GCSE Computing Revision Booklet

Your GCSE is split into three sections:

A451    Theory (exam – what this booklet covers)
A452    Practical investigation (Linux)
A453    Programming
<table>
<thead>
<tr>
<th>Unit</th>
<th>Example</th>
<th>How likely is it to be in the exam?</th>
<th>How confident are you?</th>
</tr>
</thead>
</table>
| 2.1.1 Computer Fundamentals  | • What is a computer system?  
                          • How do we make them more reliable? | 8%                                 |                        |
| 2.1.2 Hardware               | • The CPU  
                          • Binary Logic  
                          • Memory  
                          • Input and output devices  
                          • Secondary storage | 22%                                |                        |
| 2.1.3 Software               | • Operating systems  
                          • Utility software  
                          • Open source/custom written etc. | 9%                                 |                        |
| 2.1.4 Representation of data | Units of measurement (bit byte etc.)  
                          Binary representation of:  
                          • Numbers  
                          • Characters  
                          • Images  
                          • Sound  
                          • Instructions | 12%                                |                        |
| 2.1.5 Databases              | • What is a database?  
                          • Database concepts  
                          • Relational databases | 12%                                |                        |
| 2.1.6 Networks and Internet  | Networks  
                          • Why do we have networks?  
                          • Hardware  
                          • Types of network  
                          • Protocols  
                          • IP/MAC  
                          Internet  
                          • What is it?  
                          • Hardware needed  
                          • HTML  
                          • File types (jpeg, mpeg, gif etc.) | 14%                                |                        |
| 2.1.7 Programming            | • Algorithms  
                          • Programming languages  
                          • Control flow  
                          • Handling data  
                          • Testing | 23%                                |                        |
### What's going to be on the exam?

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<th>Topic</th>
<th>% chance</th>
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<td>2.1.6 - Networks - Networks</td>
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<td>2.1.6 - Networks - Networks</td>
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<td>2.1.4 - Rep of Data - Inst</td>
<td>(p) (q) instructions &amp; data</td>
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<td>2.1.2 Hardware - Memory</td>
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<tr>
<td>2.1.6 - Networks - Internet</td>
<td>(i) describe</td>
<td>0</td>
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<tr>
<td>2.1.6 - Networks - Internet</td>
<td>(j) Hardware</td>
<td>0</td>
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</tbody>
</table>
Candidates should be able to:

a) define a computer system

- Computer systems are hardware and software
- They are all around us, and control the modern world
- We can use the four box model to represent them

Input
- Devices such as keyboards, sensors etc.

Processing
- A computer program makes sense of the input and decides what to do

Output
- Devices such as screens, printers, speakers, motors

Storage
- We also need to store data and programs

Candidates should be able to:

b) describe the importance of computer systems in the modern world

- Our transport system would collapse – no trains, no buses, no traffic lights
- Without computers, it would be impossible to live in the “modern world”
- The energy industry (gas, electric etc.) would not be able to provide energy when it was needed
- Health – without monitoring equipment and other modern technology modern healthcare would be impossible

Communication
- Would break down – no phones, mobile, radio, TV

Candidates should be able to:

c) explain the need for reliability in computer systems

Because we have to rely on computer systems, we need to make them reliable

- Dual power supplies, so that if one fails, the other one can take over
- RAID drives – if a hard drive fails, the data is stored on more than one drive
- Regular Backups – several generations of data backed up so we can restore them in the event of a system failure or operator mistake
- Uninterruptible Power Supplies – if the mains power fails, the battery can safely take over, and shut the system down without causing damage
- In case of failure, organisations need a Disaster Recovery Plan

Candidates should be able to:

d) explain the need for adherence to suitable professional standards in the development, use and maintenance of computer systems

- Every person in the team must work in the same way so that everyone understands what they have done
- Computer systems are complex and there are usually developed and maintained by many people working as a team
- Programmers must add comments to all of their code so that future developers understand how it works
- Systems should also be thoroughly documented, with user manuals to help the user understand how it works and what to do if there is a problem
Candidates should be able to:

**e) explain the importance of ethical, environmental and legal considerations when creating computer systems**

<table>
<thead>
<tr>
<th>Ethical</th>
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<tbody>
<tr>
<td>Not everyone can afford CS</td>
</tr>
<tr>
<td>Some people may lose their jobs</td>
</tr>
<tr>
<td>People in poorer countries may be exploited</td>
</tr>
<tr>
<td>Can disabled people use CS?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental</th>
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<tbody>
<tr>
<td>Does the CS use a lot of power?</td>
</tr>
<tr>
<td>Using CS may mean less travel</td>
</tr>
<tr>
<td>CS sometimes use scarce natural resources</td>
</tr>
<tr>
<td>Disposal of old CS can be an issue – toxic and bulky components</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Legal</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS must conform to the law!</td>
</tr>
<tr>
<td>Data Protection Act – gives people the right to protect their own personal data stored on CS</td>
</tr>
<tr>
<td>Health and Safety at Work – employers must make sure that their CS are safe and do not injure their workforce</td>
</tr>
<tr>
<td>Copyright, Designs and Patents Act – it is illegal to copy programs, and other data without permission</td>
</tr>
</tbody>
</table>

Candidates should be able to:

**b) describe the function of the CPU as fetching and executing instructions stored in memory**

*The purpose of the CPU is to fetch and execute instructions*  
Memorise this!

![Diagram of CPU function]

Candidates should be able to:

**c) explain how common characteristics of CPUs such as clock speed, cache size and number of cores affect their performance**

- Modern CPUs have more than one core
- Each core is a separate CPU
- More cores mean the CPU can do more things at once, so it's faster
- The clock speed is the speed that the CPU can execute each instruction.
  
Faster clock speed = faster CPU

| The Central Processing Unit is the brains of the computer |
| Programs store the instructions which the CPU runs |
| Every computer system has at least one CPU |

**a) state the purpose of the CPU**

![Image of human brain]
Candidates should be able to:
c) explain how common characteristics of CPUs such as clock speed, cache size and number of cores affect their performance

CPU have some very fast internal cache storage
This means that the CPU doesn’t have to wait for the next instruction, so it’s quicker

Candidates should be able to:
de) understand and produce simple logic diagrams using the operations NOT, AND and OR

 Candidates should be able to:
d) explain why data is represented in computer systems in binary form

Computers work by switching electrical signals on and off
They can switch millions of signals on and off, millions of times a second
Humans cannot really understand what these “ons” and “offs” mean
To make it easier to understand, we use binary to represent the signals
1 = signal on, 0 = signal off

Candidates should be able to:
f) produce a truth table from a given logic diagram.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>A AND B</th>
<th>OR C</th>
</tr>
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<tbody>
<tr>
<td>0</td>
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</table>
g) describe the difference between RAM and ROM
R.A.M. stands for Random Access Memory
R.A.M. is volatile, which means it will lose its contents when the power is turned off.
R.O.M. stands for Read Only Memory
R.O.M. is non-volatile, which means it does not lose its contents when the power is turned off.

h) explain the need for ROM in a computer system
When a computer system starts, it must have some instructions to follow so that everything is correctly set up. This program is called the B.I.O.S.
The B.I.O.S. is stored in R.O.M. because it needs to stay there when there is no power.

i) describe the purpose of RAM in a computer system
A computer system needs to store programs and data when it is running. The speed of the computer system will be limited by the speed of this storage.
R.A.M. is used because it offers a good compromise between cost and speed.

j) explain how the amount of RAM in a personal computer affects the performance of the computer
As operating systems on desktop computers get more and more complex, they need to use larger and larger amounts of storage to run their programs.

Adding more R.A.M. means that the data doesn’t need to be swapped as often, so the system will run faster.
Candidates should be able to:

k) explain the need for virtual memory

Sometimes, the computer needs to use more RAM than it has available. Modern operating systems, such as Windows, can use the hard drive as an extended area of RAM, known as Virtual Memory.

Candidates should be able to:

l) describe cache memory

Cache Memory is very fast (and expensive) RAM that is on the CPU chip.

RAM

Processors can access the data in RAM at faster pace than a storage device.

Memory Devices (Hard drives etc)

Running application data and commands are transferred to RAM.

Candidates should be able to:

m) describe flash memory

Flash memory is non volatile (so it doesn’t lose its contents when the power is off), BUT it can be erased and re-programmed.

Devices which use flash memory include:

- USB pen drives
- Camera memory cards
- Mini SD cards used in mobile phones

Candidates should be able to:

n) discuss how changes in memory technologies are leading to innovative computer designs

Memory technology gets faster...

...and smaller...

...we get faster, cheaper and smaller devices such as tablet PCs, smart phones, larger USB pen drives etc...
Candidates should be able to:

o) understand the need for input and output devices

An input is data that a computer receives.
An output is data that a computer sends.

Computers only work with digital information. Any input that a computer receives must be digitised. Often data has to be converted back to an analogue format when it’s output, for example the sound from a computer’s speakers.

Candidates should be able to:

p) describe suitable input devices for a wide range of computer controlled situations

### Input Devices - mainstream

**Use:** Used to move a cursor and select icons on a screen on a Graphical User Interface.

**Advantages:** Excellent option for user’s of desktop computers – appropriate for users in seated position.

**Disadvantages:** Need a flat clean surface.

### Input Devices - specialist

**Use:** Used to capture movement of the user.

**Advantages:** Users can control a computer system without contact with a device.

**Disadvantages:** Gestures can be misinterpreted by the system. Needs light.

**Use:** Users can drag, select, expand screen items without a additional device.

**Advantages:** Very intuitive. No additional devices are required.

**Disadvantages:** Doesn’t work if fingers are wet or if the user is wearing gloves.
Candidates should be able to:

q) describe suitable output devices for a wide range of computer controlled situations

"Mainstream" Output Devices

**Monitor / VDU:**
Display information via pixels on a screen. Pixels combine to present us with images that we can recognise and gain information from. Used in a wide range of environments (homes/offices). Usually accompanies a desktop computer.

**Projector:**
Projects an image on a screen/wall/object to present us with images that we can recognise and gain information from. Used in cinemas, schools, video conferencing etc.

**Printer:**
Inks a 'image' onto paper to provide us with information. Used at home and in the office and many other settings. Inkjet printers place ink on the paper whereas a laser printer uses static energy (generated by lasers) to attract toner (tint/ink/toner) which are then placed on the paper and heated so they stick.

"Specialist / Industry" - Output Devices

**Actuator:**
These are output devices which produce movement/motion. For example, they are used on a plane to control the 'flaps' on the wing. If the autopilot senses a drop in altitude then the computer will send the appropriate data to these output devices to adjust the 'flaps' accordingly.

**Plotter:**
This is a specialist output device which prints huge images onto extensive sheets of paper or other suitable materials. They are used to generate technical drawings and blueprints. They are similar to printers but often will use a 'pen' to create the images as opposed to a 'printer head.'

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**Input Devices – specialist**

**OMR (Optical Mark Recognition) Scanners**
Device recognises marks on a document (which correspond to data) often used in surveys/multiple choice exams.

**Bar Code Scanner**
Scans the widths of the lines and spaces. These widths represent a unique code—when the code is captured by the scanner, the code is looked up in a database and the item information is displayed.

**RFID (Radio Frequency Identification)**
Tags are placed on items and the tags themselves store data/unique code (like a bar code). Unlike a bar code, these tags don't need to be in the line of sight of the scanner. The scanner sends a signal to the tag and receives a response which is the code.
“Users with Specific Needs” - Input Devices

**Suck-Puff Switch:**
Paralysed users can use their mouth to control a switch. Programs can interpret these inputs to carry out a number of tasks.

**Eye Tracker:**
Cameras locate the eye and the direction that the person is looking. The cursor will follow the eye movement. Staring at an icon will select it.

**Foot Mouse:**
Users with limited arm movement can use their feet to control the cursor and select icons.

**Braille Keyboard:**
Users with poor sight can use 2 types of keyboards: normal keyboard with braille to guide them to the correct letter or a keyboard which the user can select the position of the dots to create each braille letter.

“Users with Specific Needs” – Output Devices and Adoptions to Output Devices

**Braille Printer:**
These work by punching dents into a sheet of paper to form the Braille that someone who is visually impaired can feel and interpret as information.

**Voice Synthesiser:**
These output devices (which is a speaker and screen combined) allow users (who cannot naturally communicate) to pick letters and words from a screen and the synthesiser will then synthesise human speech to speak the letters/words aloud.
“Users with Specific Needs” – Output Devices and Adoptions to Output Devices

Screen Magnification:
Although not technically an output device in itself (the screen is the output device), screen magnification software will adapt the screen so that partially sighted people can more easily read the information on the screen.

Screen Reader:
Like the screen magnification software, this adapts the output device (screen) to present the text in a ‘spoken’ form.

Candidates should be able to:

s) explain the need for secondary storage

**Secondary storage** refers to storage devices and media that are not constantly accessible by a computer system. Examples include external hard drives, portable flash drives, CDs, and DVDs.

We need secondary storage devices to save all our data in original form so that we won’t lose it on turning our computer off. This is needed for two reasons:
1. The computer’s working memory is finite and limited in size so it cannot always hold the data we need.
2. In secondary storage data and programs do not disappear when power is turned off as they do when semiconductor memories are used.

Candidates should be able to:

t) describe common storage technologies such as optical, magnetic and solid state

Magnetic storage uses different patterns of magnetisation in a magnetisable material to store data and is a form of non-volatile memory. The information is accessed using one or more read/write heads.
Candidates should be able to:

t) describe common storage technologies such as optical, magnetic and solid state

Solid-state storage is a type of computer storage media made from silicon microchips. SSS stores data electronically instead of magnetically, as spinning hard disk drives (HDDs) or spinning optical disks.

Candidates should be able to:

a) define the terms bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte

1 bit = 1 binary digit – represents an electrical signal being on or off.

Candidates should be able to:

 Candidates should be able to:

a) define the terms bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte

4 bits = 1 nibble.

8 bits = 1 byte

*Stands for “by eight”?*
c) Convert positive denary whole numbers (0-255) into 8 bit binary numbers and vice versa.

**DENARY 2 BINARY CONVERSION**

1. **Draw a table.**
   - Draw a table, starting with $2^7$ on the right and adding one to the power on the left each time.
   - Draw a 4x8 table:
     - $2^7$ 64 32 16 8 4 2 1
     - Just double it each time!

2. **Fill in**
   - For this example, we will convert the number 219 to binary.
   - Starting from left to right, see if you can subtract the left most digit:
     - 219 - 128 = 91
     - 91 - 64 = 27
     - 27 - 16 = 11
     - 11 - 8 = 3
     - 3 - 2 = 1
     - 1 - 0 = 1
   - Your binary number is: 1101 0001

**Candidates should be able to:**

a) Define the terms bit, nibble, byte, kilobyte, megabyte, gigabyte, terabyte.

- 1024 bytes = 1 kilobyte \((\text{kilo} = 1000)\)
- 1024 kilobytes = 1 megabyte \((\text{mega} = \text{million})\)
- 1024 megabytes = 1 gigabyte \((\text{giga} = \text{billion})\)
- 1024 gigabytes = 1 terabyte \((\text{tera} = \text{trillion})\)

b) Understand that data needs to be converted into a binary format to be processed by a computer.

- Computers work by processing electrical signals.

- Electrical signals can be either on or off.

Text, images, sound and instructions all need to be converted into binary so that computers can understand the information.
### Binary 2 Denary Conversion

**Step 1: Draw a Table**
We're going to convert the binary number 11011111.

Draw a table around the number, starting with 2 to the left, adding 30 one to the power on every column.

<table>
<thead>
<tr>
<th>128</th>
<th>64</th>
<th>32</th>
<th>16</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Step 2: Find the 1s**
From the table, you need to find all of the columns that have left a 1 in them on the bottom row.

<table>
<thead>
<tr>
<th>128</th>
<th>64</th>
<th>32</th>
<th>16</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Step 3: Do some maths**
After putting all of these columns together, you have the following two sums:

\[
2^7 + 2^6 + 2^4 + 2^3 + 2^1 + 2^0
\]

Which can be expressed as:

\[
128 + 64 + 16 + 8 + 2 + 1
\]

### Binary Addition

Addition in binary is done in exactly the same way as we normally do.

Start on the right, and add up the columns one by one, carrying numbers as necessary...

We have just seen that:

1 + 1 = 10, so we have to carry one.
This makes the next column a little bit more complicated!

1 + 1 + (carry 1) = 11
...so we write down 1, and carry 1

Let's start with the simple ones!

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

We all know that:
1 + 1 = 2, but we can't have a "2" in binary, so it should be written:

1 + 1 = 10
This means we have to "carry one" to the next column, which is now:

0 + 0 + (carry 1) = 1

You only need 5 rules – what are they?

### Hexadecimal

We often need to store larger numbers in a computer, and sometimes humans have to actually type them in.

We could probably remember 708126, but could you cope with:

0000011 00000000 0001000 000001 00000010 00000110?
**Hexadecimal**

One way to make long binary numbers easier to remember is to convert them into hexadecimal.

<table>
<thead>
<tr>
<th>0</th>
<th>0000</th>
<th>0</th>
<th>8</th>
<th>1000</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0001</td>
<td>1</td>
<td>9</td>
<td>1001</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>0010</td>
<td>2</td>
<td>10</td>
<td>1010</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>0011</td>
<td>3</td>
<td>11</td>
<td>1011</td>
<td>B</td>
</tr>
<tr>
<td>4</td>
<td>0100</td>
<td>4</td>
<td>12</td>
<td>1100</td>
<td>C</td>
</tr>
<tr>
<td>5</td>
<td>0101</td>
<td>5</td>
<td>13</td>
<td>1101</td>
<td>D</td>
</tr>
<tr>
<td>6</td>
<td>0110</td>
<td>6</td>
<td>14</td>
<td>1110</td>
<td>E</td>
</tr>
<tr>
<td>7</td>
<td>0111</td>
<td>7</td>
<td>15</td>
<td>1111</td>
<td>F</td>
</tr>
</tbody>
</table>

**Convert from denary to hexadecimal:**

Convert the following denary number to hex:

124

*Step 1, divide by 16*

124 ÷ 16 = 7 remainder 12

*Step 2, make sure both numbers are hex*

7C

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**Candidates should be able to:**

h) explain the use of binary codes to represent characters

To save space, we use the least possible amount of storage (bits). We need 26 letters x 2 + 10 numbers + Punctuation? (64 characters could be stored in 6 bits = binary 100000).

Long before modern computers, telegraph systems used this system to make their messages shorter.
Candidates should be able to:

h) explain the use of binary codes to represent characters

When we started to use 8-bit computers, it made sense to extend the number of characters that we could use – so we decided on a standard set of numbers to represent each character.

This standard was the “American Standard Code for Information Interchange” - ASCII

The letter A is ASCII character 65
01000001 in binary

A = 65 = 01000001
1st letter

B = 66 = 01000010
2nd letter

C = 67 = 01000011
3rd letter

D = 68 = 01000100
4th letter

The letter a is ASCII character 97
01100001 in binary

a = 97 = 01100001

b = 98 = 01100010

c = 99 = 01100011

d = 100 = 01100100

Candidates should be able to:

j) describe with examples (for example ASCII and Unicode) the relationship between the number of bits per character in a character set and the number of characters which can be represented.

Old way – ASCII
• Only used 128 characters
• Later extended to 256 characters
• Suitable for old technology
• Still the main character set as it is so widely used and is efficient for nearly every use.

Modern Alternative - Unicode
• Can store many more characters
• Uses more than one byte for each character
• "future proof"
• At least doubles the storage space that is needed (and halves the speed that every message is sent on a network)

Candidates should be able to:

i) explain the term character set

A character set is the agreed standard for how and which numbers represent which character.

Which characters will you include?
(upper and lower case letters)
(punctuation)
(smileys)
(non-English alphabets)

What numbers will you use to represent them?
1 byte = 8 bits = 256 total characters
2 bytes = 16 bits = 65536 total characters
...or more?

Candidates should be able to:

k) explain the representation of an image as a series of pixels represented in binary

A long time ago...
Computers could only display letters and characters. They used a font where each character was the same width and height – usually the display was 80 characters wide and 32 characters tall. This made storing the text, and decoding what pixels to illuminate or not fairly easy, but it did limit the system to use only text and only one colour.
Candidates should be able to:

k) explain the representation of an image as a series of pixels represented in binary

Eventually, the demand for better quality graphics made the manufacturers develop a better system. Text was now displayed as a graphical image, which allowed the text to be much smoother and also use more colours. This also allowed high quality graphics and images to be used.

Candidates should be able to:

I) explain the need for metadata to be included in the file such as height, width and colour depth

These two images show the same combinations of ones and zeros:

Each pixel is represented by a 1 or a 0
Candidates should be able to:

l) explain the need for metadata to be included in the file such as height, width and colour depth.

The extra information (width, height and how many bits per colour) is stored in a special section of the image file called the METADATA.

Metadata can also include a lot of other information such as where the image was made, who made it, copyright information etc.

m) If we double the number of colours in an image, we will have to double the amount of data that is used to store the image.

n) If we double the resolution of an image we quadruple the amount of data that is needed to store the image.
Candidates should be able to:

n) explain how sound can be sampled and stored in digital form

Sound is a pressure wave in the air. It is continually changing, which we call an analogue signal.

Candidates should be able to:

o) explain how sampling intervals and other considerations affect

To improve the quality of the recorded sound, we can sample the sound more frequently...

Double the recording interval...

...double the amount of data

Candidates should be able to:

n) explain how sound can be sampled and stored in digital form

To record the sound on a computer, we need to convert the analogue sound into numbers (digital).

Candidates should be able to:

o) explain how sampling intervals and other considerations affect

We can also use a greater number of bits to record the sound more accurately (higher resolution).

Using 8 bits... Using 16 bits...

00011111 00101011 01101000 01110101
01010010 01010101 01100101 01101110
01101110 01101111 01100000 01100011
00100000 00100000 00100000 00100000

Double the resolution, double the filesize
Candidates should be able to:

a) describe a database as a persistent organised store of data

- **Persistent**
- **Organised**
- **Store of Data**

**Means:**
- Non-volatile
- Stored on secondary storage (such as hard drive)
- More than one person can access the database at once

b) explain the use of data handling software to create, maintain and interrogate a database

- **Create** means to set up the structure of the database, such as tables, forms etc.
- **Maintain** means to update the database, edit records, add records and delete records
- **Interrogate** means to search for data that matches certain criteria

c) describe how a DBMS allows the separation of data from applications and why this is desirable

**DBMS (Database Management System)**

This means that the actual data is stored separately from the tools that are used to view, edit and update the data.

By storing the data separately, each department can be given the tools that they need to use the database, and all departments will work on up to date information. This is called "removing inconsistencies”

d) describe the principal features of a DBMS and how they can be used to create customised data handling applications

**Features of a DBMS include:**
- Separating applications and data
- Allowing more than one person to use the database at once
- Setting up access rights, so some users will be able to delete and change records, whilst others will be view only, or even forbidden.
- Allows the data to be queried
- Allows reports to be generated.
Candidates should be able to:

e) understand the relationship between entities and tables

An entity is a real world object that can be separated from other parts of the data.

Schools have "Students", "Teachers", "Rooms", "Departments", "Lessons" etc. Each of these is a separate entity.

Each Entity is stored in a separate table

Table = Entity

2.1.5 Databases

Candidates should be able to:

f) understand the components of a relational database, such as tables, forms, queries, reports and modules

Forms (sometimes called "data entry forms") are used to display and edit the data that is stored in the tables. They usually have some navigation buttons that can be used to move around the data.

We use a query to search for data that is stored in the tables. We design a query by specifying which fields are displayed and what information we are searching for (the criteria).

We can then run the query which will display the results of the search.
Candidates should be able to:

f) understand the components of a relational database, such as tables, forms, queries, reports and modules

We use a report to display information from our database. This might be on the screen, or printed out in a neatly formatted document. The report can show information from tables or queries.

Candidates should be able to:

h) explain the use of key fields to connect tables and avoid data redundancy

We often need to add a "Primary Key" field to a table. This will be unique for every record in the database. We need to add this so that we pick the wrong records by mistake.

(James Taylor)

We can link two tables together by adding a new field to one table which matches the primary key in another table. This new field is called the foreign key.

Candidates should be able to:

g) understand the use of logical operators in framing database queries

("Name" = "Smith") AND ("Year" = 7)

We can use logical operators to specify our search.

= They are the same
> Greater than
< Less than
<> Not equal to

We can also use AND, OR and NOT to link several parts together.

Candidates should be able to:

i) describe methods of validating data as it is input

"Validating" means checking that the data is "Valid"

A presence check can be used to make sure something is actually filled in when a new record is entered.

A range check will validate data by making sure it fits into a certain range.

A type check will make sure that a field has been completed with the right kind of data (a number, or text)

A format check will make sure that the data has the right format such as a postcode or email address.

A length check will make sure that data is long enough
Candidates should be able to:

**a)** explain the advantages of networking stand-alone computers into a local area network

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**Benefit 1 – Sharing resources**

- Sharing folders and files so you can access your own documents and shared documents from any computer on the network
- Sharing an Internet connection
- Sharing peripheral devices such as printers and scanners

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**Benefit 2 – Communication**

- Transferring files between computers
- Using email to communicate with colleagues
- Using messaging systems to chat while you are working on other things

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**Benefit 3 – Centralised Management**

- Users can use any PC on the network but still see their own files
- Software can be distributed across the network rather than having to install on each computer
- Centralised backup of all files
- User profiles and security can be managed centrally

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Candidates should be able to:

**b)** describe the hardware needed to connect stand-alone computers into a local area network, including hub/switches, wireless access points

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Each computer will need to have a Network Interface Card (NIC). Some computers have this built into the motherboard.

Each computer has a cable, and these networks are sometimes referred to as “wired” networks.

The NIC is connected to a hub, which is sometimes called a “switch”
c) explain the different roles of computers in a client-server and a peer-to-peer network

The simplest form of network is when all the computers are connected together, and are configured so that they can share their files and resources with each other. This is known as a peer-to-peer network.

Some of the computers can also be configured to be a "server". This means that they have special software and hardware that will let them "serve" other computers.

Examples of servers include file servers, email servers, web servers and anti-virus servers.

d) describe, using diagrams or otherwise, the ring, bus and star network topologies

A ring topology is the simplest way of setting up a network. Each computer is linked to the other to form a ring. One disadvantage of a ring network is that only one computer can use the network at once, which makes it very slow. Another disadvantage is that if one computer or cable fails, the whole network stops working.

A bus topology uses a central data bus to connect the computers. Each computer, server, printer etc. is connected to the bus. Bus networks are also slow because only one computer can use the bus at once. If the bus fails, then the network will also stop working.
Candidates should be able to

d) describe, using diagrams or otherwise, the ring, bus and star network topologies

A star network has a central hub or switch that all the computers are connected to. The switch looks at the data that is being transmitted and only sends it to the computer who it is intended for. This means that the network runs a lot more faster and that the network will not be disabled by one faulty computer.

Candidates should be able to

e) describe the differences between a local area network and a wide area network such as the internet

Larger networks often have to link computers together that are much further apart, sometimes even in different countries. Extra technology such as satellites, microwave and telephone cables are used to link them together.

TASK

Produce a network diagram for each of the network topologies.

Add text that explains the advantages and disadvantages of each one.

Add additional text to cover each of the bullet points from a to e

Candidates should be able to

f) explain the terms IP addressing, MAC addressing, packet and protocols

To get two computers to communicate to each other, you need to make sure that they use the same language, and that they have the same rules for which one speaks when and how much they say.

These rules are called a protocol
Candidates should be able to

f) explain the terms IP addressing, MAC addressing, packet and protocols

The protocol has rules for dealing with larger amounts of data. The data is split up into smaller amounts, called packets. Each packet has some extra information which is attached in the "header" and has details such as where the message is going, how many packets that there are and which packet it is.

Candidates should be able to

f) explain the terms IP addressing, MAC addressing, packet and protocols

Every network card has a ROM containing its address. The address is known as the "Machine Access Code" or MAC address. The MAC address is fixed and cannot be changed. It is unique and there are many billions of different addresses available. The MAC address is a 48 bit binary numbers which is normally written down as a hexadecimal number such as 00-09-7C-F1-F7-85

Candidates should be able to

If one of the packets doesn't arrive, or has errors in the data, the receiving computer can send a message back to the sending computer and the packet will be re-sent.

Candidates should be able to

g) explain the need for security measures in networks, such as user access levels, suitable passwords and encryption techniques

Another way that a network can be kept secure is to make sure that users have a secure password.

The network administrator will decide how long passwords must be, how often they need to be changed, and whether they need to have capital letters, numbers and symbols.
Candidates should be able to

f) explain the terms IP addressing, MAC addressing, packet and protocols

When a computer is connected to a network, it registers its MAC address and is allocated an IP address (Internet Protocol).
The IP address is shorter and is only 32 bits long. It is usually written as four denary numbers, each less than 255 such as:
192.168.1.42
MAC addresses are fixed and they are unique. IP addresses can change.

Candidates should be able to

g) explain the need for security measures in networks, such as user access levels, suitable passwords and encryption techniques

When data is sent on a network, it can be intercepted. It would be quite easy to read the data and gain unauthorised access.
Networks can encrypt the data in a way that makes it impossible to read the data without the necessary "key".

Candidates should be able to

h) describe and justify network policies such as acceptable use, disaster recovery, failover, backup, archiving.

The network administrator must decide the rules that users must stick to when they use the network.
The rules are known as policies.

One of the most important policies is the acceptable use policy. This policy says that you may not access others users work, visit inappropriate websites, or install software on the network.
Candidates should be able to

h) describe and justify network policies such as acceptable use, disaster recovery, failover, backup, archiving.

   All networks will fail at some point. This may be a small failure such as a broken hard drive or something more serious that affects the whole network.
   The disaster recovery policy is a plan which covers what to do if there is a "disaster", and has procedures such as maintaining a full backup and checking equipment regularly to pre-empt a failure.

Candidates should be able to

h) describe and justify network policies such as acceptable use, disaster recovery, failover, backup, archiving.

   On any network, there are certain parts of the hardware and software that would cause the whole network to fail if they were to develop a fault. One example of this is if a hub fails, none of the computers would be able to access the network. The critical component can be backed up with a spare, so that in the event of a failure, the system can switch over from the non-working to the working component. This is called failover.

Candidates should be able to:

i) describe the nature of the internet as a worldwide collection of computer networks.

   The Internet is a HUGE collection of computer networks.

Candidates should be able to:

j) describe the hardware needed to connect to the internet including modems, routers.

   To connect a computer to the Internet, you need to find a wire that can carry the signals.

   Luckily, we can use a telephone line for this.
j) describe the hardware needed to connect to the internet including modems, routers

At first, users had to use a MODEM. This was slow, unreliable, and you couldn’t use the phone at the same time. It was also very expensive, because you had to pay for the phone call.

The modem converted a digital signal into an analogue sound.

k) explain the need for IP addressing of resources on the internet and how this can be facilitated by the role of DNS services

The Internet is a very large WAN. Data is sent in packets.

Each packet has the address of the computer that it is being sent to. The address that is used is the computers IP address.

Candidates should be able to:

j) describe the hardware needed to connect to the internet including modems, routers

When broadband became available, the modem was replaced with a router. The router allows you to keep using the phone while you connect to the Internet. It also transmits the signals in a digital form, so it is much faster.

k) explain the need for IP addressing of resources on the internet and how this can be facilitated by the role of DNS services

Because the IP addresses are so important, each computer must know how to convert a web address into an IP address. We use a DNS server for this.
Candidates should be able to:
k) explain the need for IP addressing of resources on the internet and how this can be facilitated by the role of DNS services

- Can I have the IP address of www.bbc.co.uk please?
  - I don't know it, try the .uk server

- Can I have the IP address of www.bbc.co.uk please?
  - I don't know it, try the .co.uk server

- Can I have the IP address of www.bbc.co.uk please?
  - I don't know it, try the .bbc server

- Can I have the IP address of www.bbc.co.uk please?
  - Yes, it is 212.58.246.94

Candidates should be able to:
m) describe common file standards associated with the internet such as JPG, GIF, PDF, MP3, MPEG

JPEG stands for Joint Photographic Experts Group, who are a group of people who created a standard way of storing a photograph on a computer. The file is compressed so that it takes up less space and loads more quickly. The compression removes some of the finer detail, but this is not usually noticeable.

JPG – used for high detail images

Candidates should be able to:

1) explain the importance of HTML and its derivatives as a standard for the creation of webpages

Tim Berners-Lee created the World Wide Web in 1989. He made a language that can be used to describe the text, images, layout, hyperlinks and other features. The language is called HyperText Markup Language. Any device which is used to view the World Wide Web has to be able to understand HTML. The language also contains methods to deal with new devices such as mobile phones.

There are also some “derivatives” and extensions to HTML which add extra features, among these are CSS which describes the styles used on a page.

Candidates should be able to:

GIF (pronounced JIF) which stands for Graphic Interchange Format, is a file format that is used for images. GIFs work best for images with large blocks of the same colour, which tend to be images that are hand drawn rather than captured with a camera. The images can also contain animation. GIFs are compressed in a way that does not lose any quality or detail.

GIF – used for cartoon style graphical images
Candidates should be able to:

m) describe common file standards associated with the internet such as JPEG, GIF, PDF, MP3, MPEG

A Portable Document Format (PDF) file is a file format that is used to display documents on screen in exactly the same way as they will appear when printed. They are mainly used for text-based documents which have some images in them. PDF files can be compressed, and can use

PDF – used for text documents

Candidates should be able to:

m) describe common file standards associated with the internet such as JPEG, GIF, PDF, MP3, MPEG

Music Player layer III or MP3 is a file format that is used for audio files. MP3s are heavily compressed using a lossy method. Most users will not notice a drop in sound quality, although some people have more sensitive hearing and claim to be able to tell that something is missing.

MP3 – used for audio (music), NOT VIDEO

Candidates should be able to:

The Moving Picture Expert Group have created several file formats for storing movie files in a digital format. MPEGs are compressed using a lossy method.

MPEG – used for video, NOT AUDIO

Candidates should be able to:

m) describe common file standards associated with the internet such as JPEG, GIF, PDF, MP3, MPEG

<table>
<thead>
<tr>
<th>File Format</th>
<th>Type of Content</th>
<th>Compression Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPEG</td>
<td>Photographs</td>
<td>Lossy</td>
</tr>
<tr>
<td>GIF</td>
<td>Cartoon style graphics</td>
<td>Lossless</td>
</tr>
<tr>
<td>PDF</td>
<td>Text documents that may contain images</td>
<td>Can be either</td>
</tr>
<tr>
<td>MP3</td>
<td>Audio files</td>
<td>Lossy</td>
</tr>
<tr>
<td>MPEG</td>
<td>Movie files</td>
<td>Lossy</td>
</tr>
</tbody>
</table>
Candidates should be able to:

n) explain the importance of compressing files that are transmitted via the internet.

Large files have more detail, but have problems:
- They take up more storage space
- They take longer to load on a web page
- They take longer to send as attachments

We can make files smaller by compressing them. They can be compressed by at least 10% and maybe 50% or more.

Candidates should be able to:

h) describe and justify network policies such as acceptable use, disaster recovery, failover, backup, archiving.

Users can sometimes make mistakes and delete or overwrite a document that they wanted to keep. There are other ways that data can be lost such as hard drive failures.

Networks will usually have an automatic system that backs up all of the data regularly. They will keep several different copies of the backup, sometimes in fireproof safes and in a different location.

Older versions of data can be kept for a longer period of time, sometimes many years. This is called archiving the data.

The data will be saved on high capacity device such as a DVD or BluRay disk which will be stored in a safe and secure location.

The archive can be accessed if any of the old data is required.

Candidates should be able to:

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The Internet is a HUGE collection of computer networks.
Candidates should be able to:

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m) describe common file standards associated with the internet such as JPG, GIF, PDF, MP3, MPEG

*JPEG stands for Joint Photographic Experts Group, who are a group of people who created a standard way of storing a photograph on a computer.*

*The file is compressed so that it takes up less space and loads more quickly. The compression removes some of the finer detail, but this is not usually noticeable.*

*JPG – used for high detail images*
Candidates should be able to:

GIF (pronounced JIF) which stands for Graphic Interchange Format, is a file format that is used for images. GIFs work best for images with large blocks of the same colour, which tend to be images that are hand drawn rather than captured with a camera. The images can also contain animation. GIFs are compressed in a way that does not lose any quality or detail.

GIF – used for cartoon style graphical images

Candidates should be able to:

m) describe common file standards associated with the internet such as JPG, GIF, PDF, MP3, MPEG

A Portable Document Format (pdf) file is a file format that is used to display documents on screen in exactly the same way as they will appear when printed. They are mainly used for text based documents which have some images in them.

PDF files can be compressed, and can use

PDF – used for text documents

Candidates should be able to:

m) describe common file standards associated with the internet such as JPG, GIF, PDF, MP3, MPEG

Music Player layer III or MP3 is a file format that is used for audio files. MP3s are heavily compressed using a lossy method. Most users will not notice a drop in sound quality, although some people have more sensitive hearing and claim to be able to tell that something is missing.

MP3 – used for audio (music), NOT VIDEO
Candidates should be able to:

m) describe common file standards associated with the internet such as JPG, GIF, PDF, MP3, MPEG

The Moving Picture Expert Group have created several file formats for storing movie files in a digital format. MPEGs are compressed using a lossy method.

MPEG – used for video, NOT AUDIO

Candidates should be able to:

p) describe syntax errors and logic errors which may occur while developing a program

Sometimes, a programmer may make a mistake in the actual design of their program.

An example of this might be if they want to print out all of the letters in the alphabet using a loop, but try to loop just 25 times. This is a logic error. Logic errors may not cause your program to display an error message, but it will not do what you expect it to. This is often known as a “bug”.

Candidates should be able to:

p) describe syntax errors and logic errors which may occur while developing a program

Examples of syntax errors include:

- Variables not declared before use
- Using an assignment incorrectly, for example $3 + 4 = x$ instead of $x = 3 + 4$
- Variable names incorrect, for example incorrect spelling or capitalisation.

(the last reason is why it is so important to use a system of naming variables i.e. camel case.)

Candidates should be able to:

p) describe syntax errors and logic errors which may occur while developing a program

When we program a computer, we have to make sure that we have spelt words correctly and punctuated the instructions in exactly the correct way.

If we don’t do this, the computer could misinterpret what we mean.

To prevent this happening, a syntax error will occur which will stop the program. This will need to be corrected before the program can be executed.
One Dimensional Arrays

o) use one-dimensional arrays.

When we are writing a program we often need to deal with a large amount of data. We could use lots of variables but this is difficult to manage.

A better way is to use an array, which is called a list in Python.

An array lets us access the different items of data using a number, which is referred to as the index.

<table>
<thead>
<tr>
<th>students</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td></td>
</tr>
<tr>
<td>Paul</td>
<td></td>
</tr>
<tr>
<td>Janet</td>
<td></td>
</tr>
<tr>
<td>Peter</td>
<td></td>
</tr>
</tbody>
</table>

This is students [1]
This is students [2]
This is students [3]
This is students [4]

Common Operations

n) perform common operations on numeric and Boolean data

We can also perform logical operations on numeric data.

Logical operations on numeric data will always give a Boolean answer. Logical operations on numeric data include:

- `< ` Less than
- `>` Greater than
- `<= ` Less than or equal to
- `>= ` Greater than or equal to
- `= ` Equal to
- `<> ` Not equal to

These will always give a true or false answer.

Common Operations

n) perform common operations on numeric and Boolean data

We can also perform logical operations of Boolean data.

Logical operations are:

- **AND** Both sides must be true to give a true answer.
- **OR** Either side can be true to give a true answer.
- **NOT** Reverses the answer, true becomes false and false becomes true

Common Operations

n) perform common operations on numeric and Boolean data

There are two other common operations that we can perform on numeric data.

They are:

- **DIV** Integer division – same as a normal divide, but forget the part of the answer after the decimal. These two operations can be performed on real and integer numbers but both give integer answers.
- **MOD** Modulo calculates the remainder, as a whole number.
Common Operations

n) perform common operations on numeric and Boolean data

We use four "common operations" on numeric data very frequently.
They are:

+ Plus – add them together
- Subtract – take one away from the other.
* Multiply – multiply one number by another.
/ Divide – divide one number by the other

These operations can be performed on real and integer numbers.
Division can only be performed on real numbers.

Data Types

l) describe the data types integer, real, Boolean, character and string

Each character or symbol is represented by a number.
If we use ASCII then this can be stored in a single byte, but we will need more space to store Unicode characters.
Each character variable can hold a single symbol or character.

Data Types

l) describe the data types integer, real, Boolean, character and string

Boolean data can only have two values!
It is either "True" or "False"
This is usually stored on a computer as 0 and 1.
Each Boolean variable can be stored in a single bit, which is very efficient.

A "string" is simply one or more characters stored one after the other.
It is used to store words, sentences and much longer collections of letters and symbols.
We can perform special functions on string variables such as make all the characters into capitals or create a sub-string.
**Data Types**

1) describe the data types integer, real, Boolean, character and string

In the "real" world, the numbers that we use are often not whole integer values. Can you think of an example? We can store these numbers in a "real" variable data type. The number is still converted into binary but we also need to store the position of the decimal point, which makes it more complicated.

**Variables and Constants**

j) define the terms variable and constant as used in an imperative language

A constant is an item of data that will not change as the program executes.
This might be values such as Pi which is fixed, or something that the program needs to keep the same. A constant also refers to data that is stored in the computers memory.

**Data Types**

1) describe the data types integer, real, Boolean, character and string

One of the simplest data types to understand is "integer" – find a meaning for this word and add it to your document. Integers are simply converted into binary and then stored in memory by splitting the binary number up into 8 bit sections.
You need to know that an integer is a whole number with no decimal part.

**Variables and Constants**

j) define the terms variable and constant as used in an imperative language

A variable is an item of data that may change as the program executes.
This may be someone's name, a control variable in a loop, or any item that the program needs to store. A variable refers to data that is stored in the computers memory.
Candidates should be able to:

i) understand and use iteration in an algorithm (FOR, WHILE and REPEAT loops).

**REPEAT**

```
    name = USERINPUT
    password = USERINPUT
UNTIL password = Correct
```

REPEAT... UNTIL loops are always executed at least once. The test is done at the end.

Candidates should be able to:

i) understand and use iteration in an algorithm (FOR, WHILE and REPEAT loops).

**WHILE Count < 10 DO**

```
    OUTPUT “Why are we waiting...”
    Count = Count + 1
END WHILE
```

This will "Test" that Count is less than 10

It isn't, so these two lines of code will be executed. It is important that whatever you are "testing" will be changed in this block, otherwise your loop will iterate forever.

Candidates should be able to:

i) understand and use iteration in an algorithm (FOR, WHILE and REPEAT loops).

**FOR Count = 1 TO 10 DO**

```
    OUTPUT “Hello”
    OUTPUT Count
END FOR
```

FOR statement

This block of code will repeat

This is the end of the "Block"

Candidates should be able to:

i) understand and use iteration in an algorithm (FOR, WHILE and REPEAT loops).

*Iteration simply means repeating a process.*

We can arrange our code in "Blocks" and use:

```
    FOR
    WHILE
    REPEAT
```

To repeat (or "iterate") through the blocks
Candidates should be able to:

h) understand and use selection in an algorithm (IF and CASE statements)

```plaintext
CASE MenuChoice OF
  1: OUTPUT “Menu Choice 1”  ...if its "1", this will happen.
  2: OUTPUT “Menu Choice 2”  ...if its "2", this will happen.
  3: OUTPUT “Menu Choice 3”  ...if its "3", this will happen.
END CASE
```

Candidates should be able to:

h) understand and use selection in an algorithm (IF and CASE statements)

```
For a program to be really useful, it should be able to react in a different way to different situations, for example "IF GreenLight THEN Go, ELSE Stop"

This is called "Selection"
```

There are two types of selection that we need to study...

---

g) understand and use sequence in an algorithm

```
"Sequence" simply means that one instruction is followed by another.
```

An algorithm usually has a series of small steps that are connected together and will be completed one after the other.

```
Each step will be completed by one or more lines of your program.
```
### Candidates should be able to

f) describe common tools and facilities available in an integrated development environment:

### Candidates should be able to

e) describe the characteristics of an assembler, a compiler and an interpreter:

<table>
<thead>
<tr>
<th>Compiler</th>
<th>Interpreter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Translates the whole program to produce the executable object code.</td>
<td>Translates and executes one line at a time.</td>
</tr>
<tr>
<td>The object code is the version that the computer runs.</td>
<td>The source code is the version that the computer runs.</td>
</tr>
<tr>
<td>Faster run time because the program is translated once, object code is run after that.</td>
<td>Slower run time because the program is translated every time that it is run.</td>
</tr>
<tr>
<td>Customers cannot see the actual code that you wrote when you distributed the program.</td>
<td>If you distributed source code with an interpreter then customers would have your actual code.</td>
</tr>
<tr>
<td>Used for distributed software.</td>
<td>Used in development.</td>
</tr>
</tbody>
</table>

### Candidates should be able to

d) explain the need for translators to convert high level code to machine code:

- Low Level (Machine Code)
- Mid Level (Assembler)
- High Level Languages (Python, JavaScript etc)

Computers run using instructions written and stored in Machine Code.

Humans can create programs using an assembler, and even directly in machine code, but it is very difficult and takes a lot of time.

### Candidates should be able to

c) explain the difference between high level code and machine code:

- **High level code is written in a way that human beings can easily understand. Programming languages are high level code.**
- **Machine code is the binary codes that the CPU decodes and executes when it runs the programs.**
- **A CPU cannot use a high level language, it needs to be converted into machine code before it can be executed.**
### Candidates should be able to

#### b) produce algorithms in pseudocode or flow diagrams to solve problems

<table>
<thead>
<tr>
<th>Loops</th>
<th>Repeating instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHILE counter &lt; 15</td>
<td>while counter &lt; 15:</td>
</tr>
<tr>
<td>OUTPUT counter</td>
<td>print(counter)</td>
</tr>
<tr>
<td>counter ← counter + 1</td>
<td>counter = counter + 1</td>
</tr>
<tr>
<td>FOR i ← 1 TO 5</td>
<td>for i in range(5):</td>
</tr>
<tr>
<td>OUTPUT i</td>
<td>print(i + 1)</td>
</tr>
<tr>
<td>ENDFOR</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditionals</th>
<th>Pseudocode</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF myVar &lt; 15 THEN</td>
<td>if myVar &lt; 15 then:</td>
</tr>
<tr>
<td></td>
<td>myVar ← myVar + 1</td>
</tr>
<tr>
<td>ELSE</td>
<td>else:</td>
</tr>
<tr>
<td>OUTPUT myVar</td>
<td>print(myVar)</td>
</tr>
<tr>
<td>ENDFOR</td>
<td></td>
</tr>
</tbody>
</table>

### Candidates should be able to

#### a) understand algorithms (written in pseudocode or flow diagram), explain what they do, and correct or complete them

- An algorithm is simply a plan of how you will do something.
- A programmer uses an algorithm to work out the best way of solving a problem.
- Algorithms can be written in several ways, we are going to look at "flowcharts" and "pseudocode"

### Candidates should be able to

#### q) select and justify test data for a program, stating the expected outcome of each test.

When we produce a testing plan, we should always check that the program works properly by supplying some test data.

Test data should be chosen from these three types:

- **Normal data** This is data that your program should deal with as intended.
- **Erroneous data** Erroneous data is data such as entering a text string instead of a number, or typing in a choice that doesn’t exist.
- **Extreme data** This is data that is right at the edge of what is acceptable, for example when a program asks for a shoe size between 3 and 11, the extremes are 3 and 11.

### Candidates should be able to

#### m) describe common file standards associated with the internet such as JPG, GIF, PDF, MP3, MPEG

<table>
<thead>
<tr>
<th>File Format</th>
<th>Description</th>
<th>Lossiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPG</td>
<td>Photographs</td>
<td>Lossy</td>
</tr>
<tr>
<td>GIF</td>
<td>Cartoon style graphics</td>
<td>Lossless</td>
</tr>
<tr>
<td>PDF</td>
<td>Text documents that may contain images</td>
<td>Can be either</td>
</tr>
<tr>
<td>MP3</td>
<td>Audio files</td>
<td>Lossy</td>
</tr>
<tr>
<td>MPEG</td>
<td>Movie files</td>
<td>Lossy</td>
</tr>
</tbody>
</table>
Candidates should be able to:

n) explain the importance of compressing files that are transmitted via the internet

Large files have more detail, but have problems:
- They take up more storage space
- They take longer to load on a web page
- They take longer to send as attachments

We can make files smaller by compressing them. Large files can be compressed by at least 10% and many files can be compressed by 20% or more.

Candidates should be able to:

o) describe the differences between lossy and lossless compression.

There are many different ways of compressing files. Some file formats, for example JPGs have compression built into the actual file format. Other file formats do not include any compression, but the files can be compressed using other tools such as ZIP.

Lossy compression is when the file is made smaller, but some of the detail is lost. Images and Audio can lose quite a lot of information without affecting their quality.

Lossless compression is when the file is made smaller without losing any information. Text files must use lossless compression so that the all the letters are included. Program files also need to use lossless because instructions will be missed if lossy compression is used.