of algorithms

Searching algorithms
- Linear search
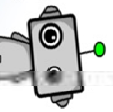- Binary search
- Compare and contrast both types
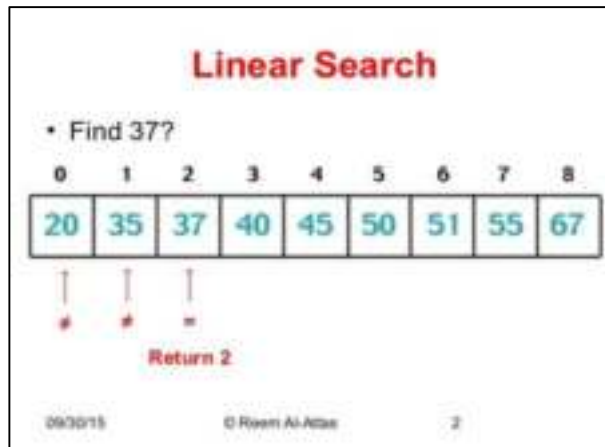
Sorting algorithms
- Merge sort
- Bubble sort
- Compare and contrast both types
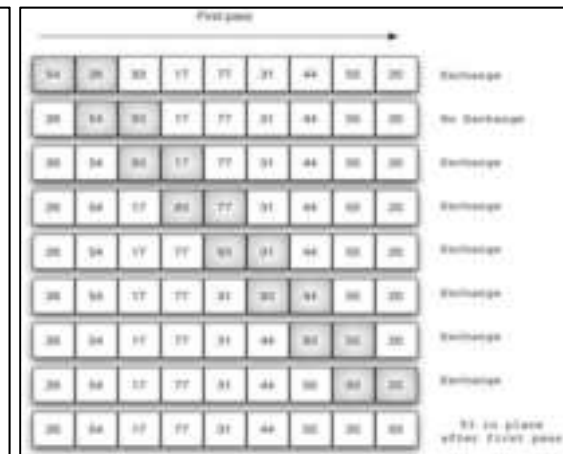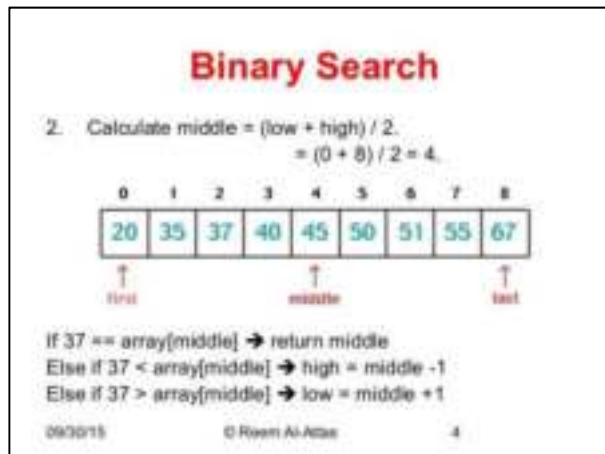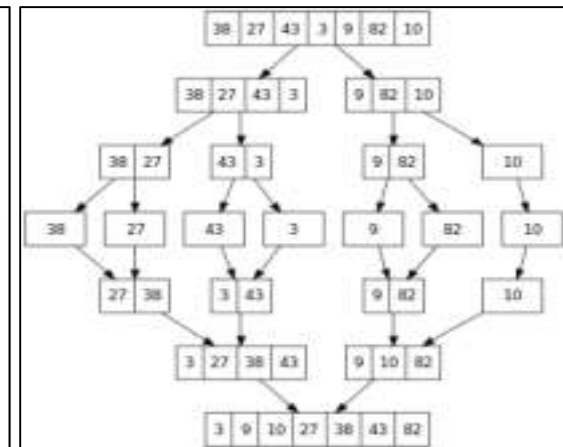
Efficiency - Time/Space. How long? How much memory?

How to... READ & WRITE PSEUDO CODE
GCSE Computer Science — AQA

Output Information

Output a string statement
OUTPUT: "Insert output statement here"

Output a string statement
OUTPUT: "Hello World"

Output both string and variables
OUTPUT: "You scored " * 10 + " points!"

Output both string and integers
score ← 10
OUTPUT: "You scored " + score + " points!"

Measuring Length

Measuring variable Length (LEN)
name ← Amelia
length ← LEN (name)
#length would be 6

Measuring Array Length (LEN)
names ← ["Ted", "Jen", "Dev"]
array_len ← LENGTH (names)
#array_len would be 3

Arithmetic Operations
For mathematical calculations

Symbol	Meaning
+	Addition
-	Subtraction
*	Multiplication
/	Division

Additional Arithmetic Operations

Symbol	Meaning	Examples
DIV	Integer Division – Identifies how many times a number can be divided by a whole number.	24 DIV 8 #answer is 3 / 24 DIV 5 #answer is 4
MOD	Modulus Division – Used to find the remainder after division.	15 MOD 7 #answer is 1 / 15 MOD 3 #answer is 0

Boolean Operators

Symbol	Meaning
=	Equal to
≠	Not equal to
<=	Less than or equal to
>=	Greater than or equal to
<	Less than
>	Greater than
AND	All operator comparisons must be true for a TRUE outcome.
OR	Either operator comparison needs to be true for a TRUE outcome.
NOT	The result will be the opposite.

Assign Variables

Assign Variables
VariableName = Assigned value

Assign String to a variable
player_name ← Lucy

Assign Integer to a variable
playerScore ← 10

Assign user Input to a variable
player_name ← INPUT( )

Variable Value Assignment
variable ← assigned value

Assign an Array
ArrayName = [data1,data2,data3,....]

Assign String to an array
names ← ["Rahim", "Madeline", "Joe"]

Assign Integers to an array
scores ← [55,63,24,79,52,84]

IF Statements

IF [enter comparison] THEN
    Enter task to perform here
ELSE
    Enter alternative task here
END IF

IF Statement
password ← "ilovecode"
OUTPUT: "Enter the password"
answer ← INPUT( )
IF answer = password THEN
    OUTPUT: "Password accepted."
ELSE
    OUTPUT: "Access denied."
ENDIF

IF Statement (multiple outcomes)
OUTPUT: "Enter your score"
score ← INPUT( )
IF score >=50 THEN
    OUTPUT: "You passed the test!"
ELSEIF score >0 AND <50 THEN
    OUTPUT: "You failed the test"
ELSE
    OUTPUT: "Invalid score."
ENDIF

Nested IF Statements
OUTPUT: "Please enter your username"
user ← INPUT( )
IF user ="rob-bot" THEN
    OUTPUT: "Please enter your password"
    pass ← INPUT( )
    IF pass = "ilovecode" THEN
        OUTPUT: "You are logged in"
    ELSE
        OUTPUT: "Incorrect password."
    ENDIF
ELSE
    OUTPUT: "Incorrect username"
ENDIF

Loops (Iteration)

WHILE LOOP
quit ← n
WHILE quit = n
    OUTPUT: "Do you want to quit (y/n):"
    quit ← INPUT( )
ENDWHILE

FOR LOOP
number ← 10
FOR i ← 1 TO number
    OUTPUT: i
ENDFOR
Note: i is commonly used to represent the varying index within the range.

REPEAT UNTIL
score ← n
REPEAT
    OUTPUT: score
    score ← score + 1
UNTIL score > 10
ENDREPEAT
Note: For a REPEAT loop, the condition check is located at the end of the loop cycle.

Subroutines

SUBROUTINE name (parameters)
    enter code here
ENDSUBROUTINE

SUBROUTINE total (a, b)
    c ← a + b
    RETURN c
ENDSUBROUTINE

Application of the subroutine:
SUBROUTINE (5,5)
This would return the value 10

Linear Search Subroutine

#find largest no. in an array
SUBROUTINE findMax [a]
    max ← array[1]
    FOR i ← 2 TO LEN [a]
        IF a[i] > max:
            max ← a[i]
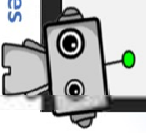   ENDIF
    ENDFOR
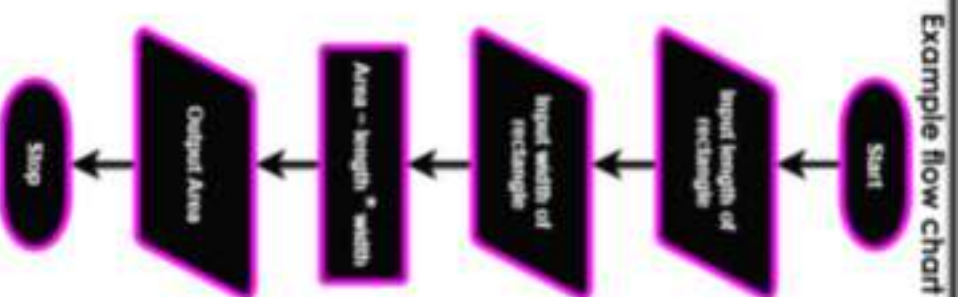   RETURN max
ENDSUBROUTINE

Example Pseudo Code Structure

Check if a user input value is in an array

START
colours ← ["red", "green", "orange", "blue", "yellow"]
colours_len ← LENGTH(colours)
check ← 0
OUTPUT: "Please input a colour:"
choice ← INPUT( )
FOR i ← 1 to length
    IF colours_len[i] = choice THEN
        OUTPUT: "We have that colour in stock."
        check ← check + 1
    ELSE
    ENDIF
ENDFOR
IF check ≠ length THEN
    OUTPUT: "I'm sorry, that colour is out of stock."
ENDIF
END

3.

Example flow chart – calculating area of a rectangle

Start → Input length of rectangle → Input width of rectangle → Area = length * width → Output Area → Stop
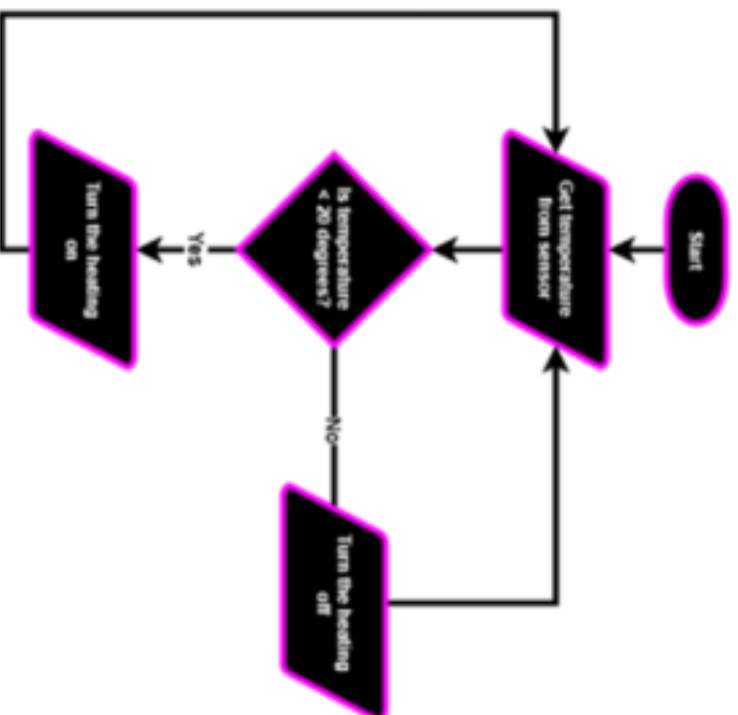
This flowchart is an algorithm for working out the area of a rectangle.
The first symbol after the start is an input/output symbol. This events states that an input is going to be made and that this input will be the length of the rectangle. The next event is the same, except the width is inputted. Then there is a process symbol. In here the process will calculate the area by multiplying the length by the width, storing the result in a variable named area. Before the stop, the area is outputted.

Example flow chart – controlling the heating for a house

Start → Get temperature from sensor → Is temperature < 20 degrees? — Yes → Turn the heating on
Is temperature < 20 degrees? — No → Turn the heating off

The first thing you will notice about this is that there is no **stop**. This system requires an **infinite loop**. Not all systems stop, some will keep going until someone turns them off (like traffic lights, automatic doors, etc.) In this case the temperature is obtained from a sensor. A decision symbol is used to test if the temperature is under 20°. If the answer is **yes**, the heating will be turned **off**. If the result is **no**, the heating will be turned **off**. Notice that the turning the heating on and off are in input/output symbols? That is because turning something on or off, so moving an object like a door, is an output.

GCSE | **Fundamentals of Algorithms** | Revision page

Algorithm	
Computational thinking	
Abstraction	
Decomposition	
Pattern recognition	
Algorithm design	
Pseudocode	
Flow Chart	

Algorithm efficiency	
How do we compare algorithms which solve the same problem?	
Compare the linear and binary search.	
Compare the merge and bubble sort.	

Name	Image	Description
Searching algorithms		
Sorting algorithms		

GCSE | **Fundamentals of Algorithms** | Required knowledge

Self-Quiz Questions	Self-Quiz Questions	Challenge Self-Quiz Quizzing
1. What is an algorithm?	11. What is computational thinking?	21. What is pattern recognition?
2. Why are algorithms used to design programs?	12. How does a binary search work?	22. Compare the use of flowcharts and pseudocode.
3. What technique is used to break problems down into smaller parts?	13. How does the bubble sort work?	23. How is pseudocode similar to python code?
4. What is abstraction?	14. How does the merge sort work?	24. How is pseudocode different to python code?
5. What shapes are used in a flowchart?	15. What does the word 'efficient' mean?	25. Why does creating algorithms make programming quicker?
6. What do each of these shapes do?	16. What 2 factors do you need to consider when comparing the efficiency of algorithms?	26. Why does creating algorithms allows us to create efficient programs?
7. What do the arrows show in a flowchart?	17. Which is more efficient? Linear or binary search?	27. What is a subroutine?
8. What is the purpose of a search algorithm?	18. Explain your decision.	28. How is a subroutine represented in a flowchart?
9. What is the purpose of a sort algorithm?	19. Which is more efficient? Bubble or merge sort?	29. How is a subroutine represented in pseudocode?
10. How does a linear search work?	20. Explain your decision.	30. What is the purpose of a trace table?

Q1.

What is an algorithm?

(Total 2 marks)

Q2.

[1]

Q3.

The code below contains a subroutine that returns a value.

```
SUBROUTINE TotalOut(a, b)
    c ← a + b
    WHILE a < c
        a ← a + 1
        b ← b - a
    ENDWHILE
    RETURN b
ENDSUBROUTINE
```

(a)   Complete the trace table below when the subroutine call TotalOut(3, 4) is made (you may not need to use all of the rows in the table):

a	b	c

6.

(3)

Q4.

A developer is using the structured approach to developing a solution and wants to write a subroutine to solve one of the sub-problems. This subroutine should have the following interface:

- The subroutine is called find_minimum
- The subroutine takes an array (of integers) as a parameter
- The subroutine returns the smallest value in the parameter array.

Using pseudo-code or a flowchart, write a subroutine that solves this sub-problem. The subroutine must have the correct interface.

_____

_____

_____

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(Total 7 marks)

7.

GCSE | **Programming** | Required knowledge

Data types
- **Integer** e.g. 23
- **Real** e.g. 23.7
- **Character** e.g. A or 5
- **String** e.g. A546TH
- **Boolean** e.g. TRUE or FALSE

Programming Concepts
- Sequence
- Selection
    - IF… ELSE… /CASE
- Iteration
    - For
    - Do While/ Repeat Until

Variables & constants
- Named storage space reserved in memory.
- Both **declared**. (←)
- Variable – Data that changes (score)
- Constant – Data that remains the same. (PI - 3.1415)

Random number generation

Arithmetic Operations
- ADD +
- SUBTRACT –
- DIVIDE /
- MULTIPLY *
- MOD
- DIV

Boolean operations
- NOT, AND, OR

Relational operations

Operations	Meaning
= or ==	Is equal to
>	Is greater than
<	Is less than
<> or !=	Is not equal to
>=	Greater than or equal to
<=	Less than or equal to

Data structures
- Arrays   list = [1,1,1,1]
- 2d Arrays   list = [[1,1,1,1], [2,2,2,2]]
    - Definition
    - Example
- Records

Input/output and file handling
- User input/output from keyboard
- Read/write to text file

Robust and secure programming
- Data validation
- Authentication routines
- Test data – normal, boundary, erroneous

String Handling
- Length
- Position
- Substring
- Concatenation
- Convert character to character code
- Convert character code to character
- String conversion operations

Subroutines and functions/structured programming
- Concept
- Advantages
- Passing parameters
- Return values
- Local variables/global variables
- Modular programming

Programming languages
- **Low level languages:**
    - Machine language
    - Assembly language
    - Mnemonics
- **High level languages:**
    - Source code/machine code
    - Advantages of high & low level
- **Program translators:**
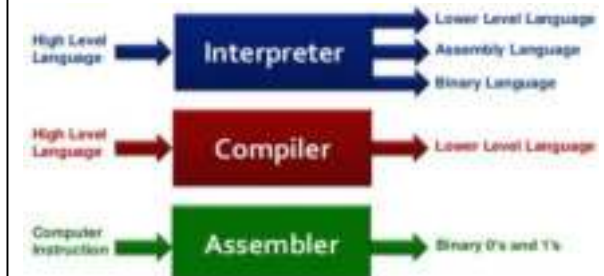
GCSE | **Programming** | Revision page

Programming Data Types

integer	
real	
Boolean	
character	
string	

Programming Concepts

	Pseudocode	
variable declaration		
constant declaration		
assignment		
iteration		
selection		
subroutine		

Programming Input/output and file handling

	Python examples of
Input	
Output	
Reading from a file	
Writing to a file	

Programming relational expressions and Boolean operators

	Python	Explanation
=		
≠		
<		
>		
≤		
≥		

GCSE | **Programming** | Quiz questions

Self-Quiz Questions	Self-Quiz Questions	Challenge Self-Quiz Quizzing
1. Name the 5 data types.	11.What data type is…. likesChocolate = True	21. Define a data structure.
2. What does selection mean?	12. What data type is…. height = 1.52	22. What is a subroutine?
3. What does iteration mean?	13. What data type is…. age = 24	23. What are the parameters used for?
4. What is the purpose of a variable?	14.Why is it important to have a meaningful identifier name?	24. When might a 2d array be used?
5. What is a constant?	15. What is the job of the compiler?	25. Explain the difference between reading and writing a text file.
6. What is machine code?	16. What is the job of the assembler?	26. Discuss the 3 types of test data?
7. What is assembly code?	17.What is the job of the interpreter?	27. How do you know what code will be repeated in a loop?
8. Give some examples of low level languages.	18. What might we mean by 'robust programming'?	28. What is nested iteration/selection?
9. Give some examples of high level languages.	19. What is concatenation?	29. What is the purpose of a validation routine?
10. Why are low level languages needed?	20. What is the purpose of the relational operators?	30. What is the purpose of an authentication routine?

11.

Q1.

The algorithm below, expressed in pseudo-code, allows three users to log in to a computer program with individual usernames and passwords.

- For this algorithm, array indexing starts at 0.
- Line numbers are included, but are not part of the algorithm.

```
01  userlist ← [ 'Rachel', 'Sam', 'Tracey' ]
02  passlist ← [ '49Class', 'Smile', 'b1K3' ]
03  REPEAT
04    OUTPUT 'Enter Username'
05    username ← USERINPUT
06    OUTPUT 'Enter Password'
07    password ← USERINPUT
08    validlogin ← False
09    FOR usernum ← 0 TO 2
10      IF username = userlist[usernum]
11      AND password = passlist[usernum] THEN
12        validlogin ← True
13      ENDIF
14    ENDFOR
15  UNTIL validlogin = True
16  OUTPUT 'Login Successful'
```

The valid usernames and passwords are listed below.

Username	Password
Rachel	49Class
Sam	Smile
Tracey	b1K3

(a) Shade in **one** lozenge in each row of the table below to indicate the most appropriate data type to use for each listed **Variable** from the algorithm, when the algorithm is implemented in a programming language.

Variable	Integer	Real	Boolean	Character	String
validlogin	◯	◯	◯	◯	◯
password	◯	◯	◯	◯	◯
usernum	◯	◯	◯	◯	◯

Most appropriate data type (shade one lozenge per row)

(3)

12.

Q1.

Figure 1 shows a pseudocode representation of the function called FindHighest.

FindHighest is used to find the largest value stored in an array.

Note: line numbers have been shown but are not part of the function.

Figure 1

```
1   FUNCTION FindHighest(arr)
2     highest ← arr[1]
3     FOR i ← 2 TO LEN(arr)
4       IF arr[i] > highest THEN
5         highest ← arr[i]
6       ENDIF
7     ENDFOR
8     RETURN highest
9   ENDFUNCTION
```

(a)   How many parameters does the function FindHighest have?

(1)

(b)   This function uses iteration. Give the line number on which iteration **starts**.

(1)

(c)   This function uses selection. Give the line number on which selection **starts**.

(1)

(d)   This function uses variable assignment. Give the line number in the function where variable assignment is **first** used.

(1)

(e)   The variable i in **Figure 1** above only has scope between lines 3 and 7. Explain with reference to the variable i what scope means.

(1)

(Total 5 marks)

GCSE | **Data Representation** | Required knowledge

Binary

- Binary – base 2
- Decimal – base 10

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1
1	0	0	1	1	0	1	1

- Units:
  - Bit (0 or 1)
  - Byte (8 bits)
  - Kilobyte (1000 bytes)
  - Megabyte (1000 kB)
  - Gigabyte (1000 MB)
  - Terabyte (1000 GB)

Binary conversions

- Converting from binary to decimal

1	0	0	1	1	0	1	1
128	0	0	16	8	0	2	1

128 + 16 + 8 + 2 + 1 = **155**

- Converting from decimal to binary

Remainder	
2)156	0
2)78	0
2)39	1
2)19	1
2)9	1
2)4	0
2)2	0
2)1	1

Write from the bottom up!

= 10011100

Binary arithmetic

Addition of up to 3 binary numbers

```
      1
    1 0 1
  00111
  01110
+ 11100
_____
 110001
```

| 1 = 1 |
| 2 = 10 |
| 3 = 11 |
| 4 = 100 |
| 5 = 101 |

Logical Binary shift:
- Left - Multiplication

Bit 7 6 5 4 3 2 1 0
0 0 0 1 1 1 0 1   29
0 0 1 1 1 0 1 0   58

29 X 2 = 58

- Right - Division

Bit 7 6 5 4 3 2 1 0
0 0 1 1 0 1 0 0   52
0 0 0 1 1 0 1 0   26

52 / 2 = 26

Describe situations where these might be used.

Hexadecimal (hex) numbers

- Hex – base 16
- Converting between hex and decimal (0 to 255)
- Converting between hex and binary
- Explain why hex is often used in computer science

Hex to Binary/Decimal

Hexadecimal	5F
Binary	0101 | 1111
	01011111
Decimal	95

Binary to Hex

0100110111010000

0100	1101	1101	0000
4	D	D	0

GCSE | **Data Representation** | Required knowledge

Images

- Stored in binary on a computer
- Pixel
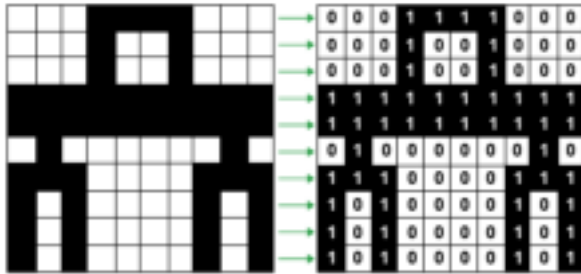
- Colour depth

Colour depth	
1-bit	$2^1 = 2$
2-bit	$2^2 = 4$
3-bit	$2^3 = 8$
4-bit	$2^4 = 16$
5-bit	$2^5 = 32$
6-bit	$2^6 = 64$
7-bit	$2^7 = 128$
8-bit	$2^8 = 256$

- Resolution (Width x Height)
- Metadata
- Bitmap images
- Understand affects on file size
- Calculate file size
    - Bits = W x H x colour depth
    - Bytes = (W x H x colour depth)/8
- Convert binary data into black & white image
- Convert a black & white image into binary data

Sound

- Analogue sound wave
- Sample
- Sampling
- Sample rate (1 Hz = 1 sample per sec)
- Sample resolution (no. of bits per sample)
- Calculate sound file sizes:
    bits = rate x res x secs

Analogue

Digital
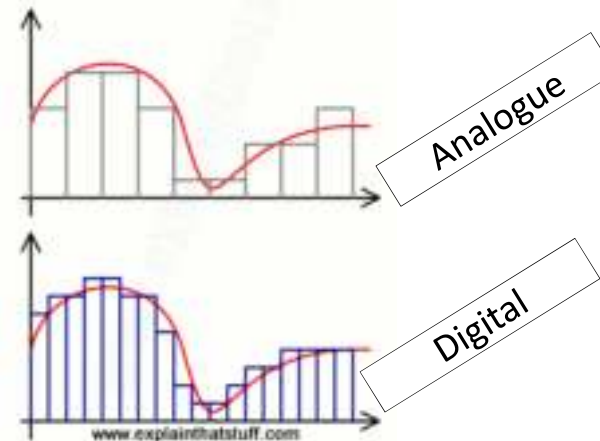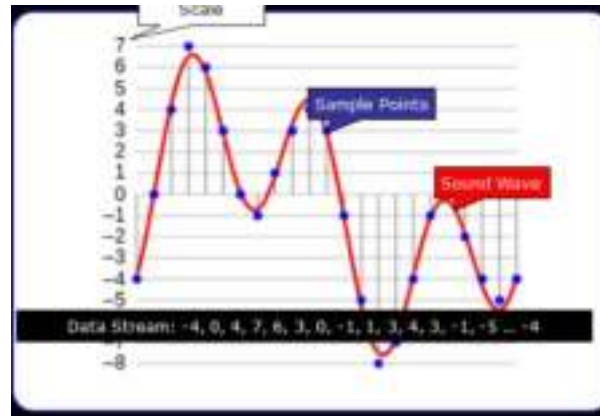
Character encoding

- Character set
    - Definition
    - ASCII
    - Unicode
- Purpose of Unicode and advantages over ASCII

- We can encode text using the ASCII Standard to represent different characters.
- ASCII code is the numerical representation of characters e.g. a to z.

Letter	ASCII code	
	Decimal	Binary
A	65	0100 0001
B	66	0100 0010
C	67	0100 0011

Data Compression

- Why data needs to be compressed
- Huffman Coding
    - Creating Huffman trees
    - Interpreting Huffman trees
    - Calculate number of bits required to store compressed data
    - Calculate no of bits required to store uncompressed data in ASCII (8 bits per character)
- Run Length Encoding (RLE)
    - Technique
    - Frequency pairs
    e.g. 0000011100000011 = 5 0 3 1 6 0 2 1

GCSE | **Data Representation** | Revision page

Data Representation Number Bases

decimal (base 10)	
binary (base 2) –Why do computers use it.	
hexadecimal (base 16). Who uses it and why?	

Data Representation Converting between Number Bases
Show with examples

Binary- Decimal	
Decimal → Binary	
Binary→ Hexadecimal	

Data Representation Units of Information

Bit	
Byte	
kilo, 1 KB	
mega, 1 MB	
giga, 1 GB	
tera, 1 TB	

Data Representation Binary arithmetic

Show by example addition of 3 binary numbers
Binary Shift -

GCSE | **Data Representation** | Quiz questions

Self-Quiz Questions	Self-Quiz Questions	Challenge Self-Quiz Quizzing
1. What base system is binary? Why?	11. What is a bitmap?	21. What might we mean by increasing the colour depth?
2. What base system is decimal? Why?	12. How does increasing the resolution affect a bitmap?	22. What affect will this have on a bitmap?
3. What base system is hexadecimal? Why?	13. What is metadata?	23. If the letter A is 01000001, what would C be?
4. How many bits are in a byte?	14. Why is hexadecimal used?	24. Why do analogue sound waves need to be converted to digital sound waves?
5. How many bits are in a megabyte?	15. Calculate the file size of a bitmap, with a height of 30 pixels, width of 40 pixels and colour depth of 4bits.	25. What is the sample rate?
6. Convert 1011 0011 to decimal.	16. What are the decimal values before and after this shift? 1100 1100 (2 right)	26. Calculate the file size of a sound file with a sample rate of 3hz, sample resolution of 10 bits and a length of 1minute.
7. Convert 134 to binary.	17. What are the decimal values before and after this shift? 0000 0111 (4 left)	27. What is the difference between ASCII and UNICODE?

8.   1110 0110
  + <u>1000 1111</u>
    _____
	18.
	  1100 1111
	  0110 1110
	+ <u>1100 1101</u>
	  _____
		28. How many bits are used to store one character using ASCII?

9. Convert 1001 1010 to hexadecimal.	19. Convert 154 into hexadecimal.	29. Why does data need to be compressed?
10. Convert F2 into binary.	20. Convert 7A into decimal.	30. Compress the following using RLE. 1111 0000 0001 0101 0000 0100

17.

Q1.

State the binary representation of the decimal number 87.

_____

(Total 1 mark)

Q2.

A student's answer to the question "Why is hexadecimal often used instead of binary?" is shown in the figure below.

> Because it uses fewer digits it will take up less space in a computer's memory.

Explain why the student's answer is incorrect.

_____

_____

_____

(Total 2 marks)

Q3.

Place these three numbers into order of size (1–3 where 1 is the largest and 3 is the smallest).

Number	Order (1–3)
The decimal number 12	
The binary number 1110	
The hexadecimal number D	

(Total 2 marks)

_____

_____

_____

(Total 2 marks)

18.

Q5.

Complete the binary addition calculation.

```
    0 0 1 0 1 0 0
+   0 1 1 0 1 0 0 1
  _____
```

(Total 2 marks)

Q6.

Complete the binary addition calculation of three numbers.

```
    0 0 0 0 1 1 0 0
    0 1 1 0 0 1 0 0
+   0 1 0 1 1 0 0 1
  _____
```

(Total 2 marks)

Q7.

The bit pattern below is stored in a byte.

0	0	0	1	0	1	0	0

(a) What bit pattern will be stored in the byte after a left binary shift of 3 places has been performed on the bit pattern?

(1)

(b) If the bit pattern above represents a whole decimal number, what would be the effect on the decimal number of performing a left binary shift of 2 places?

_____

(1)
(Total 2 marks)

Q10.

Explain how an analogue sound can be converted into digital data by a computer by sampling data.

_____
_____
_____

(Total 3 marks)

Q9.

ASCII (American Standard Code for Information Interchange) is a coding system that can be used to represent characters. In ASCII the character A is represented by the numeric code 65.

Shade one lozenge to indicate which character is represented by the numeric code 70.

A   E
B   F
C   f
D   e
E   *

☐ ☐ ☐ ☐ ☐

(Total 1 mark)

Q10.

When data is stored in a computer it is often compressed. One method that can be used to compress text data is Huffman coding. To produce a Huffman code each character in a piece of text is placed in a tree, with its position in the tree determined by how often the character was used in the piece of text.

A Huffman tree for the text ZOE SAM A ZEBRA AT THE ZOO is shown in the figure below.

Using this Huffman tree the Huffman coding for the character E would be the bit pattern 110 because from the top of the tree E is to the right, then right again and then left.

The character z is represented by the bit pattern 010 because from the top of the tree z is to the left, then right again and then left.

(a)   Using the Huffman code in the figure above, complete the table to show the Huffman coding for the characters O, SPACE and E.

Character	Huffman coding
O	
SPACE	
E	

(2)

20.

Q11.

The image below contains a black and white image consisting of 36 pixels.

(a)   Explain why 36 bits are needed to represent the pixels in the image shown above.

_____

_____

_____

(2)

(b)   How many bits per pixel would need to be used if the image above used 4 colours instead of 2?

_____

_____

(1)

(Total 3 marks)

Q12.

Calculate the file size in bits for a two minute sound recording that has used a sample rate of 1000 Hertz (Hz) and a sample resolution of 5 bits.

You should show your working.

(Total 3 marks)

Q13.

_____

A   _____   [2]

B   _____   [2]

C   _____   [2]

(Total 1 mark)

GCSE | **Computer systems** |Required knowledge

Computer system

A combination of **hardware and software,** designed to **process inputs** to give an **output**.

Utility software

- Back up, compression, defragmentation, disk clean up etc.
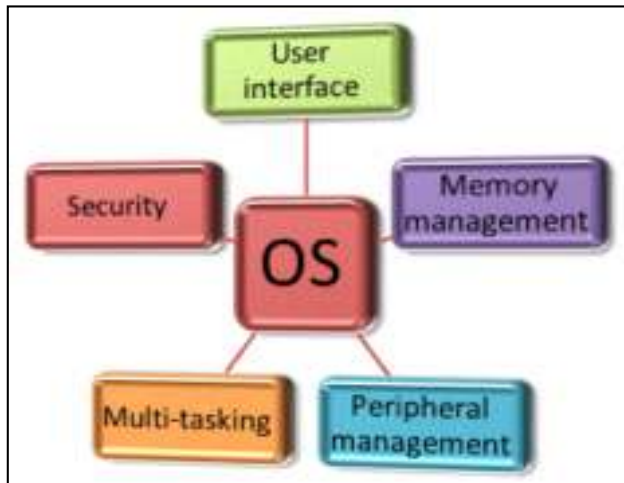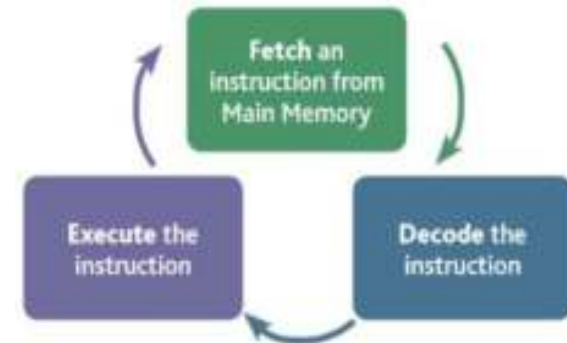

Systems Architecture

Embedded systems – A computer system within a larger system to perform a specific function. E.g DVD player, washing machine.

CPU - Von Neumann Architecture
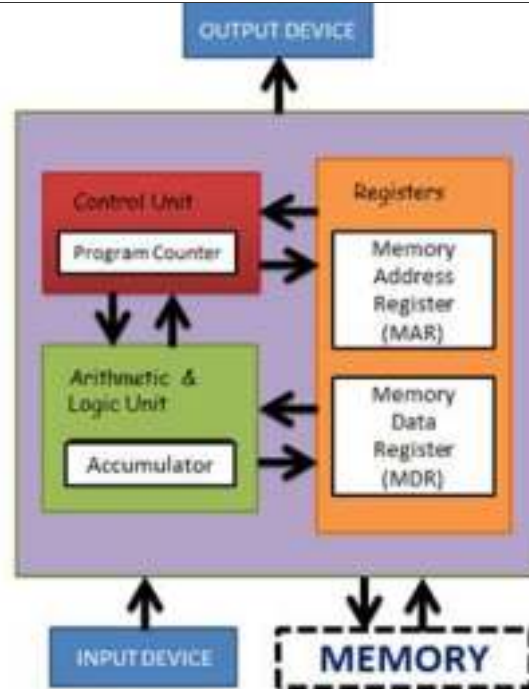
Central Processing Unit (CPU)

Fetch/Decode/Execute

Effect on CPU performance of:

Clock speed

- the operating speed of a computer or its microprocessor, expressed in cycles per second (megahertz).

Number of cores

- A processor core is an individual processor within a CPU. Many computers today have **multi-core** processors, meaning the CPU contains more than one core. Allows the CPU to multitask.

Cache size/type

- Small amount of memory near the CPU that contains regularly used instructions.

GCSE | **Computer systems** |Required knowledge

Key terms

Hardware: The physical components that make up a computer systems.

Software: The applications and operating system installed on a computer.

Input: Putting data into a computer system. E.g Text, click a button.

Process: The action that is taken with the input data. E.g a calculation, loading.

Output: Data that is given by the computer system. E.g sound, images.
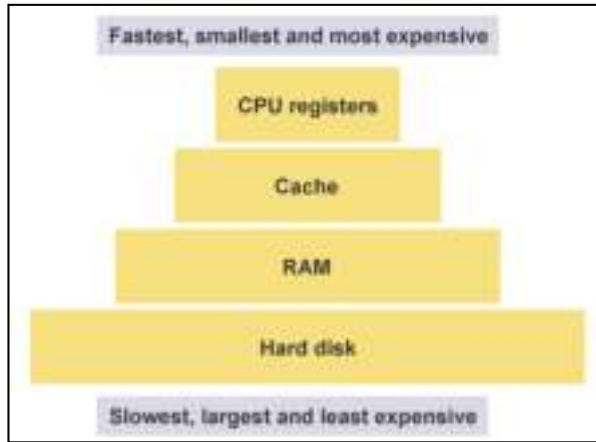
Storage: An area that saves data and documents.

Peripheral: A device connected to a computer to allow inputs or outputs.

Operating system: The software that allows the user to interact with the computer.

Volatile: When the power is switched off, data is erased.

Non-Volatile: When the power is switched off, data is saved.

Virtual memory: Temporary memory that acts like extra RAM; located on the hard-drive.

Fastest, smallest and most expensive

CPU registers

Cache

RAM

Hard disk

Slowest, largest and least expensive

Primary memory
- Random Access Memory (RAM)
  - Volatile
- Read Only Memory (ROM)
  - Non-volatile
- Main memory and Secondary Storage

Boolean Logic

NOT   AND   OR

- Construct truth tables for logic gates and simple logic circuits
- Interpret results of truth tables

A	B	Z
0	0	0
0	1	0
1	0	0
1	1	1

- Create, modify and interpret logic circuit diagrams

Secondary storage
- Solid state
- Magnetic hard disk
- Optical disk
- Cloud storage
- Explain operation of each type
- Advantages/disadvantages

Media	Suitability	Typical capacity	Durability	Portability	Speed
Flash drive	Moving relatively small files from work to home	2 GB - 64 GB	★★★★	✓	★★★★
External hard drive	Backing up a home computer system	500 MB - 4 TB	★	✓	★★★
CD / DVD / Blu-ray disk	Storing multimedia files	650 MB (CD) 9 GB (DVD) 50 GB (Blu-Ray)	★★★	✓	★★
Magnetic tape	Backing large commercial servers on multiple tapes	200 GB - 400 GB	★★	✓	★
The Cloud	Storing data on third-party servers through internet connection	Up to 10 GB free then monthly subscription to more storage	—	✓	Dependant on Internet connection

GCSE | **Computer systems** |Revision page

Computer Systems
Hardware (define with examples)

Software (define with examples)

Computer Systems Boolean Logic

AND gate
OR gate
NOT GATE
TRUTH Table

Computer Systems Software classification

Application software e.g.	
System software e.g.	
Utility programs. eg	
the OS handles management of the: 1	
2	3
4	5

Computer Systems -Systems architecture

Von Neumann architecture.	
Arithmetic logic unit	
control unit	
Clock	
Bus	
Fetch-Execute cycle.	

GCSE | **Computer systems** | Quiz questions

Self-Quiz Questions	Self-Quiz Questions	Challenge Self-Quiz Quizzing
1. What is the difference between hardware and software?	11. Explain the difference between the two types of software.	21. Describe the process of defragmentation.
2. What are the two types of software?	12. List the 3 buses in the Vin Neumann architecture.	22. Explain the purpose of the buses in the Von Neumann architecture.
3. Utility software are types of system software, what is the purpose of utility software?	13. Suggest 3 ways you can increase the performance of the CPU.	23. Explain the fetch, decode, execute cycle.
4. What is the purpose of the operating system? Give 3 examples.	14. What is the difference between volatile and non-volatile?	24. Which storage method is quickest? Why?
5. What is an embedded system?	15. How does the cache affect the access speed of the CPU?	25. Which storage method is cheapest?
6. What is cloud storage?	16. Give 3 examples of solid state storage.	26. Discuss the advantages and disadvantages of cloud storage.
7. Explain the purpose of the CPU.	17. Give 3 examples of magnetic storage.	27. Why is virtual memory needed?
8. What factors affect the CPU performance?	18. Give 3 examples of optical storage.	28. What is the rule of the OR gate?
9. Why is secondary storage needed?	19. What is the rule of the NOT gate?	29. Z = NOT(X AND Y) What value will Z have if X = 1 and Y = 0?
10. Why is primary memory needed?	20. What is the rule of the AND gate?	30. Z = NOT(X OR Y) AND (V AND W) What value will Z have if X = 1, Y = 0, V = 1, W = 1?

GCSE | **Computer systems** | Exam practice

Q1.

The Central Processing Unit (CPU) is one of the hardware components of a computer system.

Define the term hardware.

_____

_____

(Total 1 mark)

Q2.

Explain the purpose of an operating system.

_____

_____

_____

_____

_____

_____

(Total 4 marks)

Q3.

An SD card is a type of solid state storage.

State **two** advantages of solid state storage compared to magnetic storage.

_____

_____

_____

(Total 2 marks)

Q4.

A hard computing system will have automatically start a new operating system if the operating system fails.

For each of the two statements below indicate whether the statement is true or false.

RAM is volatile memory.

A	True	[ ]
B	False	[ ]

Instructions are copied from RAM than ROM.

A	True	[ ]
B	False	[ ]

(Total 2 marks)

26.

Q5.

Most modern washing machines are embedded systems. Embedded systems normally have less main memory than non-embedded systems.

Describe **two** other likely differences between the main memory for a washing machine and the main memory for a non-embedded system.

_____

_____

_____

_____

(Total 2 marks)

Q6.

"Used to connect different components in the CPU" is a description of which of the following? Shade one lozenge to show the correct answer.

A   Control Unit   ☐

B   Bus   ☐

C   Arithmetic Logic Unit ☐

D   Clock   ☐

E   Ethernet   ☐

(Total 1 mark)

Q7.

(a)   Complete the truth table for the OR logic gate:

A	B	A OR B
0	0	
0	1	
1	0	
1	1	

(1)

(b)   Complete the truth table for the logic circuit shown in the figure below.

A	B	X	Y	Z
0	0			
0	1			
1	0			
1	1			

(3)
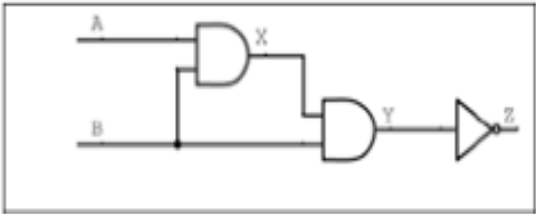
(c)   A logic circuit is being developed for an automatic door system:

• The automatic door has two sensors, one on either side of the door, sensor F and sensor B. The door opens when either of these sensors is activated.
• The door system can also be turned on / off using a manual switch, S. The door will not open unless S is on.
• The output from this logic circuit, for whether the door is open or not, is D.

Complete the logic circuit diagram for this system:

F ▬▬▬

B ▬▬▬   ▬▬▬ D

S ▬▬▬
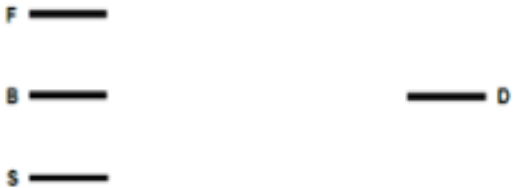
(3)

(Total 7 marks)

GCSE | **Networks**| Required knowledge

Networks

Collection of connected computers to communicate and share peripherals.

- PAN (Personal area network)
  - Usually wireless
  - Bluetooth, Wi-Fi, Ethernet.
  - Centers around a person
- LAN (Local area network)
  - Small geographical area
  - Office, school, building.
- WAN (Wide area network)
  - Wide geographical area
  - The internet
- Wired – Ethernet, Coaxial
- Wireless – Wi-Fi, Bluetooth

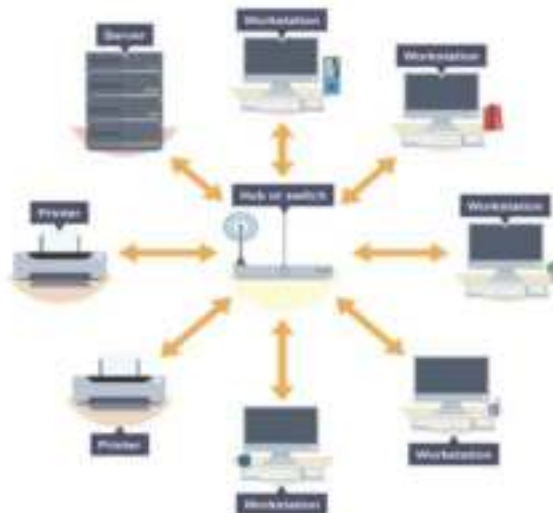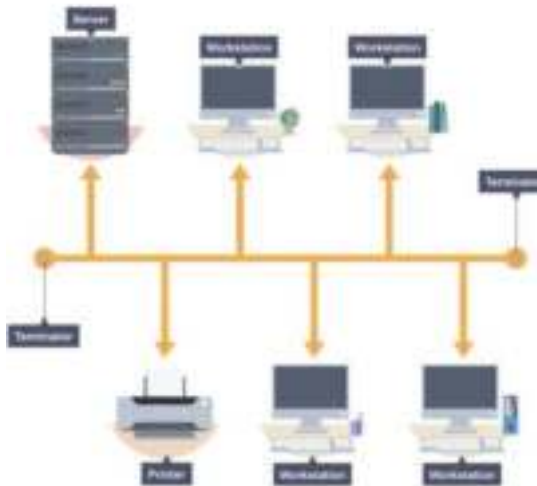| Wireless networks	
Advantages	**Disadvantages**
Access easily	Potential interference. Limited range.
Easy to set up	Needs high security settings.
Cheaper to set up	Speed usually slower

Wired networks	
Advantages	**Disadvantages**
Very secure	Expensive equipment. E.g. Hubs
Higher speed	Specialist staff needed to set up.
No interference	Trailing wires.

Network topologies

Diagram, advantages and disadvantages of the following:

- Bus
- Star

The internet and communication

- TCP/IP model:
  - Application layer
  - Transport layer
  - Network layer
  - Data link layer

The four layers of the TCP/IP protocol suite

Application Layer (OSI Layer7)	FTP, HTTP, POP, etc.
Transport Layer (OSI Layer4)	TCP, UDP
Network Layer (OSI Layer3)	IP, ICMP, IGMP
Link Layer (OSI Layer1+2)	Ethernet, WLAN

Network security

- Authentication
- Encryption
- Firewall
- MAC address filtering

GCSE | **Networks** | Revision page
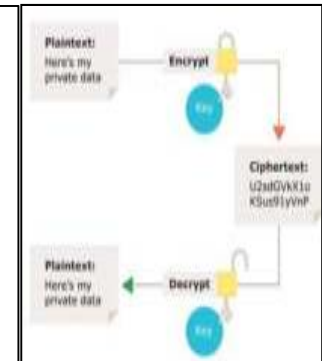
Networks – What and Why

What is a network
Benefits
Drawbacks

Networks Main Types

PAN
LAN
WAN

Networks- Connections

Wireless
Twisted Pair / Coaxial cable
Fibre Optic

Networks – Topologies

Bus
Star

GCSE | **Networks** | Quiz questions

Self-Quiz Questions	Self-Quiz Questions	Challenge Self-Quiz Quizzing
1. What is a network?	11. Give 2 advantages of connecting computers in a network.	21. Give 2 disadvantages of connecting computers in a network.
2. What is a PAN?	12. Give a definition for the word 'topology'.	22. Why is the internet an example of a WAN network?
3. What is a LAN?	13. Where are LAN networks used?	23. A school wants to set up a network in a classroom, which topology would be best suited and why?
4. What is a WAN?	14. Where are WAN networks used?	24. What does the term ' network traffic' mean?
5. Draw a bus topology with 4 computers.	15. Give 2 advantages and 2 disadvantages of a bus topology.	25. Why are terminators needed in a bus topology?
6. Draw a star topology with 5 computers.	16. Give 2 advantages and 2 disadvantages of a star topology.	26. What is the purpose of the hub in a star topology?
7. How can you connect networks wirelessly?	17. List 2 advantages and 2 disadvantages of wireless networks.	27. Compare the use of wired and wireless networks. (Which connection is better and why?
8. How can you connect networks with a wired connection?	18. List 2 advantages and 2 disadvantages of wired networks.	28. What is the difference between bandwidth and latency?
9. What is a protocol?	19. Which layer does the IP protocol work in and why?	29. Describe the process of encryption an decryption.
10. What is the purpose of the TCP/IP model?	20. Which layer does the HHTPS protocol work in and why?	30. Explain the packet switching process.

GCSE | **Networks** | Exam practice

Q1.

Define the term network.

_____

_____

(Total 2 marks)

Q2.

PANs and LANs are two different types of network.

Describe one difference between a PAN and a LAN.

_____

_____

(Total 1 mark)

Q3.

Most schools have a computer network.

Some schools allow teachers to access the school network from their home computers.

Give one reason why some schools allow this and one reason why some schools do not allow this.

Reason for: _____

_____

Reason against: _____

_____

(Total 2 marks)

Q4.

"Schools should use a wireless network instead of a wired network".

Discuss this statement.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 6 marks)

Q5.

Draw a diagram showing a four-computer network using a bus topology.
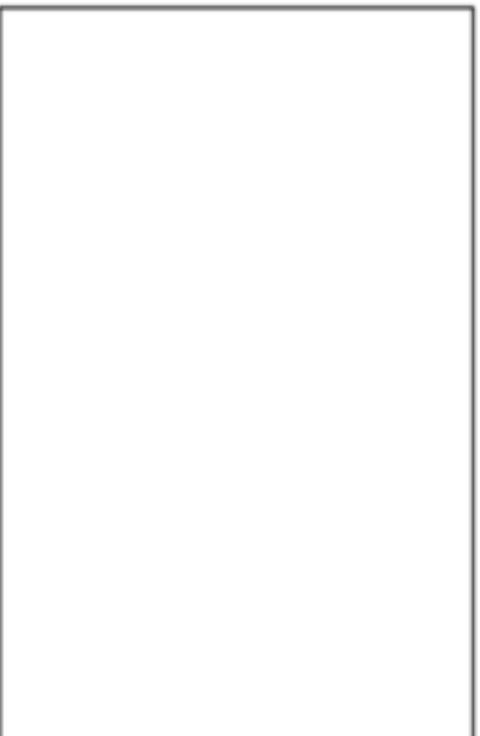
(Total 3 marks)

Q6.

When two computers on a network communicate with each other they need to use the same protocol.

Define the term protocol.

_____

_____

_____

_____

(Total 2 marks)

Q7.

TCP / IP is a protocol stack used in networking. There are four layers in the TCP / IP stack.

Complete the table by placing the four layers of the TCP / IP stack into order (1 – 4), where 1 is the top layer and 4 is the bottom layer.

Layer	Order (1 - 4)
Transport	
Link	
Internet	
Application	

(Total 3 marks)

Q8.

Barnes Pest Control is a small business with four employees. Each of their employees has a standalone desktop computer. They have decided to use a network instead of standalone machines.

Two security measures that Barnes Pest Control could use are authentication and encryption. Explain each of these security measures and how Barnes Pest Control could use them.

Authentication _____

_____

_____

Encryption _____

_____

_____

(Total 4 marks)
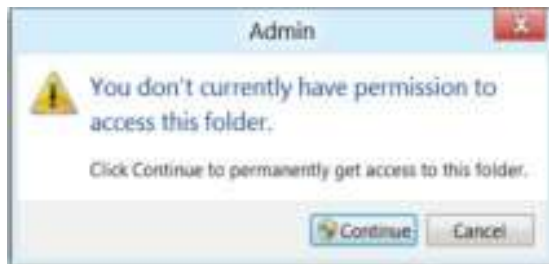
GCSE | **Cyber Security**| Required knowledge

Cyber security - Processes, practices and technologies designed to protect networks, computers, programs and data from attack, damage or unauthorized access.

Cyber security threats

- Malicious code
- Social engineering techniques
- Weak and default passwords

HOW FAST CAN A HACKER'S COMPUTER GUESS YOUR PASSWORD?

6 lowercase letters: 10 MINUTES

9 lowercase and uppercase letters: 23 DAYS

8 lowercase, uppercase, numbers, and symbols: 463 YEARS

- Misconfigured access rights

Admin

You don't currently have permission to access this folder.

Click Continue to permanently get access to this folder.

Continue   Cancel

- Removable media

- Unpatched/outdated software

tton to start the Update process.

Please Wait ...

Malicious code

Malware – a variety of forms of hostile or intrusive software:

Computer virus
- Downloaded onto your computer without your knowledge.
- Can delete or change files so they don't work properly.
- Can fill up your hard drive so the computer runs slow.
- Spread through attachments or emails.
- Spread through internet downloads.

Trojan
- A program that disguises itself as something safe.
- Normally spread by email.
- User clicks on a link and it gives the controller unauthorized access.
- Could crash a computer, spread malware, corrupt data, reformat disks, access sensitive information.

Spyware
- Gathers information about a person or business without their knowledge.
- Tracks the users movements through 'keylogging'.
- Can collect personal information about the user.

Adware
- Analyses sites that the user visits and presents adverts for relates products.
- Usually integrated into free software.
- Companies pay to have their products advertised in this way.
- Most adware operates legally, usually just over used and annoying.

Social engineering

The art of manipulating people so they give up information:

Blagging (pretexting)
- Knowingly or recklessly obtaining personal information through convincing or tricking.
- Protection – Businesses should provide security training to employees.
- Protection – Do not give out information online or over the phone.

Phishing
- Emails and texts designed to steal money, get log in details or steal identity.
- Protection – Be aware of links in emails.
- Protection – Check spelling and grammar mistakes.

Pharming
- Code is put onto a hard drive which redirects your web searches to fake sites.
- Pharming is a concern for banking and e-commerce sites.

Shouldering (shoulder surfing)
- Using direct observation techniques to gain information such as passwords.
- Protection – Be wary of people and cameras when entering pin numbers and passwords.

Detection and prevention

- Biometric measures
- Password systems
- CAPTCHA
- Email confirmations
- Automatic software updates

Pen testing – Testing a system to check for vulnerabilities – Black box testing – White box testing.

GCSE | **Cyber Security**| Required knowledge

Cyber Security Threats

social engineering techniques	
malicious code	
weak and default passwords	
misconfigured access rights	
removable media	
Unpatched and/or outdated software.	
penetration testing	

Cyber Security Social Engineering

blagging (pretexting)	
phishing	
pharming	
Shouldering (or shoulder surfing).	

Cyber Security Malicious code

malware:	
computer virus	
trojan	
spyware	
adware	

Cyber Security – Methods to detect and prevent

biometric measures	
password systems	
CAPTCHA	
using email confirmations to confirm a user's identity	
automatic software updates	

GCSE | **Cyber Security**| Quiz questions

Self-Quiz Questions	Self-Quiz Questions	Challenge Self-Quiz Quizzing
1. List 5 threats to security.	11. Why might outdated software be a security threat?	21. Define cyber security.
2. Give 3 reasons someone might carry out a cyber attack.	12. Why might removable media be a security threat?	22. Describe 3 ways malware can spread between devices.
3. Give an example of a strong password.	13. List 5 actions that malware can carry out.	23. What is an E-commerce website
4. What is malware?	14. Why are Trojans hard to initially detect?	24. Why is pharming a problem for banking and E-commerce sites?
5. List 4 types of malware.	15. List 5 actions that a Trojan could perform to data.	25. How could you identify a secure website?
6. Which type of malware doesn't damage your computer system but is annoying?	16. What can a computer virus do?	26. How could you reduce the risk of blagging?
7. What does keylogging software do?	17. Give 3 precautions you should take with your passwords.	27. How could you reduce the risk of phishing?
8. What is social engineering?	18. Describe the process of shouldering.	28. How could you reduce the risk of shouldering?
9. A smartphone has a fingerprint scanner. What security measure is this an example of?	19. Describe the process of pharming.	29. Explain the difference between black box and white box testing.
10. What is this an example of?	20. What is penetration testing?	30. Why might companies use penetration testers?

35.

Q1.

Organisations often spend a lot of money on cyber security.

Penetration testing is an attack on its own computer system by an organisation to try and identify security weaknesses.

Describe **one** difference between black-box and white-box penetration testing.

_____

_____

(Total 1 mark)

Q2.

Explain each of the cyber security threats listed below.

(a)   Social engineering.

_____

_____

_____

_____

_____

_____

(2)

(b)   Outdated software.

----

(2)

36.

(c) Misconfigured access rights.

(2)

Q3.

List three different measures that can be used to maintain the security of a computer system.

[for each response:]

- Outline what the measure is.
- Explain how it helps to meet the cyber security aim.

(Total 9 marks)

37.

Q4.

The algorithm below, expressed in pseudo-code, allows three users to log in to a computer program with individual usernames and passwords.

- For this algorithm, array indexing starts at 0.
- Line numbers are included, but are not part of the algorithm.

```
01 userlist ← [ 'Rachel', 'Sam', 'Tracey' ]
02 passlist ← [ '49Class', 'Smile', 'b1K3' ]
03 REPEAT
04    OUTPUT 'Enter Username'
05    username ← USERINPUT
06    OUTPUT 'Enter Password'
07    password ← USERINPUT
08    validlogin ← False
09    FOR usernum ← 0 TO 2
10       IF username = userlist[usernum]
11       AND password = passlist[usernum] THEN
12          validlogin ← True
13       ENDIF
14    ENDFOR
15 UNTIL validlogin = True
16 OUTPUT 'Login Successful'
```

The valid usernames and passwords are listed below.

Username	Password
Rachel	49Class
Sam	Smile
Tracey	b1K3

(a)   Shade in **one** lozenge in each row of the table below to indicate the most appropriate data type to use for each listed **Variable** from the algorithm, when the algorithm is implemented in a programming language.

Variable	Most appropriate data type (shade one lozenge per row)				
	Integer	Real	Boolean	Character	String
password	○	○	○	○	○
validlogin	○	○	○	○	○
usernum	○	○	○	○	○

(3)

Ethical issues

Ethical – Moral principles. Whether something is right or wrong.

Smart phones
✓ Keep in touch easily.
▪ Neglect face to face interaction.

Wearable technology
✓ Wireless headsets – Stop people using phones when driving.
✓ Fitness trackers – Promote healthily lifestyle.
▪ Smart glasses - Location, privacy.

Computer based implants
✓ Monitoring of health.
✓ Convenience.
▪ Less privacy, expensive.

Privacy
- Websites want you to provide personal information to set up an account.
- Users have to accept the privacy agreement however, people tend to not read these.
- Companies can share your details to other organizations.
- Users can take steps to make sure their information is secure.
- Users have to trust companies to keep their information secure (data protection act).

Digital divide!!
Some people have greater access to new digital technologies. People who have limited access are at a disadvantage.

Surveillance and censorship
- Surveillance – When someone monitors what people are accessing on the internet.
- Packet sniffers – Used to monitor internet traffic. Looks for key terms relating to illegal activities such as terrorism.
- Internet censorship – Some countries control what people access on the internet.
- Many countries restrict access to inappropriate sites.

Ethical and cultural vocabulary

Driverless cars	A vehicle that is capable of sensing its environment and navigating without human input.
Manufacturing	Computer technology is used to produce items faster, more accurately and cheaper than can be done by hand.
Shopping	Online shopping has led to the closing of many high street stores. It has also helped people who find it difficult to get to a supermarket for their food shopping.
Communication	Advancements in technology now make it much easier to communicate all over the world using social media, email, texting and phone calls. Information is spreads at a much faster rate.
Employment	The advancement of computer technology has made many new jobs, but has also put many people out of work in a number of industries (for example, manufacturing). Some jobs are now automated or controlled by robots.
Developments in software	Computer software is becoming substantially more developed as time goes on – this is especially visible within the field of artificial intelligence.
Artificial Intelligence	The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.
Healthcare	Technology is used to monitor patients, administer drugs and diagnose illnesses. Health apps are used more regularly on smartphones than ever before.
Social networking	Many people of all ages use social networking sites to keep in touch with others. It is much easier to communicate in this way than it would be to send a card, for example.
Rating culture	Services use star or score-based rating systems to judge people's performance. For example, the taxi company Uber does this to assess the performance of their drivers, based on what their passengers suggest.
Privacy	According to a recent study, Google is within a few years of having sufficient information to be able to track the exact movements and intentions of every individual, via Google Earth and other software they are developing. Greater advancements in technology could further risk our privacy.
Cookies	File, often unique identifiers, that are sent by web servers to web browsers and which may then be sent back to the server each time the browser request a page from the server. Can be used to recognise computers when they revisit a website, track users navigating the site, etc.

Legal issues

Legal issues and events that adhere to or break the law.

Cyber crime is any illegal act that involves computers. The most infamous is hacking.

Hacking – Gaining access to a system by finding weaknesses within a system.
This is done to destroy, steal or infect data.

Passive attacks – Monitoring activity (using packet sniffers)
Active attacks – Using malware to attack systems directly.
Brute force – automated software and trial and error to crack passwords.
Denial-of-service attacks – preventing people from using a network by flooding it with useless traffic.
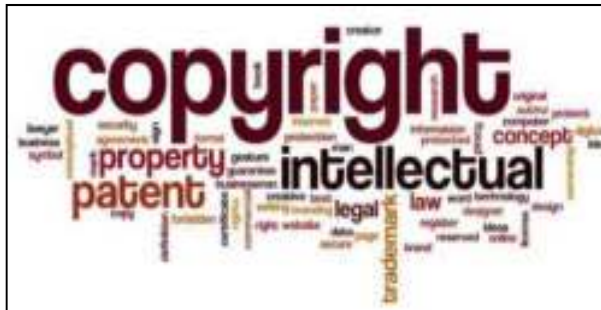
Copyrighted code?
It can be difficult to prove if computer code has been copied because:
- Similarities in code could be a coincidence.
- Difficult to measure an 'original' piece of code.
- Creators of paid software keep their source code secret – therefore not being able to compare it makes it difficult to identify code that has been copied.

DRM (Digital rights management)
- Files are easily shared over the internet, therefore making it harder to protect copyrighted content.
- Developers include DRM with software to prevent unauthorised use of software such as activation keys and authentication.
- DRM software is a target of cracking (illegally modify software to bypass these features).
- Cracked software is distributed online – This makes people argue that DRM does not work.
- Some DRM can make older software unusable if authentication service is no longer available.
- Cracked software can lead to loss of income for the software creators.
- Hackers use cracked software to distribute malware.

Copying and sharing legally
Open source software – Users are allowed to download and modify source code. (E.g. Mozilla Firefox, VLC media player)

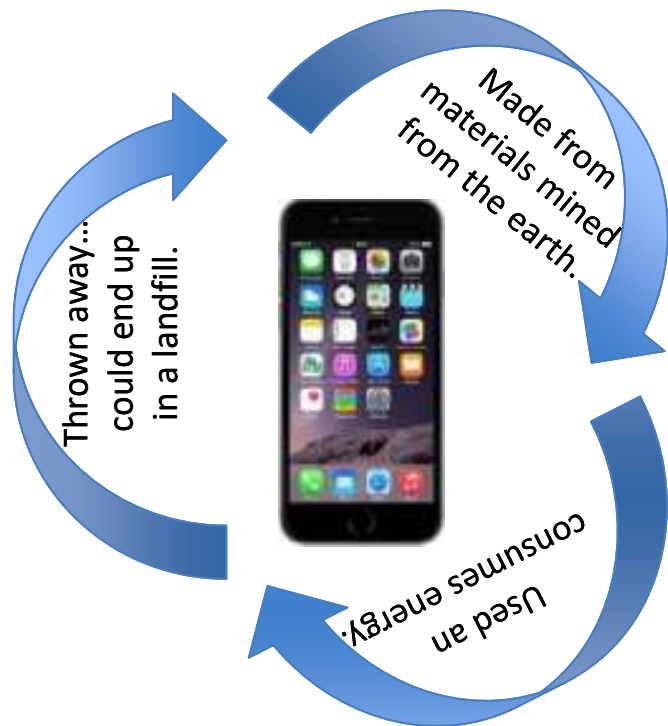|	
Data Protection Act 1998	This Act states that anyone who stores personal details must keep them secure. Companies with computer systems that store any personal data must have processes and security mechanisms designed into the system to meet this requirement. Made up of 8 principles.
Freedom of Information Act 2000	This Act gives people access to data held by public authorities, including state schools, police forces, local authorities and the NHS. It does not give access to personal data about people, but it means, for example, that anyone can ask for a list of all of the state schools in a certain area.
Computer Misuse Act 1990	This Act has three main principles, primarily designed to prevent unauthorised access or 'hacking' of programs or data. These are: unauthorised access to computer material; unauthorised access with intent to commit or facilitate a crime; unauthorised modification of computer material.
Copyright Designs and Patents Act 1988	This Act is designed to protect the creators of books, music, video and software from having their work illegally copied.
Creative Commons Licensing	When an author is willing to give people the right to share or use a work that they have created. The creator can choose to allow only non-commercial use, so that their work cannot be copied and distributed for profit.

GCSE| **Ethical, Legal and Environmental Impacts**| Required Knowledge

Environmental issues

Any creation, use or disposal of technology.

Cloud - reduce energy consumption by sharing applications (email), more energy efficient servers used

Made from materials mined from the earth.

Thrown away… could end up in a landfill.

Used an consumes energy.

Creating devices

- Making devices uses natural resources.
- Electronic devices contain **raw materials.**
- Plastics come from **crude oil.**
- **Precious metals** are used such as gold, silver, copper, mercury, palladium, platinum.
- Extracting these metals uses **energy,** creates **pollution** and depletes scarce natural resources.

Using devices

- Devices consume energy in the form of electricity.
- Electricity is made using non-renewable resources like coal, oil and gas.
- Extracting these causes lots of pollution.
- Computers generate heat. Servers need to be cooled down in air-conditioned rooms.
- Devices waste energy. People leave devices idle, using energy without doing anything.

Reducing energy

- Virtual servers rather than real machines.
- Switching off devices overnight.
- Devices use energy searching for wireless connections. Disabling this or using wired connections saves energy.

Disposing devices

- Disposing of technology creates   E-waste.
- Modern devices have a short life (upgrading phones, breakages).
- Manufacturers provide short warranties and advertise to convince people to upgrade.
- Can be cheaper to replace devices rather than repair.

Waste Electric & Electronic Equipment directive

- The WEEE outlines rules for disposing of E-waste. Promoting reusing and recycling.
- To cut costs, waste is sent to African and Asian countries where rules are less strict.
- Here it ends up in landfills. Toxic chemicals leak into the ground water and harm wildlife.

Environmental vocabulary	
Carbon footprint	The amount of carbon dioxide released into the atmosphere as a result of the activities of a particular individual, organization, or community.
Pollution	The presence in or introduction into the environment of a substance which has harmful or poisonous effects.
Computer-aided manufacturing	The use of software to control machine tools and related ones in the manufacturing of workpieces.
Sensors	A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture, pressure, or any one of a great number of other environmental phenomena.

41.

GCSE| **Ethical, Legal and Environmental Impacts**| Revision page

Ethical, legal and environmental impacts of digital technology

Cyber Security

Mobile Technologies

Ethical, legal and environmental impacts of digital technology

Wireless networking

Cloud storage

Ethical, legal and environmental impacts of digital technology

Theft of computer code

Copyright of algorithms

Cracking

Hacking

Ethical, legal and environmental impacts of digital technology

Wearable technologies

Computer based implants.

GCSE | **Ethical, Legal and Environmental Impacts** | Quiz questions

Self-Quiz Questions	Self-Quiz Questions	Challenge Self-Quiz Quizzing
1. Define ethical in a sentence.	11. Give a reason why trolling and cyberbullying have become to common.	21. Give 3 reasons why the digital divide might exist.
2. Define legal in a sentence.	12. What can you do to make the information your share online more private?	22. Give 3 examples of services that have been changed by new technology.
3. Define environmental in a sentence.	13. Explain the difference between censorship and surveillance.	23. Explain in less than 30 words, how businesses can be affected by computer-based implants.
4. Give one negative and one positive of mobile devices.	14. Give 2 reasons why someone might give their personal details online.	24. Explain in less than 30 words, how businesses can be affected by mobile devices.
5. Give one negative and one positive of wearable technology.	15. Give 2 problems with many online companies' privacy agreements.	25. Give one argument for and one against internet censorship.
6. Give one negative and one positive of the internet.	16. Describe 4 methods that a hacker might use to attack a system.	26. Give one argument for and one against governments carrying out internet surveillance.
7. When do data protection laws apply?	17. Describe 2 reasons someone might find it difficult to prove if their code has been copied.	27. Explain how copyright and patents apply to software.
8. What is a hacker?	18. What is meant by 'open source' software?	28. Explain how copyright and patents apply to computer code.
9. Give 3 examples of natural resources which are used to make computers.	19. Explain how a devices need for energy impacts the environment.	29. Why do we generate lots of E-waste?
10. Give 3 ways to reduce the amount of energy devices waste.	20. What is E-waste?	30. Describe an environmental danger caused by E-waste left at landfill sites.

Q1.

Some people believe that copying program code without permission should not be a crime. State one reason why they might believe this and state one reason why some people would disagree with them.

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(Total 2 marks)

Q2.

Chess is a two-player board game. Every year there is a competition to find the best chess-playing computer program. In 2011 the chess program Rybka was accused of having copied program code from other chess-playing computer programs and was disqualified from the World Computer Chess Championship. Prize money won in previous years had to be returned.

(a) To date, it has never been proven or disproven that Rybka contained copied program code. State **two** reasons why it could be difficult to prove if program code in Rybka had been copied from another program.

_____

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_____

(2)

(b) The program code that Rybka was accused of copying was open-source; this means that it was publically available so that anyone could look at it. The programmers of Rybka could have tried to prove they were innocent by publishing all their program code. This would allow people to compare it to the code they were accused of copying and see that it was different.

Assuming that there was not any copied program code in Rybka, state **one** reason why the programmers might not want to do this.

_____

_____

(1)

(Total 3 marks)

43.

Q3.

Many people use smartphones. Smartphones often include a range of sensors and have the ability to run software known as apps. Smartphones are an example of a mobile technology.

Discuss some of the ethical, legal and environmental issues that surround the use of smartphones and apps on them.

(Total 9 marks)

44.