GCSE

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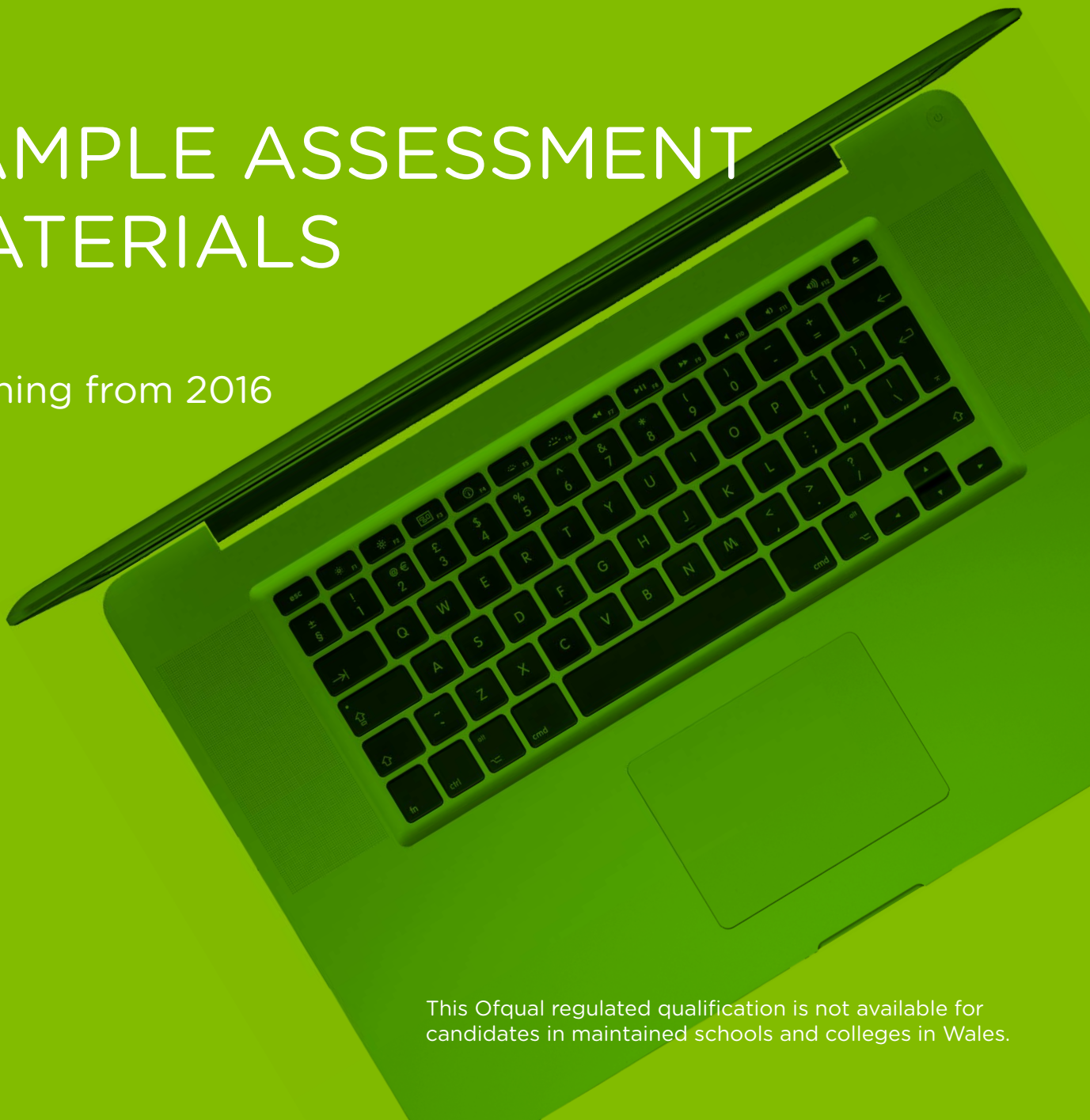
WJEC Eduqas GCSE in

COMPUTER SCIENCE

ACCREDITED BY OFQUAL

SAMPLE ASSESSMENT MATERIALS

Teaching from 2016



wjec cbac

This Ofqual regulated qualification is not available for candidates in maintained schools and colleges in Wales.

For teaching from 2016
For award from 2018

GCSE (9-1) COMPUTER SCIENCE

SAMPLE ASSESSMENT MATERIALS

Contents

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

COMPUTER SCIENCE

COMPONENT 1

Understanding Computer Science

SAMPLE ASSESSMENT MATERIALS

1 hour 45 minutes

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use pencil or gel pen. Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page. Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the continuation pages at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the need for good English and orderly, clear presentation in your answers.

The use of calculators is not permitted in this examination.

The total number of marks is 100.

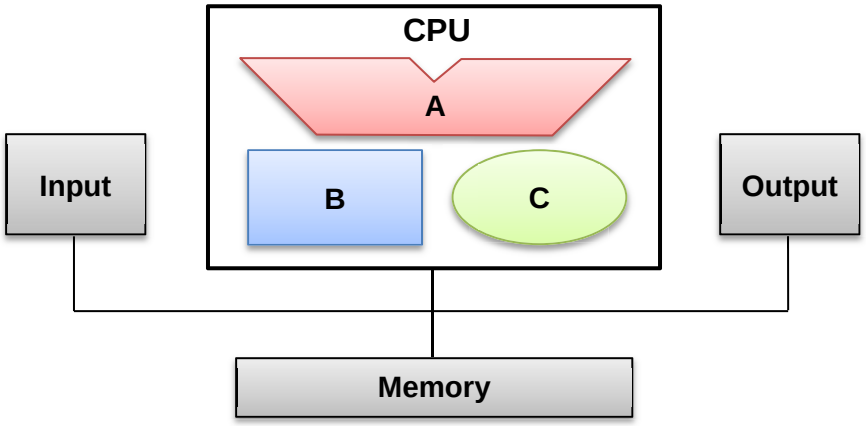
Questions 4, 8d(i) and 12b will require you to draw on your knowledge from multiple areas of your course of study.

1. High and low level languages are used by programmers.

Tick (✓) the correct boxes below to show whether the statements apply to a high or low level language. [3]

STATEMENT	HIGH LEVEL	LOW LEVEL
They are easier to understand, learn and program as commands are similar to natural language.	1	2
They require less time for translation into machine code.	3	4
They are preferred when the execution speed is critical.	5	6

2. Below is an incomplete diagram of a Von Neumann architecture computer, with a single core Central Processing Unit (CPU).



(a) Identify components A, B and C above. [3]

Component A: .....

Component B: .....

Component C: .....

(b) Cache size, clock speed and number of cores are the **three** main factors that affect performance. Describe how performance is affected by these **three** factors. [6]

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(c) Additional hardware components are used in most computer systems.

Describe the role of each of the following.

(i) Motherboard. [2]

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(ii) GPU. [2]

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3. Giving specific examples, describe **two** different types of programming errors. [6]

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4. A local independent retailer wishes to store the details of customers on a computer system. A partially complete data structure design is shown below.

Complete the table, suggesting:

- **Three** most suitable data types
- **Three different** methods of validation. [6]

Field name	Data type	Example data	Validation check
Customer ID		2	
First Name	String	John	Presence check
Surname	String	Smith	Presence check
Gender		M	Presence check
Date of birth	Date	23/04/1967	
Address	String	123 Park Avenue	Presence check
Post code	String	CF12 3DT	
Telephone number		029 2026 5137	Length check

5. Cyber security is essential in the protection against different types of malware.

(a) Describe **two** methods of protection against the use of key loggers. [4]

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(b) Describe **two** characteristics of a worm. [2]

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6. (a) Showing your workings, complete the table below, converting between denary, binary and hexadecimal numbers as necessary. [6]

Denary	Binary	Hexadecimal
27_{10}	00011011_2	$1B_{16}$
	10100110_2	$A6_{16}$
39_{10}		27_{16}
44_{10}	00101100_2	

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(b) (i) Showing your workings, add 01000101_2 and 00110011_2. [2]

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(ii) Using an example of binary addition, explain the concept of overflow. [4]

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(c) Perform arithmetic shifts on the numbers below and state the effect of each of these operations.

(i) Arithmetic shift left by one place on 00101010_2. [2]

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(ii) Arithmetic shift right by one place on 00110110_2. [2]

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7. Three resources managed by an operating system are input devices, the hard disc and Random Access Memory (RAM).

Describe the role of the operating system when managing **each** of these resources. [3]

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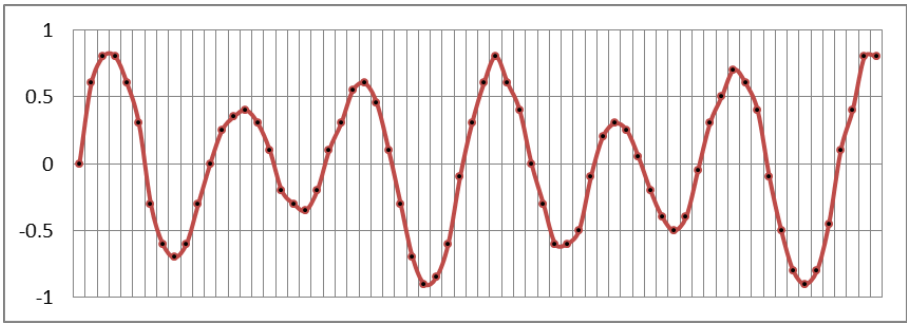
8. Sound sampling is used in the digital storage of sound.



(a) Explain the process of sound sampling. [3]

(b) Describe how sound samples are stored. [2]

(c) Give **two** examples of metadata stored in sound files. [2]

(d) A lossy algorithm is used to compress a sound file whose original file size was 960 KB.

(i) Describe how a lossy algorithm would compress the sound file. [2]

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(ii) Following compression, the sound file size is reduced to 80 KB. Calculate the compression ratio. [2]

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9. TCP/IP is a protocol used for communication between computers when transmitting data over networks.

(a) Complete the diagram below, which shows the typical contents of a TCP/IP packet. [3]

<table>
<tr><td>The source address</td><td>……..……</td></tr>
<tr><td colspan="2">……..……</td></tr>
<tr><td colspan="2">Other tracking information</td></tr>
<tr><td>The data itself</td><td>……..……..</td></tr>
</table>

(b) Describe the function of each layer in the TCP/IP 5-layer model. [5]

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10. (a) (i) Complete the following truth table. [4]

$\boldsymbol{A}$	$\boldsymbol{B}$	$\boldsymbol{A.B}$	$\boldsymbol{\overline{A.B}}$	$\boldsymbol{\overline{B}}$	$\boldsymbol{\overline{A.B}+\overline{B}}$
1	1				
1	0				
0	1				
0	0				

(ii) Use this truth table to simplify the expression. [1]

$$\overline{A.B}+\overline{B}$$

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(b) (i) Using the following identities:

$\boldsymbol{P.1=P}$

$\boldsymbol{P.Q+P.R=P.(Q+R)}$

$\boldsymbol{P+\overline{P}=1}$

simplify the Boolean expression: [3]

$$X=A.B+A.\overline{B}$$

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(ii) Draw a truth table for the expression: [4]

$$X = A.B + A.\overline{B}$$

11. Domain names are used because IP addresses are difficult to remember. Explain how a domain name is used to access a web site including the role of Domain Name System (DNS) servers. [6]

12. A large organisation stores confidential data about its customers on its network.

(a) The Data Protection Act (DPA) applies to the data stored by the organisation.

Identify **two** principles of the DPA that such an organisation would breach if an unauthorised person incorrectly amended customer data. [2]

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(b) You have been given the role of security consultant for the organisation. The organisation has adequate physical security methods in place.

Explain methods of security that you would employ to protect customer data held by the organisation. [8]

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END OF PAPER

COMPONENT 1 - UNDERSTANDING COMPUTER SCIENCE

MARK SCHEME

Guidance for examiners

Positive marking

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

For band marked questions mark schemes are in two parts.

Part 1 is advice on the indicative content that suggests the range of computer science concepts, theory, issues and arguments which may be included in the learner's answers. These can be used to assess the quality of the learner's response.

Part 2 is an assessment grid advising bands and associated marks that should be given to responses which demonstrate the qualities needed in AO1, AO2 and AO3. Where a response is not credit worthy or not attempted it is indicated on the grid as mark band zero.

Banded mark schemes

Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks.

Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. Once the annotation is complete, the mark scheme can be applied.

This is done as a two stage process.

Stage 1 – Deciding on the band

When deciding on a band, the answer should be viewed holistically. Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content. Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Indicative content is also provided for banded mark schemes. Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

Q	Answer	Marks	AO1	AO2	AO3	Total
1	• They are easier to understand, learn and program as commands are more similar to natural language - High Level (box 1) • They require less time for translation into machine code - Low Level (box 4) • They are preferred when the execution speed is critical - Low Level (box 6)	 1 1 1	 1.1b 1.1b 1.1b			3
2a	Component A: Arithmetic Logic Unit (*Accept* ALU) Component B: Register Component C: Control unit	1 1 1	1.1a 1.1a 1.1a			3
2b	Cache size • More cache memory improves the performance as it can provide instructions and data to the CPU at a much faster rate than other system memory such as RAM. • More cache memory will allow more instructions that are repeatedly used by a CPU to be stored, and therefore increase the hit rate; increasing performance as a result. Clock speed • The faster the clock speed, the faster the computer is able to run the fetch-decode-execute cycle and therefore process more instructions. • The faster the clock speed, the more power is generally required which creates greater requirements for heat dissipation and can place more strain on battery life. Number of cores • In a single-core CPU each instruction is processed one after the other, whereas in a dual-core CPU, two instructions may be processed at the same time. In theory, dual-core CPU should mean that the computer can process instructions twice as fast as a single-core CPU. • Performance may be affected where one core is waiting on the result of another and therefore cannot carry out any more instructions, leading to the performance being no better than a single core processor. *Accept other answers that compare different numbers of cores*	 1 1 1 1 1 1	 1.1b 1.1b 1.1b 1.1b 1.1b 1.1b			6
2ci	• A motherboard provides connections between many of the components used by computer systems, • such as the CPU, memory, hard disc interface, expansion slots and other peripherals.	1 1	1.1b 1.1b			2
2cii	• GPUs are specialised electronic circuits designed to rapidly manipulate and alter memory • GPUs efficiently manipulate computer graphics and carry out image processing.	1 1	1.1b 1.1b			2

Q	Answer	Marks	AO1	AO2	AO3	Total

3	2 marks for each description x 2
	1 mark for each example x 2
	
	<u>Logical error</u>
	• Description: A logical error is a mistake in the program (1) instructing the program to do the wrong thing so the program works but produces the wrong output (1)
	• Example: GrossPrice = NetPrice – VAT instead of GrossPrice = NetPrice + VAT
	
	Note: example must show both correct and incorrect code
	
	<u>Syntax error</u>
	• Description: A syntax error is a mistake in the rules or grammar of the program (1) so the program cannot be converted into an executable form (1)
	• Example: MsgBos in VB should be MsgBox / Print in Python should be print
	
	Note: many examples exist but answer must clearly show correct and incorrect code
	
	<u>Execution error</u>
	• Description: An execution error is when the program unexpectedly stops (1) as a result of an operation during execution (1)
	• Example: Attempt to read past the end of file / attempt dividing by zero
	
	<u>Rounding error</u>
	• Description: A rounding error is when the program rounds a real number to a fixed number of decimal places (1) resulting in losing some information as the number becomes less accurate (1)
	• Example: 3.125 rounding to 3.13
	
	<u>Truncation error</u>
	• Description: A truncation error is when the program truncates a real number to a fixed number of decimal places (1) resulting in losing some information as the number becomes less accurate (1)
	• Example: 3.125 truncating to 3.12
	
	<u>Linking error</u>
	• Description: A linking error occurs when a compiler can't find the sub procedure (1) as the programmer might have declared it incorrectly / did not instruct the compiler to include the sub program (library) in the code. (1)
	• Example: `math.sqrt(4)` when the math library has not been included in the code
	or
	`declare FindLargst()`
	`Call FindLargest()`
	
	Accept other suitable examples of programming errors
		4
		2
			1b
			1b
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<table>
<tr><th>Q</th><th>Answer</th><th>Marks</th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th></tr>
<tr><td>4</td><td>1 mark for each correct data type x 3
1 mark for each suitable <u>different</u> validation check x 3

<table>
<tr><th>Field name</th><th>Data type</th><th>Example data</th><th>Validation check</th></tr>
<tr><td>Customer ID</td><td>Integer</td><td>2</td><td>Type check</td></tr>
<tr><td>First Name</td><td>String</td><td>John</td><td>Presence check</td></tr>
<tr><td>Surname</td><td>String</td><td>Smith</td><td>Presence check</td></tr>
<tr><td>Gender</td><td>Character</td><td>M</td><td>Presence check</td></tr>
<tr><td>Date of birth</td><td>Date</td><td>23/04/1967</td><td>Range check</td></tr>
<tr><td>Address</td><td>String</td><td>123 Park Avenue</td><td>Presence check</td></tr>
<tr><td>Post code</td><td>String</td><td>CF12 3DT</td><td>Format check</td></tr>
<tr><td>Telephone number</td><td>String</td><td>029 2026 5137</td><td>Length check</td></tr>
</table>
Alternative approach:

<table>
<tr><th>Field name</th><th>Data type</th><th>Example data</th><th>Validation check</th></tr>
<tr><td>Customer ID</td><td>Integer</td><td>2</td><td>Range check</td></tr>
<tr><td>First Name</td><td>String</td><td>John</td><td>Presence check</td></tr>
<tr><td>Surname</td><td>String</td><td>Smith</td><td>Presence check</td></tr>
<tr><td>Gender</td><td>Character</td><td>M</td><td>Presence check</td></tr>
<tr><td>Date of birth</td><td>Date</td><td>23/04/1967</td><td>Format check</td></tr>
<tr><td>Address</td><td>String</td><td>123 Park Avenue</td><td>Presence check</td></tr>
<tr><td>Post code</td><td>String</td><td>CF12 3DT</td><td>Type check</td></tr>
<tr><td>Telephone number</td><td>String</td><td>029 2026 5137</td><td>Length check</td></tr>
</table>
</td><td>3
3</td><td></td><td>2.1a
2.1b</td><td></td><td>6</td></tr>
<tr><td>5a</td><td>• Prevent physical access to the keyboard input port, e.g. USB or PS2 (1), to eliminate the risk of pass through connectors, which captures the key presses (1).
• Prevent the installation of device drivers or other low level software (kernel hacks) (1) which records input via the keyboard to a file (1).</td><td>2

2</td><td>1.1b

1.1b</td><td></td><td></td><td>4</td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Marks</th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th></tr>
<tr><td>5b</td><td>Any two of:
• A worm will often target existing open ports that are not sufficiently secured
• A computer program that copies itself to other computers across a network
• Unlike a computer virus, it does not need to attach itself to an existing program
• Worms often infect computers by exploiting bugs / security failures in legitimate software.</td><td>2</td><td>1.1b</td><td></td><td></td><td>2</td></tr>
<tr><td>6a</td><td>1 mark for correct workings x 3 (All valid methods accepted)
1 mark for correct conversion x 3
<table><tr><th>Denary</th><th>Binary</th><th>Hexadecimal</th></tr><tr><td>27_{10}</td><td>00011011_2</td><td>$1B_{16}$</td></tr><tr><td>166_{10}</td><td>10100110_2</td><td>$A6_{16}$</td></tr><tr><td>39_{10}</td><td>00100111_2</td><td>27_{16}</td></tr><tr><td>44_{10}</td><td>00101100_2</td><td>$2C_{16}$</td></tr></table></td><td>3
3</td><td></td><td>2.1a
2.1a</td><td></td><td>6</td></tr>
<tr><td>6bi</td><td>1 mark for correct workings
1 mark for correct answer

01000101
00110011
Answer 01111000
Carry 0000111</td><td>1
1</td><td></td><td>2.1a
2.1a</td><td></td><td>2</td></tr>
<tr><td>6bii</td><td>1 mark for each:
• Choose two suitable binary numbers which, when added, will cause overflow
• Correct addition of the two chosen binary numbers

Worked example:

11000101
10110011
Answer 01111000
Carry <u>1</u>00001110

• Identifying that a carry on the MSB has occurred
• CPU detects that a carry has occurred and sets the overflow flag to true.</td><td>1

1

1
1</td><td></td><td>2.1a

2.1a

2.1b
2.1b</td><td></td><td>4</td></tr>
<tr><td>6ci</td><td>01010100_2
The effect is to multiply the number by 2.</td><td>1
1</td><td></td><td>2.1a
2.1b</td><td></td><td>2</td></tr>
<tr><td>6cii</td><td>00011011_2
The effect is to divide the number by 2.</td><td>1
1</td><td></td><td>2.1a
2.1b</td><td></td><td>2</td></tr>
</table>

7	• The OS manages input devices by communicating with and receiving data input from a keyboard, mouse or other valid input device. • The OS manages the hard disc by ensuring that files and data can be stored and retrieved correctly by maintaining a filing system such as FAT or NTFS. • The OS manages RAM by ensuring that programs or data do not corrupt each other and stored in correct memory locations.	1 1 1	1.1b 1.1b 1.1b			3
8a	• Sampling is a method of converting an analogue sound signal into a digital file. • At specific intervals (frequency) a measurement of the amplitude (bit depth) of the signal is taken. • The higher the sampling rate / bit depth the better the quality of the sound file	1 1 1	1.1b 1.1b 1.1b			3

Q	Answer	Marks	AO1	AO2	AO3	Total
8b	• The amplitude of each sound sample is converted into the equivalent binary number. • The whole collection of data (binary numbers) is then stored in a digital file.	1 1	1.1b 1.1b			2
8c	Any **two** of: • Artist • Title / Track Title • Product / Album Title • Track Number • Date Created / Year • Genre • Comments • Copyright • Software • Type • Duration • File size • Bit rate • Sampling rate • Channels • Volume	 1 1	 1.1a 1.1a			2
8di	• Sound files are compressed using a lossy algorithm by analysing the waveform and removing sound that cannot be heard by people. • To increase the compression, lossy algorithms remove more data which reduces the quality of the sound file (lowers fidelity)	1 1		2.1b 2.1b		2
8dii	$\boldsymbol{Compression\ ratio = \frac{Original\ file\ size}{Compressed\ file\ size}}$ $\boldsymbol{Compression\ ratio = \frac{960\ KB}{80\ KB}}$ $\boldsymbol{Compression\ ratio = \frac{12\ KB}{1\ KB} = 12 : 1}$	 1 1		 2.1a 2.1a		2
9a	• The destination address • Reassembly data / packet order number • Error checking data / checksum	1 1 1	1.1a 1.1a 1.1a			3

9b	**Process and application layer:** Provides applications services to users and programs.	1	1.1a			5
	Transport layer: Handles data-consistency functions, i.e. provides a reliable byte stream between two nodes on a network.	1	1.1a			
	Internet layer: Provides network addressing and routing.	1	1.1a			
	Data link layer: Prepares and corrects data to be passed to the physical layer.	1	1.1a			
	Physical: Transfers bits over a physical link.	1	1.1a			

<table>
<tr><th>Q</th><th>Answer</th><th>Marks</th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th></tr>
<tr><td>10ai</td><td>
<table>
<tr><th>A</th><th>B</th><th>$A.B$</th><th>$\overline{A.B}$</th><th>$\overline{B}$</th><th>$\overline{A.B} + \overline{B}$</th></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
</table>
Marking
• $A.B$ correct
• $\overline{A.B}$ correct
• $\overline{B}$ correct
• $\overline{A.B} + \overline{B}$ correct
</td><td>1
1
1
1</td><td></td><td>2.1b
2.1b
2.1b
2.1b</td><td></td><td>4</td></tr>
<tr><td>10aii</td><td>$\overline{A.B}$</td><td>1</td><td></td><td>2.1b</td><td></td><td>1</td></tr>
<tr><td>10bi</td><td>$X = A.B + A.\overline{B}$
$X = A.(B + \overline{B})$
$X = A.(1)$
$X = A$</td><td>1
1
1</td><td></td><td>2.1b
2.1b
2.1b</td><td></td><td>3</td></tr>
<tr><td>10bii</td><td>
<table>
<tr><th>A</th><th>B</th><th>$A.B$</th><th>$\overline{B}$</th><th>$A.\overline{B}$</th><th>$A.B + A.\overline{B}$</th></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
</table>
Mark by row as table could contain more or less columns and be correct.
</td><td>1
1
1
1</td><td></td><td>2.1b
2.1b
2.1b
2.1b</td><td></td><td>4</td></tr>
</table>

<table>
<tr><th>Q</th><th>Answer</th><th>Marks</th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th></tr>
<tr><td>11</td><td>Indicative content
• A DNS server will contain a list of domain names
• A DNS server will contain a list of corresponding IP addresses
• A web site address is typed into the address bar of a browser
• The browser checks the local (cached) host file to check if it already holds the IP address
• The local (your domain) DNS server is queried for the IP address
• If the local DNS server does not hold the IP address then the query is passed to another DNS server at a higher level until the IP address is resolved
• The address is passed on to DNS severs lower in the hierarchy
• When the full address has been resolved, the IP address is then passed to your browser
• The browser then connects to the IP address of the server and downloads the web site.

<table>
<tr><th>Band</th><th>AO1.1b
(Max 6 marks)</th></tr>
<tr><td>2</td><td>4 - 6 marks
The candidate has:
• shown clear understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides four to six relevant detailed points from the indicative content
• addressed the question appropriately explaining how a domain name is used to access a web site including the role of Domain Name System (DNS) servers with minimal repetition and no irrelevant material
• used appropriate technical terminology referring to the indicative content accurately.</td></tr>
<tr><td>1</td><td>1 - 3 marks
The candidate has:
• attempted to address the question and has demonstrated some knowledge of the topic specified in the indicative content. Some knowledge is defined as a response that provides one to three relevant points from the indicative content
• addressed the question explaining how a domain name is used to access a web site including the role of Domain Name System (DNS) servers
• used limited technical terminology referring to the indicative content.</td></tr>
<tr><td>0</td><td>0 marks
Response not credit worthy or not attempted.</td></tr>
</table>
</td><td>6</td><td>1.1b</td><td></td><td></td><td>6</td></tr>
</table>

Q	Answer	Marks	AO1	AO2	AO3	Total
12a	• The Data Protection Act makes it a legal obligation for organisations to hold its data securely. • The Data Protection Act makes it a legal obligation for organisations to ensure that the data held is accurate and up to date.	1 1		2.1b		2
12b	Indicative content • Unique username and a strong secure password - the organisation limits access to the network by ensuring that all authorised users have unique username and a strong secure password. • Access rights - access to confidential files on the network is limited to authorised users only by assigning access rights to users that only allow certain users to access specified area of the network and/or specified files. • Encryption - hackers are prevented from reading the confidential files even they gain access to it by encrypting the files • Encryption – an encryption key is used and known only by the organisation • Firewall - the servers would be protected with firewall software blocking / checking all network traffic entering or leaving specified ports / stop programs accessing the internet • Antivirus software - file servers would be protected with antivirus software which regularly scans all files stored on them for possible infection by malware • Antivirus software - email server would be protected with antivirus software and all incoming emails would be scanned to see if attached files are infected • Antivirus software - workstations would be protected with antivirus software and all files from external media would be scanned before they're allowed to be accessed • Accounting or auditing software – all files accessed by a user are recorded in an activity log	8		2.1b		8

<table>
<tr><th>Q</th><th>Answer</th><th>Marks</th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th></tr>
<tr><td></td><td>
<table>
<tr><th>Band</th><th>AO2.1b
(Max 8 marks)</th></tr>
<tr><td>3</td><td>6 - 8 marks
The candidate has:
• shown clear understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides six to eight relevant detailed points from the indicative content
• addressed the question appropriately describing methods that the organisation can use to protect its data.
• used appropriate technical terminology referring to the indicative content accurately.</td></tr>
<tr><td>2</td><td>4 - 5 marks
The candidate has:
• shown adequate understanding of the requirements of the question and a satisfactory knowledge of the indicative content. Satisfactory knowledge is defined as a response that provides four to five points from the indicative content.
• addressed the question describing methods that the organisation can use to protect its data.
• used appropriate technical terminology referring to the indicative content.</td></tr>
<tr><td>1</td><td>1 - 3 marks
The candidate has:
• attempted to address the question but has demonstrated superficial knowledge of the indicative content. Superficial knowledge is defined as a response that provides one to three points from the indicative content.
• used limited technical terminology referring to the indicative content</td></tr>
<tr><td>0</td><td>0 marks
Response not credit worthy or not attempted.</td></tr>
</table>
</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">TOTAL</td><td>100</td><td>52</td><td>48</td><td>0</td><td>100</td></tr>
</table>

Candidate Name	Centre Number					Candidate Number				
						0				

GCSE

COMPUTER SCIENCE

COMPONENT 2

Computational Thinking and Programming

SAMPLE ASSESSMENT MATERIALS

2 Hours

ADDITIONAL MATERIALS

You will require the electronic answer booklet for this examination and files for question 8, all of which should be pre-installed on your examination account.

Your computer should be pre-installed with text editing software, a word processing package and a functional copy of a familiar version of the Greenfoot IDE.

INSTRUCTIONS TO CANDIDATES

You will need to enter your answers to questions 1, 3, 4, 5, 6 and 7 within the electronic answer booklet provided.

You will need to create a new plain text file to answer question 2.

You will complete the work for question 8 within the Greenfoot IDE.

Carry out all tasks and make sure that you check your work carefully to ensure that the work you produce is accurate and correct.

Save your work regularly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the need for good English and orderly, clear presentation in your answers.

The total number of marks available for this examination is 60.

Questions 5, 6 and 8 will require you to draw on your knowledge from multiple areas of your course of study.

1. State the HTML tags needed for each of the following: [3]

(a) To start a new paragraph.

(b) To embed an image.

(c) To create an anchor for a hyperlink.

Enter your answers in the electronic answer document.

2. A first attempt at producing an HTML web page to advertise a fitness tracking wristband is shown below. [10]

My Fitness Tracker
Fitness tracking wearable technology!

Do you need to monitor:
your heart rate
your running speed
total calories burned

All of the above in a sturdy, sporty, and comfortable design. Displays time, steps, and other stats on your wristband. Wirelessly syncs with your mobile device using Bluetooth to upload to our tracking website!

Click the link below to find out more:

www.myfitnesstracker.co.uk

The web page was then improved using various HTML tags to provide the formatting and content shown below.

Copy the text from the electronic answer document into a basic text editor.
Insert the HTML tags that would be needed to display the content and formatting shown in the improved web page above.

Save your new web page as myfitnesstrackerFinal.txt

3. (a) Describe the difference between local and global variables. [2]

(b) Explain why it is better practice to use local variables. [3]

Enter your answers in the electronic answer document.

4. Below is an algorithm:

```
1   total is integer
2   set total = 0
3   Declare Subroutine CountUp
4    counter is integer
5    set counter = 0
6    output "Before the loop"
7    repeat
8     set counter = counter + 1
9     set total = total + counter
10    output "Count is:" counter
11   until counter = 3      {Note loop has ended here}
12   output "Total is:" total
13   output "Algorithm is finished"
14  End subroutine
```

Give all of the outputs of the algorithm. [6]

Enter your answers in the electronic answer document.

5. Below is an incomplete algorithm which is intended to check the username and password entered by a user.

```
1   Declare Subroutine LoginScreen
2   username is string
3   password is string
4   counter is integer
5   flag is boolean
6   set flag = false
7   set counter = 0
8   repeat
9    output "Type in username"
10   ……
11   ……
12   input password
13   ……
14    output "Username and password correct"
15    set flag = true
16   else
17    output "Username or password incorrect"
18   end if
19   ……
20  until counter = 3
21  End Subroutine
```

Lines 10, 11, 13 and 19 are missing from the algorithm above. Using four of the lines of code below, complete this algorithm in the electronic answer document. [4]

- `else is true`
- `if username = "User1" AND password = "Pass1" then`
- `input username`
- `input flag`
- `set counter = counter + 1`
- `if username = "User1" OR password = "Pass1" then`
- `output "Type in password"`

6. An athlete records the amount of time taken (in seconds) to run one lap around a 400m training track.

An algorithm is required to calculate the total, average, slowest and fastest value of a set of lap times.

The algorithm needs to:

- input the number of laps completed
- input the time in seconds for each lap
- output the total of all the lap times
- output the average lap time
- output the slowest lap time
- output the fastest lap time

An example of the **input** and output of the algorithm is shown below.

Please enter the number of laps completed: ***3***

Enter time in seconds: ***57***

Enter time in seconds: ***53***

Enter time in seconds: ***58***

Total: 168

Average: 56

Slowest: 58

Fastest: 53

Write the required algorithm in the electronic answer document. [9]

7. Using your knowledge of how a bubble sort operates and of how a merge sort operates, demonstrate how the following data would be sorted using both methods, clearly describing each step:

7	4	8	1

Enter your answer in the electronic answer document. [8]

8. Open the Greenfoot world WJECTrain8 and familiarise yourself with its contents.

[15]

(a) Populate the world with an **athlete**, at least two **water traps** and at least two **gates**.

(b) Edit the **gates** and **water traps** so that they turn and move randomly.

(c) Edit the program code to make the **athlete** move at an appropriate speed in the direction of the arrow keys when pressed.

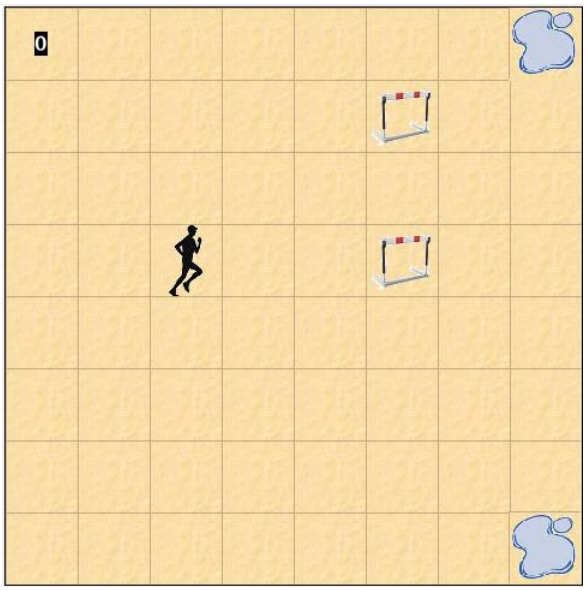
(d) Edit the **athlete** so that it "jumps" a **gate** when they collide (removes the **gate** from the world).

(e) Add a sound which will play every time the **athlete** "jumps" a **gate**.

(f) Add a **counter** and edit the code so that the **counter** displays how many **gates** have been "jumped".

(g) Edit the code so that the **counter** loses a point (1 point is deducted) if the **athlete** collides with a **water trap**.

(h) Save your completed world as FinalTrain8



COMPONENT 2 - COMPUTATIONAL THINKING AND PROGRAMMING

MARK SCHEME

Guidance for examiners

Positive marking

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

For band marked questions mark schemes are in two parts.

Part 1 is advice on the indicative content that suggests the range of computer science concepts, theory, issues and arguments which may be included in the learner's answers. These can be used to assess the quality of the learner's response.

Part 2 is an assessment grid advising bands and associated marks that should be given to responses which demonstrate the qualities needed in AO1, AO2 and AO3. Where a response is not credit worthy or not attempted it is indicated on the grid as mark band zero.

Banded mark schemes

Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks.

Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. Once the annotation is complete, the mark scheme can be applied.

This is done as a two stage process.

Stage 1 – Deciding on the band

When deciding on a band, the answer should be viewed holistically. Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content. Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

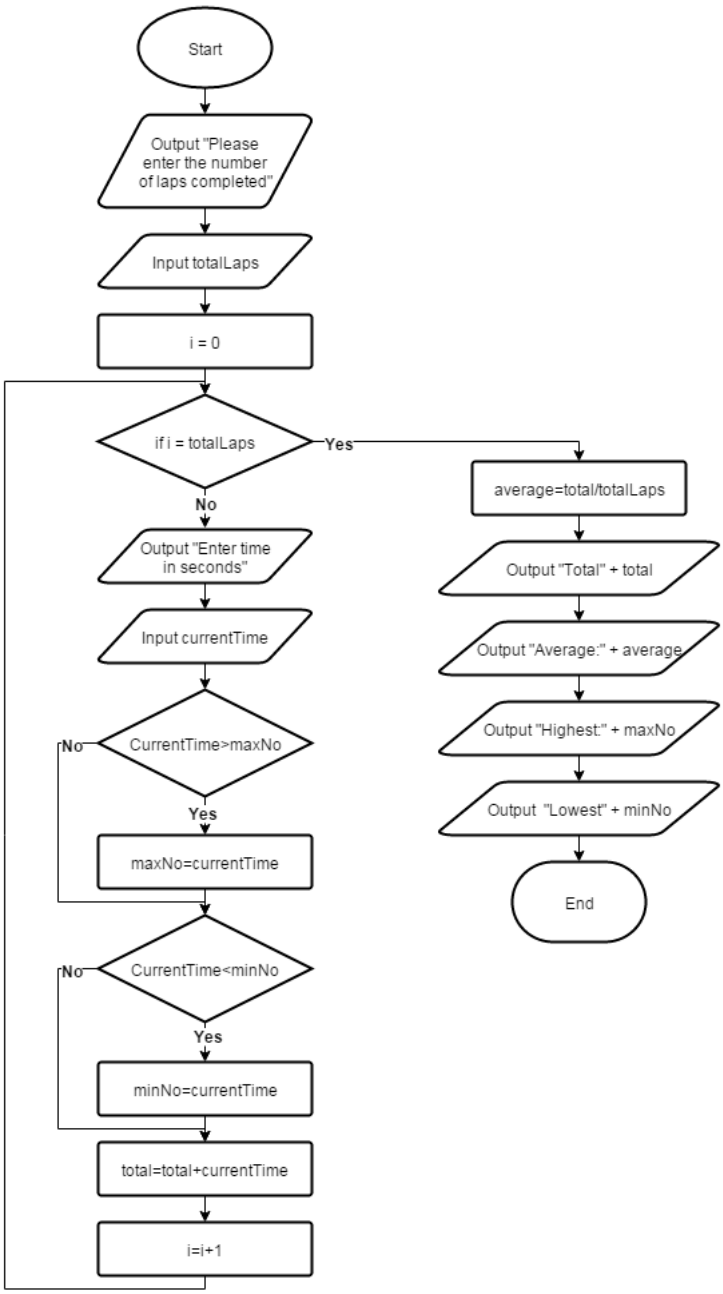
Indicative content is also provided for banded mark schemes. Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

Q	Answer	Mark	AO1	AO2	AO3	Total
1. (a) (b) (c)	<p> <img src= alt=> (Accept <img>) . . . 	1 1 1	1.1a			3
2.	**1 mark for each correct <u>pair</u> in the correct location: i.e.** **<h1> </h1>** **<center> </center>** ** ** **Accept either <p> or <p> </p> (No need to close p)** ** (Note http:// is required or the link will not work correctly on many devices)** **Accept alternative tags e.g. <big></big> instead of <h1></h1>, etc** **Accept alternative HTML (not CSS) solutions which work (only if the identical formatting would be achieved).** <html> <head> <title> My Fitness Tracker Homepage </title> </head> <body> <center> <h1> My Fitness Tracker. </h1> <p> <i> Fitness tracking wearable technology! </i> </p> </center> <p>Do you need to monitor: - your heart rate - your running speed - total calories burned </p>	1 1 1 1 1(center) 1 (h1) 1 (need b i) 1 (need ul and li)		2.1a		10

Q	Answer	Mark	AO1	AO2	AO3	Total
	All of the above in a sturdy, sporty, and comfortable design. Displays time, steps, and other stats on your wristband. Wirelessly syncs with your mobile device using Bluetooth to upload to our tracking website! Click the link below to find out more: www.myfitnesstracker.co.uk </body> </html>	 1 (a href) 1 (http://)				
3.(a)	Local variables are declared and used(accessible) within limited parts of a program, such as a subroutine, function or method. Whereas Global variables are used(accessible) throughout the entire program.	 1 1	1.1b			2
3.(b)	It is better practice to use local variables whenever a variable is not needed throughout the entire program as it uses memory only when needed (OR: global variables use memory whenever the program is loaded whether the variable is needed or not) It is harder to debug errors involving global variables as global variables are liable to be changed within any subroutine, even if this was not initially planned. Subroutines are easier to use in other programs (improved reusability)	 1 1 1	1.1b			3
4.	 Before the loop Count is:1 Count is:2 Count is:3 Total is:6 Algorithm is finished	 1 1 1 1 1 1		2.1b		6
5.	 1 Declare Subroutine LoginScreen			2.1b		4

Q	Answer	Mark	AO1	AO2	AO3	Total
	2 username is string 3 password is string 4 counter is integer 5 flag is boolean 6 set flag = false 7 set counter = 0 8 repeat 9 output "Type in username" 10 **input username** 11 **output "Type in password"** 12 input password 13 **if username = "User1" AND password = "Pass1" then** 14 output "Username and password correct" 15 set flag = true 16 else 17 output "Username or password incorrect" 18 end if 19 **set counter = counter + 1** 20 until counter = 3 21 End Subroutine	 1 1 1 1				
6.	**Brackets+Bold text indicate other accepted Pseudocode.** **Accept i,j,k for loops; accept any other meaningful variable name.** **Amendments to check for zero entered or divide by zero error (and any further validation) accepted not expected.** **Line numbers not necessary. Ignore indentation or lack of it.** **Accept alternative solutions as long as they provide exactly the same result.** Example: Declare totalLaps=0 Declare currentTime=0 Declare maxNo =0 Declare minNo=999 **(or any large number)** Declare total=0 Declare average as real=0 output "Please enter the number of laps completed:" input totalLaps Repeat **(for i = 1 to totalLaps)** output "Enter time in seconds:" input currentTime				3.2b	9

Q	Answer	Mark	AO1	AO2	AO3	Total
	if currentTime >maxNo then maxNo= currentTime endif if currentTime <minNo then minNo= currentTime endif total=total+ currentTime Until totalLaps loops **(next for)** average=total/totalLaps output "Total:" output total output "Average:" output average output "Highest:" output maxNo output "Lowest:" output minNo End **Marks:** Output Text Input value Repeat (concept of loop) Selection (comparison using if) Correctly adding (total=total+ currentTime) Correctly calculating average (average=total/totalLaps) Output a variable The solution provides up to three correct numerical outputs The solution provides all correct numerical outputs	1 1 1 1 1 1 1 1 1				

Q	Answer	Mark	AO1	AO2	AO3	Total
	Alternative flowchart example:  					

7.	**Marking for Bubble sort:**					8
	Correctly swapping items if list items are out of order.	1		2.2b		
	Correctly not swapping items if list items are in order.	1		2.2b		
	Performing additional passes through the data if any swaps were performed.	1		2.2b		
	Stating that when no swaps are performed the data is in order and the algorithm has ended.	1		2.2b		
	Worked example of bubble sort: 7 | 4 | 8 | 1 The first two items are compared and as they are out of order they are swapped. 4 | 7 | 8 | 1 The second and third items are compared and no swap is needed. 4 | 7 | 8 | 1 The third and fourth items are compared and swapped. 4 | 7 | 1 | 8 The algorithm is repeated as there were swaps performed. 4 | 7 | 1 | 8 The first and second items are compared and no swap is needed. 4 | 7 | 1 | 8 The second and third items are compared and a swap is needed. 4 | 1 | 7 | 8 The process repeats as there were swaps performed. 4 | 1 | 7 | 8 The first and second items are compared and swapped. 1 | 4 | 7 | 8					

	Another pass through the list would result in no swaps being made meaning the data is sorted resulting in the algorithm ending 1 | 4 | 7 | 8 **<u>Marking for Merge sort:</u>** Dividing the list into the smallest units - 1 item. (Applying the concept of divide and conquer.) Comparing each element with the adjacent list and correctly sorting. Correctly merging the adjacent lists. Stating that when the lists are all merged the data is in order as required and the algorithm has ended. **<u>Worked example of merge sort:</u>** 7 | 4 | 8 | 1 The list is divided into the smallest elements. 7 | 4 8 | 1 7 4 8 1 The first and second item are compared and placed in the correct order**.** The two adjacent elements are merged. 4 | 7 8 1 The third and fourth items are compared, placed in the correct order and merged. 4 | 7 1 | 8 The process continues by sorting (comparing) and merging the remaining two adjacent lists. 1 | 4 | 7 | 8 When the last elements are merged together the data will have been sorted and the algorithm has ended. 1 | 4 | 7 | 8	1 1 1 1		2.2b 2.2b 2.2b 2.2b		

8.	1 mark per bullet point below:				3.2b	15
(a)	World is pre-populated on load with: • one athlete • two or more gates • two or more water traps.	 1 1 1				
(b)	• water trap moves randomly around world. • gate moves randomly around world. • random movement implemented using a function (such as `getrandomnumber`)	1 1 1				
(c)	• athlete moves around world according to arrow keys. • athlete moves with appropriate relative speed to gate and water traps (equal to or greater than the speed of the gates and traps)	1 1				
(d)	• gate is removed from world on collision with athlete.	1				
(e) (f)	• sound plays when gate and athlete collide. • adding counter to world. • counter increases when athlete and gate collide.	1 1 1				
g)	• counter decreases when athlete and water trap collide. • implementation via parameter passing as opposed to wholly new method.	1 1				
(h)	• Greenfoot world saved correctly as FinalTrain8	1				

GCSE

COMPUTER SCIENCE

COMPONENT 3

Software Development Assignment

SAMPLE ASSESSMENT MATERIALS

20 Hours

INSTRUCTIONS TO CANDIDATES

You will have 20 hours to complete your chosen task.

Read the scenario carefully to make sure that you understand what is needed.

It is important that you work independently from other candidates and make sure that what you hand in is your own unaided work.

Your report should be about 2,000 words.

Make sure that you check your work carefully to ensure that the work you produce is accurate and correct.

Save your work regularly.

INFORMATION FOR CANDIDATES

Teachers and candidates will be required to sign a declaration that all work presented is the work of the candidate alone.

Information about the assessment of this component is shown in Appendix A and Appendix B of the specification.

Names for numbers

Sara Johnson teaches at Parkview Vale Primary School. She is concerned that her pupils are having difficulty in writing down numbers when they are said out loud. For example, when Sara asked the pupils to write down one thousand, nine hundred and five, many of them wrote down incorrect numbers.

Sara thinks that the pupils would benefit from more practice converting the names of numbers into figures. She would like a system that would produce a number written as a word, and require the pupil to enter the correct digits.

The system should present each pupil with ten numbers written as words and should keep a record of the correct responses. Sara would like the system to output the pupil's results each time a test is taken and produce an average (mean) mark each time the pupil has completed three tests.

Sara has also decided that once a pupil has answered a question successfully, that question should not appear in the ten questions the next time the pupil uses the system. If the question was answered incorrectly the question should appear the next time the pupil uses the system.

Sara has asked you to create a computer-based system that will:

- allow each pupil to be presented with 10 relevant numbers written as words per session
- ensure that questions that have been answered correctly by that pupil in previous sessions are not included
- store the pupil's responses to the questions
- calculate and display the number of correct responses
- display the average (mean) score each time a pupil has completed three sessions.

Miss Johnson's names for numbers sample questions.

Name	Number
One thousand, nine hundred and sixty five	1,965
Five thousand, seven hundred and seventy one	5,771
Nine thousand, eight hundred and sixty four	9,864
Eight thousand, eight hundred and sixty eight	8,868
Four thousand, six hundred and fifty four	4,654
Nine thousand, one hundred and thirty two	9,132
Seven thousand, two hundred and twenty seven	7,227
Six thousand, four hundred and nine	6,409
Four thousand and ninety nine	4,099
Two hundred and twenty eight	228