

GCSE

WJEC Eduqas GCSE in COMPUTER SCIENCE

ACCREDITED BY OFQUAL

SAMPLE ASSESSMENT MATERIALS

Teaching from 2020

Version 1

Contents

	Page
Component 1: Understanding Computer Science	
Question Paper	3
Mark Scheme	21
 Component 2: Computer Programming	
Pre-released Scenario	32
Question Paper	36
Mark Scheme	43

Candidate Name	Centre Number					Candidate Number				
						0				



GCSE
COMPUTER SCIENCE
COMPONENT 1
Understanding Computer Science
SAMPLE ASSESSMENT MATERIAL
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 total number of marks is 100.

Some questions will require you to draw on your knowledge from multiple areas of your course of study.

1. (a) Describe the purpose of the CPU. [2]

.....

.....

.....

- (b) The CPU uses different registers to store data resulting from the fetch-decode-execute cycle.

PC	CIR	ACC	MAR	MDR
----	-----	-----	-----	-----

Choose **two** registers and state their purpose.

- (i) [1]

Register:

Purpose:

.....

.....

- (ii) [1]

Register:

Purpose:

.....

.....

2. Jordan is a gamer considering purchasing a new computer system.

Jordan is considering the following two specifications:

Specification A	Specification B
	
• Processor: • Quad-core • 2.5 GHz • 1 MB cache • 4 GB RAM • 1 TB Hard Disk Drive • 136dB Gaming Sound Card • 1080p Integrated GPU	• Processor: • Dual-core • 3.5 GHz • 2 MB cache • 8 GB RAM • 128GB Solid State Drive • 116dB Gaming Sound Card • 1080p Dedicated GPU

- (a) Give **one** reason for choosing Specification A or B based on the following aspects alone:

- (i) Number of cores [1]

.....

.....

.....

- (ii) Main memory [1]

.....

.....

.....

- (iii) Graphics card [1]

.....

.....

.....

- (b) Describe the functional characteristics of the secondary storage technologies used **either** in a Hard Disk Drive **or** a Solid State Drive. [4]

.....

.....

.....

.....

.....

.....

.....

.....

3. (a) State the logical operator used in the following truth table: [1]

Input		Output
A	B	C
0	0	0
1	0	1
0	1	1
1	1	0

.....

- (b) Tick (✓) **one box only** to show the Boolean expression that represents the function described by the truth table. [1]

Input		Output
P	Q	R
0	0	0
1	0	1
0	1	0
1	1	0

$$R = P \oplus Q$$

☐

$$R = \overline{P} \cdot \overline{Q}$$

☐

$$R = P \cdot \overline{Q}$$

☐

$$R = P + Q$$

☐

- (c) Complete the truth table. [4]

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

4. (a) High and low level languages are used in programming.

Tick (✓) **one box only** for each statement that applies to a high level 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.	☐	☐
They require less time for translation into machine code.	☐	☐
They are preferred when the execution speed is critical.	☐	☐

- (b) Describe how each type of program translator works.

- (i) Assembler [2]

.....

.....

.....

.....

- (ii) Interpreter [2]

.....

.....

.....

.....

5. (a) Describe the OSI 7-layer model. [3]

.....

.....

.....

.....

.....

.....

- (b) Name the missing layers in the OSI 7-layer model. [3]

	LAYER
7	
6	Presentation
5	Session
4	
3	Network
2	
1	Physical

- (c) Describe the purpose of each of the following layers:

- (i) Physical layer [2]

.....

.....

.....

- (ii) Network layer [2]

.....

.....

.....

6. A local sports club wants to store the details of its members on a computer system. A partially complete data structure design is shown below. [6]

Complete the table, suggesting:

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

FIELD NAME	DATA TYPE	EXAMPLE DATA	VALIDATION CHECK
Member ID	Integer	12345	
Title	String	Miss	Look-up list
First name	String	Mary	Presence check
Surname	String	Johnson	Presence check
Gender		F	Presence check
Date of birth	Date	23/04/1984	
Address	String	123 Park Avenue	Presence check
Post code	String	E1 7AE	
Telephone number		020 7946 0914	Length check
Membership paid		Yes	Presence check

7. (a) Complete the table, converting between denary, binary and hexadecimal numbers as necessary. [3]

DENARY	BINARY	HEXADECIMAL
	11111100 ₂	FC ₁₆
184 ₁₀		B8 ₁₆
54 ₁₀	00110110 ₂	

- (b) Show how -92₁₀ can be represented using two's complement in an 8-bit register. [1]

.....

.....

.....

.....

- (c) Perform an arithmetic shift left by one place on the number below and name the error caused by the shift. [2]

10110111₂.

.....

.....

Error:

8. Clearly showing each step, simplify the Boolean expression using Boolean algebra and identities. [4]

$$A.(B + A)$$

.....

.....

.....

.....

.....

.....

.....

.....

9. A weather station records monthly rainfall figures in millimetres (mm) for a year, starting in January. [10]

Write an algorithm, using pseudo-code, which will use these twelve monthly rainfall figures as input.

The program should output:

- the total rainfall for the year
- the mean monthly rainfall for the year
- the month numbers (1 for January, etc) where the rainfall was above the mean.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

10. Graphics can be represented and stored on computer systems.

- (a) Explain how bitmap graphics are stored and the effects of different colour depths. [4]

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Lossy and lossless are two types of data compression used to compress digital graphics.

A certain method achieves the following compression ratios:

Lossy	5:2
Lossless	10:9

Calculate the resulting file size using each compression type for a 200 KB graphic. [2]

.....

.....

.....

.....

.....

Lossy file size:

Lossless file size:

11. The Internet allows access to a wealth of resources and services, such as webpages and applications of the World Wide Web.

(a) (i) State the role of a web browser. [1]

.....

.....

.....

(ii) Explain the structure of this URL. [4]

<https://www.eduqas.co.uk/qualifications/compsci>

.....

.....

.....

.....

.....

.....

.....

.....

- (b) 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. The operating system is a suite of system programs that manages a computer's resources.

Explain how the operating system manages:

- (a) Multi-tasking [3]

.....

.....

.....

.....

.....

.....

- (b) Interrupts [2]

.....

.....

.....

.....

.....

.....

13. (a) **Tick (✓) one box only** for each description that is relevant to the named legislation. [4]

Description	General Data Protection Regulation	Copyright Designs and Patents Act 1988	Regulation of Investigatory Powers Act 2000	Creative Commons Licensing
Allows interception of communication in the interests of national security.	☐	☐	☐	☐
When a programmer gives people the right to share and modify their work.	☐	☐	☐	☐
Ensures protection against unauthorised or unlawful processing of data.	☐	☐	☐	☐
Protects intellectual property in software development.	☐	☐	☐	☐

- (b) Give **three** principles of the Computer Misuse Act 1990. [3]

Principle 1:

.....

Principle 2:

.....

Principle 3:

.....

14. Cybersecurity ensures that computer systems are protected against the threats of criminal activity using electronic data.

(a) Describe the characteristics of the following threats to computer systems:

(i) Malware [2]

.....

.....

.....

.....

(ii) Brute force attacks [2]

.....

.....

.....

.....

(b) Describe the following ways of protecting against threats:

(i) Penetration testing [4]

.....

.....

.....

.....

.....

.....

.....

.....

(ii) Double authentication [3]

.....

.....

.....

.....

.....

.....

.....

.....

END OF PAPER



MARK SCHEME



Sample Assessment Material GCSE (9-1) COMPUTER SCIENCE

Component 1: Understanding Computer Science

Q	Answer	Marks	AO1	AO2	AO3	Total
1.(a)	Award one mark for each of the following up to a maximum of two marks: - The purpose of the CPU is to process instructions consisting of: - simple arithmetic - and logical operations.	2	2			2
1.(b)	Award one mark for each of the following up to a maximum of one mark per register: Program counter (PC) - stores the memory location of the next instruction that will be needed by the processor Current instruction register (CIR) - stores the instruction that is currently being executed by the processor Accumulator (ACC) - stores the results of calculations made by the ALU Memory address register (MAR) - stores the memory location where data is currently being written to or read from Memory data register (MDR) - stores the data that is being transferred from memory to the CPU (or vice versa).	2	2			2
2.(a)(i)	Spec A has a quad-core CPU, which means it is able to process four instructions at the same time, whereas Spec B is a dual-core CPU and two instructions may be processed at the same time.	1		1		1
2.(a)(ii)	Spec B has 8GB of RAM, which means it is able to store more currently running programs than Spec A which only has 4 GB of RAM.	1		1		1
2.(a)(iii)	Spec B has a dedicated GPU which means that the processing of games won't be hindered like an integrated GPU which shares its processing with a CPU.	1		1		1

Q	Answer	Marks	AO1	AO2	AO3	Total
2.(b)	Award one mark for each of the following up to a maximum of four marks: Hard Disk Drive - uses magnetic secondary storage technology - non-volatile, rewritable memory - data is stored on a hard drive platter - platter is divided into billions of tiny areas - each one of those areas can be independently magnetized (to store a 1) or demagnetized (to store a 0) - data is read and saved using an arm that has a special read/write head at the end - as the disk spins, the arm travels across the disk - each sector of the platter can store data and the movement of both the disk and the read/write head means that every sector on the hard drive can be reached - the faster the platter spins, the faster data can be read from the disk - a common speed for hard drives is 7200 RPM, but it can vary - fragmentation can slow access speeds. Solid-state storage - uses solid-state secondary storage technology - non-volatile, rewritable memory - non-mechanical design of semiconductor chips - does not require defragmentation - there are two types of flash memory: NOR and NAND - both contain cells -- transistors -- in a grid, but the wiring between the cells differs - if a chain of transistors conducts current, it has the value of 1 - if it doesn't conduct current, it's 0 - at first, all transistors are set to 1. But when a save operation begins, current is blocked to some transistors, turning them to 0 - this occurs because of how transistors are arranged. At each intersection of column and row, two transistors form a cell - one of the transistors is known as a control gate - the other as a floating gate - when current reaches the control gate, electrons flow onto the floating gate, creating a net positive charge that interrupts current flow - by applying precise voltages to the transistors, a unique pattern of 1s and 0s emerges.	4	4			4
3.(a)	Award one mark for the following: XOR	1	1			1
3.(b)	Award one mark for the following: $R = P \cdot \bar{Q}$	1		1		1

Q	Answer	Marks	AO1	AO2	AO3	Total																			
3.(c)	<table><tr><th>$A.B$</th><th>$\overline{A.B}$</th><th>$\overline{B}$</th><th>$\overline{A.B + B}$</th></tr><tr><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></tr><tr><td>0</td><td>1</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td></tr></table> Award one mark for each of the following columns: $A.B$ $\overline{A.B}$ $\overline{B}$ $\overline{A.B + B}$	$A.B$	$\overline{A.B}$	$\overline{B}$	$\overline{A.B + B}$	0	1	1	1	0	1	0	1	0	1	1	1	1	0	0	0	1 1 1 1	1 1 1 1		4
$A.B$	$\overline{A.B}$	$\overline{B}$	$\overline{A.B + B}$																						
0	1	1	1																						
0	1	0	1																						
0	1	1	1																						
1	0	0	0																						
4.(a)	Award one mark for each of the following up to a maximum of three marks: - they are easier to understand, learn and program as commands are similar to natural language – High Level - they require less time for translation into machine code – Low Level - they are preferred when the execution speed is critical – Low Level.	3	3			3																			
4.(b)(i)	Award one mark for each of the following up to a maximum of two marks: - converts low-level language programs into executable code - each mnemonic is replaced with the corresponding machine code.	2	2			2																			
4.(b)(ii)	Award one mark for each of the following up to a maximum of two marks: - convert high-level language programs into executable code, one line at a time - each instruction generates several low-level instructions - if an error is encountered, the interpreter stops and shows the error.	2	2			2																			

Q	Answer	Marks	AO1	AO2	AO3	Total								
5.(a)	Award one mark for each of the following up to a maximum of three marks: - the OSI model is a conceptual model - it characterises communication between two endpoints in a network - the model separates a communication system into 7 abstraction layers - a layer serves the layer above it and is served by the layer below it - in a given message between users, there will be a flow of data down through the layers in the source computer - data is sent across the network, and then up through the layers in the receiving computer.	3	3			3								
5.(b)	Award one mark for each of the following up to a maximum of three marks: <table><tr><td></td><td>LAYER</td></tr><tr><td>7</td><td>Application</td></tr><tr><td>4</td><td>Transport</td></tr><tr><td>2</td><td>Data link</td></tr></table>		LAYER	7	Application	4	Transport	2	Data link	3	3			3
	LAYER													
7	Application													
4	Transport													
2	Data link													
5.(c)(i)	Award one mark for each of the following up to a maximum of two marks: - transports data using electrical, mechanical or procedural interfaces - responsible for sending computer bits from one device to another along the network - determines how physical connections to the network are set up and how bits are represented into predictable signals as they are transmitted either electrically, optically or via radio waves.	2	2			2								
5.(c)(ii)	Award one mark for each of the following up to a maximum of two marks: - moves data into and through other networks - packages data with correct network address information - selects the appropriate network routes and forwards the packaged data up the stack to the transport layer.	2	2			2								

Q	Answer	Marks	AO1	AO2	AO3	Total
6.	Award one mark for each of the following up to a maximum of six marks: Data type • Gender: Character • Telephone number: String • Membership paid: Boolean Validation check • Membership ID: Type check/Format check • Date of birth: Range check • Post code: Format check (NOT TWICE)	3 <				

Q	Answer	Marks	AO1	AO2	AO3	Total
9.	Indicative content <pre> 1 Declare RainfallProc 2 3 rainfall[12] is integer 4 total is integer 5 mean is real 6 7 set total = 0 8 set mean = 0 9 10 for i = 1 to 12 11 input rainfall[i] 12 total = total + rainfall[i] 13 next i 14 15 output "The total rainfall is ", total 16 mean = total / 12 17 output "The mean rainfall is ", mean 18 19 output "Months above mean:" 20 21 for i = 1 to 12 22 if rainfall[i] > mean then 23 output i 24 end if 25 next i 26 27 End RainfallProc </pre> Award one mark for each of the following up to a maximum of ten marks: • declare array • initialise variables • loop structure allowing 12 monthly readings • input rainfall • calculate total • output total • calculate mean • output mean • comparison of rainfall value against mean to determine if it is higher • output months above mean.	10			10	10

Q	Answer	Marks	AO1	AO2	AO3	Total
10.(a)	Award one mark for each of the following up to a maximum of four marks: • RGB colour uses three colour components for each pixel • a bitmap graphic stores the colour of every individual pixel in a 2D array • the number of colours that an image can represent depends on its colour depth • a black and white image has a colour depth of 1 • the simplest grey scale image would have a colour depth of 2 — representing four colours • increasing the colour depth will increase the amount of storage needed to store the image • but will result in a better quality image.	4	4			4
10.(b)	Award one mark for each of the following up to a maximum of two marks: Lossy file size • 80 KB Lossless file size • 180 KB DO NOT award marks if units not present	1 1		1 1		2
11.(a)(i)	Award one mark for the following: • The role of a web browser is to render HTML	1	1			1
11.(a)(ii)	Award one mark for each of the following up to a maximum of four marks: • https is the protocol • www.eduqas.co.uk is the domain name stored on a DNS • /qualifications/ is the folder structure leading to where the web page is located • compsci is the requested web page.	4		4		4

Q	Answer	Marks	AO1	AO2	AO3	Total								
11.(b)	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 servers 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></td><td>5 - 6 marks</td></tr><tr><td>3</td><td> The candidate has: • shown strong understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides five to six relevant detailed points from the indicative content • shown a sustained line of reasoning which is coherent, relevant, substantiated and logically structured • used appropriate terminology. </td></tr><tr><td>2</td><td> 3 - 4 marks The candidate has: • shown some understanding of the requirements of the question and sound knowledge of the indicative content. Sound knowledge is defined as a response that provides three to four relevant detailed points from the indicative content • shown a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure • used mainly appropriate terminology. </td></tr></table>	Band	AO1.1b (Max 6 marks)		5 - 6 marks	3	The candidate has: • shown strong understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides five to six relevant detailed points from the indicative content • shown a sustained line of reasoning which is coherent, relevant, substantiated and logically structured • used appropriate terminology.	2	3 - 4 marks The candidate has: • shown some understanding of the requirements of the question and sound knowledge of the indicative content. Sound knowledge is defined as a response that provides three to four relevant detailed points from the indicative content • shown a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure • used mainly appropriate terminology.	6	6			6
Band	AO1.1b (Max 6 marks)													
	5 - 6 marks													
3	The candidate has: • shown strong understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides five to six relevant detailed points from the indicative content • shown a sustained line of reasoning which is coherent, relevant, substantiated and logically structured • used appropriate terminology.													
2	3 - 4 marks The candidate has: • shown some understanding of the requirements of the question and sound knowledge of the indicative content. Sound knowledge is defined as a response that provides three to four relevant detailed points from the indicative content • shown a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure • used mainly appropriate terminology.													

Q	Answer	Marks	AO1	AO2	AO3	Total
	1 - 2 marks The candidate has: - shown limited understanding of the requirements of the question and superficial knowledge of the indicative content. Superficial knowledge is defined as a response that provides one to two relevant points from the indicative content - shown a basic line of reasoning which is not coherent, largely irrelevant with very little structure - used limited terminology.					
	0 marks No attempt made or no response worthy of credit.					
12.(a)	Award one mark for each of the following up to a maximum of three marks: - multitasking allows a user to seemingly perform more than one task at a time - in reality, a computer never performs more than one task at a time, but the CPU is so fast that it gives the impression of performing multiple tasks at the same time - the computer uses scheduling to manage the selection and processing between different tasks - tasks are sorted according to different criteria, such as task delivery time and priority - task are allocated a time-slice by the CPU.	3	3			3
12.(b)	Award one mark for each of the following up to a maximum of two marks: - a signal sent of the CPU usually generated when I/O is required - there are two types of interrupt, hardware and software. Accept examples - hardware interrupts are generated when a key is pressed or when the mouse is moved - software interrupts are generated by a program requiring disk input or output.	2	2			2

Q	Answer	Marks	AO1	AO2	AO3	Total
13.(a)	Award one mark for each of the following up to a maximum of four marks: - allows interception of communication in the interests of national security — Regulation of Investigatory Powers Act 2000 - when a programmer gives people the right to share and modify their work — Creative Commons Licensing - ensures protection against unauthorised or unlawful processing of data — General Data Protection Regulation - protects intellectual property in software development — Copyright Designs and Patents Act 1988	4	4			4
13.(b)	Award one mark for each of the following up to a maximum of three marks: - unauthorised access to computer material. This refers to entering a computer system without permission (hacking) - unauthorised access to computer materials with intent to commit a further crime. This refers to entering a computer system to steal data or destroy a device or network (such as planting a virus) - unauthorised modification of data. This refers to modifying or deleting data, and also covers the introduction of malware or spyware onto a computer (electronic vandalism and theft of information) - making, supplying or obtaining anything which can be used in computer misuse offences.	3	3			3
14.(a)(i)	Award one mark for each of the following up to a maximum of two marks: - software program - can perform a variety of different functions such as: - stealing data, encrypting or deleting sensitive data - altering or hijacking core computing functions - monitoring users' computer activity without their permission.	2	2			2

Q	Answer	Marks	AO1	AO2	AO3	Total
14.(a)(ii)	Award one mark for each of the following up to a maximum of two marks: - a hacking algorithm - tries all possible combinations of lowercase and uppercase characters, numbers and symbols to gain unauthorised access to a computer system.	2	2			2
14.(b)(i)	Award one mark for each of the following up to a maximum of four marks: - the process of testing a computer system, or network, to find vulnerabilities an attacker could exploit - the tests can be automated with software applications or they can be performed manually. Penetration testing strategies include: - targeted testing — testing carried out by the organisation's ITC team and the penetration testing team working together - external testing — to find out if an outside attacker can get in and how far they can get in once they have gained access - internal testing — to estimate how much damage a dissatisfied employee could cause - blind testing — to simulate the actions and procedures of a real attacker by severely limiting the information given to the team performing the test.	4	4			4
14.(b)(ii)	Award one mark for each of the following up to a maximum of three marks: - double authentication is a second layer of security to protect an account or system - users must go through two layers of security before being granted access to an account or system - increases the safety of online accounts by requiring two types of information from the user, such as a password or PIN, an email account, an ATM card or fingerprint, before the user can log in - the first factor is the password; the second factor is the additional item.	3	3			3
TOTAL		100	60	30	10	100



GCSE

COMPUTER SCIENCE

COMPONENT 2

Computer Programming

SAMPLE ASSESSMENT MATERIALS

PRE-RELEASED MATERIAL

**TO BE MADE AVAILABLE TO CANDIDATES
FROM 01 September 20xx**



INSTRUCTIONS FOR CANDIDATES

You must **not** take this material or any associated research material into the examination with you.

INFORMATION FOR CANDIDATES

The information overleaf is provided to assist your preparation for the Computer Programming examination.

All programs should be developed using Python version 3.8.0

Original Requirements

Parkwood Vale is a small primary school that serves the local community.

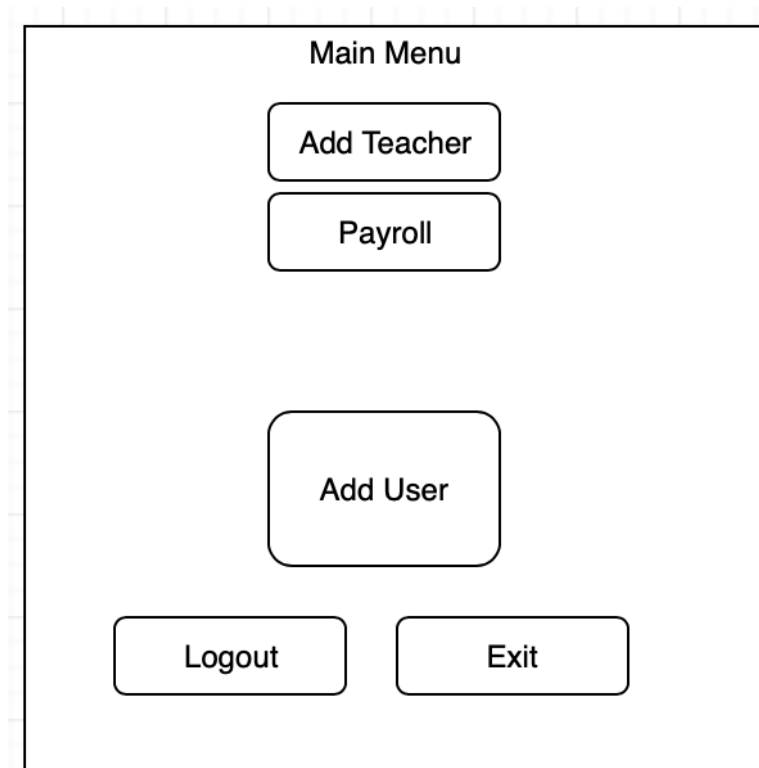
Parkwood Vale would like to begin storing data on a computerised system. Whilst the school could buy an off-the-shelf package, it has decided to commission you and your team to work together to develop a bespoke solution.

Authentication

Data security is critical to the school and so it has insisted that the system has a login screen that requires a username and a password for authentication before accessing the main menu. The system must display a message stating whether login was successful or unsuccessful. There will need to be a way to add additional users and passwords.

Main Menu and Navigation

Some of the school's staff are non-specialist computer users and they have requested that the system is user friendly; therefore, a Graphical User Interface (GUI) will be used. A partial design for the interface has been provided here:



Add Teacher

The school has decided that it would like to store the following staff details:

- TeacherID
- Firstname
- Surname
- Address
- Postcode
- Qualification (such as BSc (Hons) Physics).

The form should also include buttons that:

- save the details to a file on disk called TeacherDetails.txt
- return to the main menu.

The school has provided a partial design of the user interface they would like to use:

The image shows a partial design of a user interface for adding a teacher. It is enclosed in a rectangular frame. At the top center, the title "Add Teacher" is displayed. Below the title, on the left side, there is a list of labels: "TeacherID", "Firstname", "Surname", "Address", "Postcode", and "Qualification". To the right of these labels is a vertical stack of six empty rectangular input boxes, each corresponding to one of the labels. At the bottom of the frame, there are two rounded rectangular buttons: "Back" on the left and "Save" on the right.

Payroll

Parkwood Vale would like to calculate the correct amount of pay for individual teachers.

Users will enter the monthly salary (Gross Pay) and the system will calculate and display deductions (Tax, National Insurance and Pension Contribution), and the correct amount of take-home pay (Net Pay).

The following calculations should be used for the prototype software:

- Tax = 20% (0.2) of Gross Pay
- National Insurance = 14% (0.14) of Gross Pay
- Pension Contribution = 8% (0.08) of Gross Pay
- Deductions = Tax + National Insurance + Pension Contribution
- Net Pay = Gross Pay – Deductions.

They have decided that currently there is no need to store the results of these calculations.

A partial design for the user interface has been provided:

The image shows a window titled "Payroll" with a light gray background. Inside the window, there are several labels and input fields. On the left side, the labels are "Gross Pay", "Tax", "National Insurance", "Pension Contribution", "Deductions", and "Net Pay", arranged vertically. To the right of each label is a rectangular input field. A "Calculate" button, which is a rounded rectangle, is located to the right of the "Gross Pay" input field. At the bottom center of the window is a "Back" button, also a rounded rectangle.

Parkwood Vale would like the system developed using the Python programming language to enable them to make additions and changes to the program at a later date.

Candidate Name	Centre Number					Candidate Number				
						0				

**GCSE****COMPUTER SCIENCE****COMPONENT 2****Computer Programming****SAMPLE ASSESSMENT MATERIAL****2 Hours****ADDITIONAL MATERIALS**

You will require the prototype Python file: ParkWoodSchool.py with supporting files which should be pre-installed on your examination account.

Your computer should be pre-installed with a word processing package and a functional copy of Python 3.8.0.

INSTRUCTIONS TO CANDIDATES

Questions 1, 2, 4, 5, 7, 10 and 11 should be answered in a word-processed document. All other questions will require the use of the Python 3.8.0 IDE.

Save your work regularly.

INFORMATION FOR CANDIDATES

The total number of marks available for this examination is 80.

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 quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question 11.

Create a new word-processed document called ExamAnswers.

Open the ParkWoodSchool.py file and the Payroll.py file and familiarise yourself with the contents.

Investigation

1. Using the ParkWoodSchool.py file:
 - (a) Provide a screenshot of the error message displayed following a failed login attempt. State the username and password used. [2]
 - (b) Provide a screenshot of the message displayed following a successful login attempt. State the username and password used. [2]

Enter your answers in your ExamAnswers document.

2. Identify **one** example of each of the following from the ParkWoodSchool.py file. Copy each example identified into your word-processed document:
 - (a) a Boolean value; [1]
 - (b) iteration; [1]
 - (c) selection. [1]

Enter your answers in your ExamAnswers document.

3. Describe **one** example of each of the following using annotation in the ParkWoodSchool.py file:
- (a) a user-defined function or subroutine; [2]
 - (b) assignment; [2]
 - (c) writing information to a file; [2]
 - (d) code to generate a button on a form. [2]

Enter your answers as code in the ParkWoodSchool.py Python file.

Design

Park Wood School would like you to design additional features for the system.

4. Design an algorithm that accepts the input of a pupil's first name. Your algorithm should output a suitable error message if the data entered contains any numeric values.

Your algorithm should be written using pseudo-code and self-documenting identifiers. [6]

Enter your answers in your ExamAnswers document.

5. Park Wood School requires an additional feature that will calculate the student loan repayment amounts which need to be deducted from staff salaries.

You may assume that student loan repayments are 10% of gross pay.

Design an algorithm which:

- allows the user to input the employee's gross pay;
- calculates the student loan repayment;
- calculates the net pay by deducting the student loan from the gross pay;
- outputs the result of the calculations.

Your algorithm should be written using pseudo-code and self-documenting identifiers. [5]

Enter your answers in your ExamAnswers document.

Implementation

6. Park Wood School would like to create a new form to store pupil details.
- (a) Create a new form. [1]
 - (b) Insert a title on the form “Add Pupil”. [2]
 - (c) Create a text box and provide appropriate labels to allow a user to input each of the following:
 - Pupil ID
 - First name
 - Surname
 - Form class
 - Date of birth [3]
 - (d) Create a functioning “Back” button that returns the user to the main menu. [2]
 - (e) Add code to implement a presence check on Pupil ID. [2]
 - (f) Create a “Save” button and add code to the Python file to enable the saving of the above details in a file called “pupilDetails.txt” displaying a confirmation message. [3]
 - (g) Implement the validation check that you designed in question 4 to check that a pupils first name does not contain a numeric character. [3]
 - (h) Explain how all the new functionality works by annotating the code you have added within your Python file. [6]

Enter your answers as code in a new Python file called Pupils.py.

Testing

Park Wood School requires you to carry out the following tests on the program.

7. (a) Test the functionality of the presence check on the Pupil ID field and provide a screenshot of the error message. [1]

- (b) The following pupil details are to be stored using your Python program:

- Pupil ID: 1101
- First name: Kwai
- Surname: Oer
- Form class: 4B
- Date of birth: 6/1/2015

Test the functionality of the Python program by providing screenshots of the following:

- (i) the form completed with the above details; [1]
- (ii) a message confirming that the pupil details have been stored; [1]
- (iii) the pupilDetails.txt file open with the above details stored; [2]

Enter your answers in your ExamAnswers document.

Refinement

Park Wood School has asked you to carry out the following code refinements to change the function and improve the efficiency of their code.

8. Park Wood School is aware of changes to the tax system that they will have to implement. Refine the code within ParkWoodSchool.py to take account of the following changes.
- (a) (i) Increase the Tax Rate from 20% to 22%. [1]
 - (ii) Describe the refinements you have made to your code for the increase in Tax Rate by annotating your code. [2]
 - (b) (i) Change the National Insurance Rate to 8.5% [1]
 - (ii) Describe the refinements you have made to your code for the change in National Insurance Rate by annotating your code. [2]
 - (c) (i) Refine your program, using your design work from Question 5, to include this calculation in your payroll form. [2]
 - (ii) Describe the refinements you have made to include the student loan deduction by annotating your code. [2]

Enter your answers as code in Payroll.py.

9. The code within the ParkWoodSchool.py program makes use of many nested if statements which are used to display an error.
- (a) Refine this code to make it more efficient. [3]
 - (b) Describe the refinements you made by annotating the code. [2]

Enter your answers as code in ParkWoodSchool.py.

Refinement testing

10. Provide a screenshot of your Payroll form showing all outputs when a gross pay of £1,850.00 is input. [6]

Enter your answer in your ExamAnswers document.

Evaluate

11. Discuss how your final program meets the revised requirements. You should consider:
- Two refinements that your program succeeds in implementing
 - How the code achieves those refinements
 - Areas for improvement in your final program.
- [6]

Enter your answers in your ExamAnswers document.

End of Paper.



MARK SCHEME



Sample Assessment Material GCSE (9-1) COMPUTER SCIENCE Component 2: Computer Programming

Q	Answer	Mark	AO1	AO2	AO3	Total
1.	Award marks where indicated for a screenshot showing:					4
(a)	Failed login screen message (1) (incorrect username & incorrect password (1))	2		2		
(b)	Correct login screen message (1) (correct username & password from provided file: i.e. admin WJEC2020 (1))	2		2		
2.	Award one mark for each code reference line in the ExamAnswers document:					3
(a)	Boolean declaration or use line from Python	1		1		
(b)	For loop or do while loop or other iteration from Python	1		1		
(c)	Selection (if statement or other) from Python	1		1		
3.	Award one mark for each correct location of annotation (1 line above, below or to the right of the line) up to a maximum of four.	4		4		8
	Award one mark for describing each example up to a maximum of four.	4		4		
	Indicative content for each example:					
(a)	<code>#Declares the function which draws the GUI user interface to the screen.</code>					
(b)	<code>#Sets the initial value of gross_pay to 0 to prevent calculations on a None or Null value</code>					
(c)	<code>#Writes the information to a text file called "Staff.txt"</code>					
(d)	<code>#uses TKINTER to draw a command button on the screen with the caption "back"</code>					

Q	Answer	Mark	AO1	AO2	AO3	Total
4.	Award one mark for each correct concept designed in pseudo-code (Pseudo-code syntax and examples are provided in the subject specification) • Declare variables • Use of MID string handling • If statement (selection to look for numbers) OR ASCII • Use of flag to prevent multiple messages • Output message if string is invalid • Fully correct algorithmic logic Annotation is not required but provided for clarity. Indicative content: <pre> firstName is string error is Boolean set error = FALSE output "Please enter firstname" input firstName for i = 1 to len(firstName) {get the length of the string} for j = 0 to 9 if VAL(MID(firstName,i,1)) = j then error = TRUE end if next j next i if error = TRUE then output "Numeric value found" end if </pre>	1 1 1 1 1 1		1 1 1 1 1 1		6

Q	Answer	Mark	AO1	AO2	AO3	Total
5.	Award one mark for each correct concept designed in pseudo-code (Pseudo-code syntax and examples are provided in the subject specification) • declare variables • input gross pay • calculate student loan (gross pay * 0.1) • calculate net pay (gross pay – student loan) • correct outputs (student loan & net pay) Indicative content: <pre>grossPay is real studentLoan is real netPay is real output "Please enter the gross pay" input grossPay studentLoan = grossPay * 0.1 netPay = grossPay - studentLoan output "Student loan repayment is:" studentLoan output "Net pay is:" netPay</pre>	1 1 1 1 1			1 1 1 1 1	5

Q	Answer	Mark	AO1	AO2	AO3	Total
6.	Award one mark for each bulleted item listed below.					22
(a)	New form exists (does not require title name or content.)	1			1	
(b)	- New form has a title or label - Title on form reads "Add pupil record"	1 1			1 1	
(c)	- Data entry or textbox allowing typing for the following: Pupil ID First name Surname Form class Date of birth - label for each of above - intuitive layout (not overlapping or at random on form)	1 1 1			1 1 1	
(d)	- Button on form for "Back" any valid title/label e.g. "HOME" - Button returns user to main menu	1 1			1 1	
(e)	- Validation check (presence) on Pupil ID - Sensible message pops up when no data entered / OR on save	1 1			1 1	
(f)	- Button on form for "Save" any valid title/label e.g. "SAVE" - Button initiates save routine - Standard data saved from form into text file (examiner to enter standardised test data provided by WJEC)	1 1 1			1 1 1	
(g)	One mark for each section for code that is fully functional and allows: - acceptance of name with no numeric data - rejection of name with numerical data - suitable output message on validation failure	1 1 1			1 1 1	
(h)	Annotation within Python file for following: - Creating new form code/GUI has annotation - File handling code has annotation - Presence check code has annotation - Back to main menu button/code has annotation - Annotation that explains the check for a numeric - annotation of the error message	1 1 1 1 1 1		1 1 1 1 1 1		

Q	Answer	Mark	AO1	AO2	AO3	Total
7.	Award one mark for each successfully carried out test below.					5
(a)	Screenshot in ExamAnswers of suitable message on screen (popup box or message on from) stating pupil ID validation error (e.g. "Must enter Pupil ID or Pupil ID cannot be blank." etc.)	1		1		
(b) (i)	Screenshot of Python form with details from QP filled.	1		1		
(ii)	Screenshot including confirmatory message.	1		1		
(iii)	Screenshot of text file (1) with details from QP saved (ignore other data present from testing) (1).	2		2		
8.						10
(a) (i)	Award one mark for a correct change within the Python program (ParkWoodSchool.py) of tax rate from 0.2 to 0.22 (OR percentage method).	1			1	
(ii)	Award one mark for annotation around the tax calculation code. Must be line above, same line or line below. Award one mark for suitable description of tax value Exemplar: #Tax rate changed from 0.2 to 0.22 as per client requirement	1		1		
		1		1		
(b) (i)	Award one mark for change within Python program (ParkWoodSchool.py) of national insurance rate from 0.8 to 0.85 (OR percentage method)	1			1	
(ii)	Award one mark for annotation around the national insurance calculation code. Must be line above, same line or line below. Award one mark for suitable description of tax value Exemplar: #Tax rate changed from 0.8 to 0.85 as per client requirement	1		1		
		1		1		
	Allow follow through from Q5.					
(c) (i)	New code within Python program (ParkWoodSchool.py) of student loan one mark for correct location(before deductions) one mark for correct new figure.	1 1			1 1	
(ii)	One mark for annotation around the new student loan calculation code. Must be line above, same line or line below. One mark for suitable change for the gross pay line e.g. #Student loan charge added to gross pay	1		1		
		1		1		

Q	Answer	Mark	AO1	AO2	AO3	Total																					
9. (a)	Award one mark for each correct concept programmed in python. - Defining a switcher (Case statement) - Setting the array (dict) - Outputting the full name. Exemplar answer/indicative content: <pre>def switch_demo(argument): switcher = { 1: "No username", 2: "No password", 3: "No username and password entered", } print switcher.get(argument, "Login failed")</pre>	1 1 1			1 1 1	5																					
(b)	Award up to two marks for describing how the code is refined (fewer statements/more efficient to execute/easier to read/faster to execute).	2		2																							
10.	Award one mark for each correct calculation result in the screenshots within the answer document using the following table. <table border="1"> <thead> <tr> <th>Gross Pay</th><th>Tax</th><th>National insurance</th><th>Pension Contribution</th><th>Student Loan</th><th>Deductions</th><th>Net Pay</th></tr> </thead> <tbody> <tr> <td>1850</td><td>407</td><td>259</td><td>148</td><td>185</td><td>999</td><td>851</td></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	Gross Pay	Tax	National insurance	Pension Contribution	Student Loan	Deductions	Net Pay	1850	407	259	148	185	999	851								6		6		6
Gross Pay	Tax	National insurance	Pension Contribution	Student Loan	Deductions	Net Pay																					
1850	407	259	148	185	999	851																					

Q	Answer	Mark	AO1	AO2	AO3	Total												
11.	Award marks according to the band described below. Candidates should include the following: Two refinements that the candidate states are successful. Explanations of how the code achieves these refinements. Consideration of how the final program could be improved upon, for example: - Validation - User Interface - Extensibility <table><tr><th>Band</th><th>AO3.2c (Max 6 marks)</th></tr><tr><td colspan="2">5 - 6 marks</td></tr><tr><td>3</td><td> The candidate has: - shown strong understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides five to six relevant detailed points from the indicative content - shown a sustained line of reasoning which is coherent, relevant, substantiated and logically structured - used appropriate terminology and accurate spelling, punctuation and grammar. </td></tr><tr><td>2</td><td> 3 - 4 marks The candidate has: - shown some understanding of the requirements of the question and sound knowledge of the indicative content. Sound knowledge is defined as a response that provides three to four relevant detailed points from the indicative content - shown a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure - used mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. </td></tr><tr><td>1</td><td> 1 - 2 marks The candidate has: - shown limited understanding of the requirements of the question and superficial knowledge of the indicative content. Superficial knowledge is defined as a response that provides one to two relevant points from the indicative content - shown a basic line of reasoning which is not coherent, largely irrelevant with very little structure - used limited scientific terminology and inaccuracies in spelling, punctuation and grammar. </td></tr><tr><td>0</td><td> 0 marks No attempt made or no response worthy of credit. </td></tr></table>	Band	AO3.2c (Max 6 marks)	5 - 6 marks		3	The candidate has: - shown strong understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides five to six relevant detailed points from the indicative content - shown a sustained line of reasoning which is coherent, relevant, substantiated and logically structured - used appropriate terminology and accurate spelling, punctuation and grammar.	2	3 - 4 marks The candidate has: - shown some understanding of the requirements of the question and sound knowledge of the indicative content. Sound knowledge is defined as a response that provides three to four relevant detailed points from the indicative content - shown a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure - used mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.	1	1 - 2 marks The candidate has: - shown limited understanding of the requirements of the question and superficial knowledge of the indicative content. Superficial knowledge is defined as a response that provides one to two relevant points from the indicative content - shown a basic line of reasoning which is not coherent, largely irrelevant with very little structure - used limited scientific terminology and inaccuracies in spelling, punctuation and grammar.	0	0 marks No attempt made or no response worthy of credit.	6			6	6
Band	AO3.2c (Max 6 marks)																	
5 - 6 marks																		
3	The candidate has: - shown strong understanding of the requirements of the question and a clear knowledge of the indicative content. Clear knowledge is defined as a response that provides five to six relevant detailed points from the indicative content - shown a sustained line of reasoning which is coherent, relevant, substantiated and logically structured - used appropriate terminology and accurate spelling, punctuation and grammar.																	
2	3 - 4 marks The candidate has: - shown some understanding of the requirements of the question and sound knowledge of the indicative content. Sound knowledge is defined as a response that provides three to four relevant detailed points from the indicative content - shown a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure - used mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.																	
1	1 - 2 marks The candidate has: - shown limited understanding of the requirements of the question and superficial knowledge of the indicative content. Superficial knowledge is defined as a response that provides one to two relevant points from the indicative content - shown a basic line of reasoning which is not coherent, largely irrelevant with very little structure - used limited scientific terminology and inaccuracies in spelling, punctuation and grammar.																	
0	0 marks No attempt made or no response worthy of credit.																	