OCR
Oxford Cambridge and RSA

Monday 16 May 2022 – Afternoon

GCSE (9–1) Computer Science

J277/01 Computer Systems

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions.

1 Computers represent data in binary form.

(a) Tick (✓) **one** box in each row to identify the binary unit equivalent of each of the given file sizes.

File size	2 megabytes	2 petabytes	2 kilobytes	2 bytes	2 gigabytes
2000 bytes					
2000 terabytes					
16 bits					
4 nibbles					

[4]

(b) Convert the denary number 221 into 8 bit binary. Show your working.

.....

.....

.....

..... **[2]**

(c) Convert the hexadecimal number 2F into denary. Show your working.

.....

.....

.....

..... **[2]**

(d) Convert the binary number 10110000 into hexadecimal.

.....

..... **[1]**

(e) Identify how many unique values can be represented by 4 bits.

..... **[1]**

(f) Perform a binary shift of 3 places right on the binary number 10001110.

..... **[1]**

2 Complete the table by writing the missing definition or name of each of the common CPU components and registers.

CPU component or register	Definition
	Stores the address of the next instruction to be fetched from memory. Increments during each fetch-execute cycle.
CU (Control Unit)	
	Stores the address of the data to be fetched from or the address where the data is to be stored.
	Performs mathematical calculations and logical operations.

[4]

3 A library has a LAN (Local Area Network).

(a) The LAN allows access by both wired and wireless devices.

Users have reported that the network sometimes runs very slowly.

(i) Explain why the number of devices using the network at the same time can affect the performance of the network.

.....

.....

.....

.....

.....

..... **[3]**

(ii) Identify **one** other factor that can affect the performance of the network.

.....

..... **[1]**

(b) Users can access websites from the library computers.

Complete the description of accessing websites using the given list of terms. Not all terms will be used.

0 1 127 128 255 256 Colon

Domain Name Server Embedded systems File server Full stop

Hyphen Internet protocol MAC address Router

Uniform Resource Locator Web server Clients

A website is hosted on a ..... . The computers that access the websites are called ..... .

The user enters the ..... into a web browser. The web browser sends a request to the ..... for the matching IP (Internet Protocol) address. If found the IP address is returned. A request is then sent to this IP address.

An IPv4 address is made of 4 groups of digits. Each group can be between the denary values ..... and ..... . The groups of digits are separated by a ..... .

[7]

(c) The wired connection is an Ethernet connection. Ethernet is considered a standard.

Explain why Ethernet is a standard.

.....

.....

.....

..... **[2]**

(d) The network has several routers.

Identify **three** tasks carried out by a router.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(e) The library does not use encryption when data is transmitted through the network.

Give **two** reasons why the library should use encryption.

1 .....

.....

2 .....

.....

[2]

(f) Protocols are used to transmit data through the network and over the internet.

Identify **one** protocol that can be used to perform each of the following tasks:

Send an email .....

Access a website securely .....

[2]

4* Social networking websites use artificial intelligence (AI) to monitor posts from users.

Discuss the positive and negative uses of AI by social networking websites including:

- Legal issues
- Ethical issues
- Privacy issues

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[8]**

5 A software development company wants to protect their computer systems and data from unauthorised access.

(a) Identify **two** methods of physical security that the company could use to protect their computer systems.

1 .....

.....

2 .....

.....

[2]

(b) Identify **and** describe **two** software-based security methods that the company can use to protect their computer systems and data.

Method 1 .....

Description .....

.....

.....

.....

Method 2 .....

Description .....

.....

.....

.....

[6]

(c) Tick (✓) **one** box on each row to identify the legislation that would cover each of the given events.

Event	The Data Protection Act (2018)	Computer Misuse Act (1990)	Copyright Designs and Patents Act (1988)
A company transmits personal data to another company without the individual's permission.			
A school accidentally publishes their students' addresses on the school website.			
The interface for a piece of software is replicated by a rival company.			
A user leaves a computer logged on and another person leaves them a message on their desktop.			
A student guesses their teacher's password and accesses their computer account.			

[5]

6 A student is creating a range of documents for a school project.

(a) The student records a podcast about computer science.

(i) Describe how an analogue sound wave is converted into digital form.

.....

.....

.....

.....

.....

..... **[3]**

(ii) Tick (✓) **one or more** boxes on each row to identify the effect(s) that each change will have on the sound file.

Change	File size increases	File size decreases	Accuracy increases	Accuracy decreases
Duration changes from 10 minutes to 20 minutes				
Sample rate changes from 44 kilohertz to 8 kilohertz				
Bit depth changes from 8 bits to 16 bits				

[3]

(b) The student writes a report about volcanoes.

(i) The computer stores text using the ASCII character set.

Part of the ASCII character set is shown:

Character	ASCII denary code
M	77
N	78
O	79
P	80
Q	81

Identify the character that will be represented by the ASCII denary code 84.

..... **[1]**

(ii) Identify a second character set.

..... **[1]**

(c) The student takes a photograph of their science experiment. The image file includes metadata.

Identify **three** pieces of metadata that is often stored with an image.

1 .....

2 .....

3 .....

[3]

(d) The student compresses all their documents before emailing them to their teacher.

(i) Give **two** benefits of compressing the data before it is emailed.

1 .....

.....

2 .....

.....

[2]

(ii) Explain why lossy compression may **not** be appropriate to compress all of the student's files.

.....

.....

.....

..... **[2]**

7 A smart television allows the user to search the Internet and watch videos online.

(a) The smart television has both RAM and ROM.

(i) State the difference between RAM and ROM.

.....

..... **[1]**

(ii) Give **two** examples of data that the smart television could store in RAM.

1 .....

2 .....

[2]

(b) The smart television has secondary storage.

(i) State, using an example, why the smart television needs secondary storage.

.....

.....

.....

..... **[2]**

(ii) Identify **one** appropriate type of secondary storage for the smart television. Justify your choice.

Secondary storage type .....

Justification .....

.....

.....

.....

.....

.....

[4]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

Oxford Cambridge and RSA

GCSE

Computer Science

J277/01: Computer systems

General Certificate of Secondary Education

Mark Scheme for June 2022

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the scoris messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

   Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
    - there is nothing written in the answer space

   Award Zero '0' if:

    - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The scoris **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the scoris messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response: Not applicable in F501
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following:

Descriptor	**Award mark**
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	Meaning
	Omission mark
	Benefit of doubt
	Cross
	Follow through
	Not answered question
	Benefit of doubt not given
	Repeat
	Tick
	Too vague
	Noted but credit not given, blank pages, pages with no annotation

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>1 mark for each row

<table>
<tr><th>File size</th><th>2 megabytes</th><th>2 petabytes</th><th>2 kilobytes</th><th>2 bytes</th><th>2 gigabytes</th></tr>
<tr><td>2000 bytes</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>2000 terabytes</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>16 bits</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>4 nibbles</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
</table></td><td>4</td><td></td></tr>
<tr><td>1</td><td>(b)</td><td></td><td>1 mark for working
e.g. dividing by 2, or writing the powers/values with the binary below, subtracting.

1 mark for answer
11011101</td><td>2</td><td>No FT for answer from working.

Award the working mark if the binary is back-to-front i.e.
1 2 4 8 16 32 64 128
1 0 1 1 1 0 1 1</td></tr>
<tr><td>1</td><td>(c)</td><td></td><td>1 mark for working
e.g. multiplying by 16 (2 * 16 + 15), or converting to binary first (0010 1111)

1 mark for answer
47</td><td>2</td><td>No FT for answers from working.</td></tr>
<tr><td>1</td><td>(d)</td><td></td><td>1 mark for B0</td><td>1</td><td>Correct answer only</td></tr>
<tr><td>1</td><td>(e)</td><td></td><td>16</td><td>1</td><td>Correct answer only</td></tr>
<tr><td>1</td><td>(f)</td><td></td><td>00010001</td><td>1</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>2</td><td></td><td></td><td>1 mark for each term or definition

<table>
<tr><th>CPU component or register</th><th>Definition</th></tr>
<tr><td>Program Counter // PC</td><td>Stores the address of the next instruction to be fetched from memory. Increments in each fetch-execute cycle.</td></tr>
<tr><td>CU (Control Unit)</td><td>(Sends signals to) synchronise / control / coordinates the processor/hardware/F-E cycle/processes/flow of data
// decodes instructions (in CIR)
// runs F-E cycle</td></tr>
<tr><td>Memory Address Register // MAR</td><td>Stores the address of the data to be fetched from, or the address where the data is to be stored.</td></tr>
<tr><td>Arithmetic Logic Unit // ALU</td><td>Performs the mathematical and logical calculations.</td></tr>
</table></td><td>4</td><td>Read whole answer for CU and award correct point at any stage.

CU 'sends signals to components' is not enough, it isn't saying what the signal's purpose is</td></tr>
</table>

Question			Answer	Mark	Guidance

3	(a)	(i)	1 mark each to max 3
			• Slower transmission of data // less data can be transmitted **at the same time** // the transmission rate decreases // time to send/receive increases
			• (More devices mean) more data is being transmitted (at a time)
			• **Bandwidth** will be split between all the devices (sending data) // each device uses some of the bandwidth
			• …this means that there is less **bandwidth for each device**
			• Devices have to wait **longer** before they can transmit // **increased** latency
			• If the maximum bandwidth is used then devices cannot transmit
			• Central device/switch/router has to handle more requests and may run slower
			• **More** collisions (likely) // **higher** error rate …
			• …more data has to be retransmitted
			• Loss of **more** packets …
			• …more data has to be retransmitted
				3	The question is why.
					
					More devices do not decrease the bandwidth of the network. They decrease the amount allocated/available to each device.
					
					Do not accept higher contention ratio. This term means the number of users on a connection, and is therefore repeating the question.

3	(a)	(ii)	1 mark e.g. • Bandwidth • Interference // by example • Wired // wireless // transmission medium • Type/amount of data being transmitted • Central hardware performance // by example e.g. router/switch • Error rate • Distance between nodes • Topology // physical layout • Wireless repeaters	1	Do not award the number of users. Question is performance of network as a whole, not an individual device.

3	**(b)**		1 mark for each completed term A website is hosted on a **web server**. The computers that access the websites are called **clients**. The user enters a **Uniform Resource Locator** into a web browser. The web browser sends a request to the **Domain Name Server** for the matching IP (Internet Protocol) address. If found the IP address is returned. A request is then sent to the IP address for the website. An IPv4 address is made of 4 groups of digits. Each group can be between **0** and **255**. The groups of digits are separated by a **full stop**	7	Words are given so must match, however accept domain name system for domain name server, URL, DNS. Accept 0 and 255 in either order Do not allow server for web server because file server is another option and it will be ambiguous.
3	**(c)**		1 mark each to max 2 • Ethernet is used by (mostly) all manufacturers // Ethernet is used in many devices • To allow **compatibility** with other devices • Ethernet has a high bandwidth • Ethernet has inbuilt security • Ethernet is a proven/reliable connection • Ethernet is low cost for **purchase/installation/maintenance** (compared to other wired connections)	2	Accept description of a standard, and/or benefits of Ethernet (i.e. why has this become a standard).
3	**(d)**		1 mark each to max 3 e.g. • Receive packets • Forward/sending/transmitting packets • Maintain a routing table // by description • Identify the most efficient path to the destination / correct IP / correct location • Assign IP addresses to nodes/devices • Converts packets from one protocol to another.	3	Question is tasks carried out by a router, not the use of a router in a network.

3	**(e)**		1 mark each to max 2 e.g. • Data cannot be **understood** if intercepted // The data will be meaningless • So that only authorised users can access the **confidential** material // protect **confidential/personal/user/library** data • To follow legislation/DPA	2	Question is transmission not storage Candidates might answer in terms of why encryption is good, or why the current system is not good. If the candidate has not clearly said which they are talking about (e.g. the current system ….. or encryption means ….) then the reverse of each mark point can be given.
3	**(f)**		1 mark each e.g. Send email: **SMTP** // simple mail transfer protocol Access website securely: **HTTPS** // hypertext transfer protocol secure	2	Mark first answer in each line. If abbreviation is inaccurate, check if written out (and vice-versa).
4			**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** Legal issues: • Copyright designs and patents act - can check for plagiarism automatically and highlight posts e.g. videos or images • Data protection act - needs to make sure rules are followed so that the AI algorithm does not breach e.g. security • Check that materials are all legal • User has agreed the terms when signing up so should expect it Ethical issues: • Users may not want everything they post monitoring • May incorrectly block users/posts

			relation to the question; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact on most areas, showing reasonable recognition of influencing factors. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit		• Can limit plagiarism • Can make sure inappropriate/illegal posts are not published • Website will need to tell users what it is doing and they must agree with it • Record of monitoring reports may be stored and used for other means • Users may feel safer using the website because they know inappropriate material will not be published Privacy issues: • Users may feel like they are being watched all the time • Terms and conditions may sign away their rights to privacy when using the website • People may prefer a computer analysing their posts than people reading them

Question			Answer	Mark	Guidance
5	(a)		1 mark each to max 2 e.g. • Locks • Keycard entry • Biometric **entry to room** • Passcode **entry to room** • Alarms • Security guards/team • CCTV	2	Secure room/device is TV Mark first in each answer space Do not award password, but do award passcodes/word on doors.
5	(b)		1 mark for each name, 1 per bullet for matching to description to max 2 each. e.g. • Anti-malware o Scans for / identifies virus/spyware/malware o Compares data to a database of malware o Alerts user and requests action such as .. o Quarantines/deletes virus/spyware/malware o Stops the download of virus/spyware/malware • Firewall o Scans incoming and outgoing traffic o Compares traffic to a criteria o Blocks traffic that is unauthorised o Blocks incoming/outgoing traffic • Encryption o Scrambles data o …using an algorithm o So if intercepted it cannot be **understood** o Key needed to decrypt • User access levels o Data can be read/write/ read-write // by example o Prevents accidental changes o Limits data users can access • Anti-virus	6	Mark method first. If method is wrong, do not read on. If method is unclear, or part of a description of a method, read full answer. If second method is a repeat of the first (for example password and then locking out) mark whole answer for max 3.

			○ Scans for / identifies virus/malware ○ Compares data to a database of viruses/malware ○ Alerts user and requests action such as .. ○ **Quarantines**/**deletes** virus/spyware ○ Stops the **download** of virus/malware • Anti-spyware ○ Scans for / identifies spyware / keylogger ○ Compares data to a database of spyware ○ Alerts user and requests action such as .. ○ Quarantines/deletes spyware ○ Stops the download of spyware/malware • Passwords/biometrics/authentication ○ code/fingerprint etc. has to be **correctly** entered to gain access ○ strong password // letters, numbers, symbols // fingerprint is unique to individual … ○ harder/impossible for a brute-force attack to succeed ○ lock after set number of failed attempts • Two-step authentication ○ a code is sent to user's separate device ○ unauthorised person will need access to this device as well		

<table>
<tr>
<td>5</td>
<td>(c)</td>
<td></td>
<td>1 mark for each row
<table>
<tr><th>Event</th><th>The Data Protection Act (2018)</th><th>Computer Misuse Act (1990)</th><th>Copyright Designs and Patents Act (1988)</th></tr>
<tr><td>A company transmits personal data to another company without the individual's permission</td><td>✓</td><td></td><td></td></tr>
<tr><td>A school publishes their student's addresses on the school website.</td><td>✓</td><td></td><td></td></tr>
<tr><td>The interface for a piece of software is replicated by a rival company</td><td></td><td></td><td>✓</td></tr>
<tr><td>A user leaves a computer logged on and another person leaves them a message on their desktop</td><td></td><td>✓</td><td></td></tr>
<tr><td>A student guesses their teacher's password and accessing computer account</td><td></td><td>✓</td><td></td></tr>
</table></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(a)</td>
<td>(i)</td>
<td>1 mark per bullet to max 3
• (analogue) sound wave is sampled
• … amplitude/height (of wave) is measured
• … at set/regular time intervals // by example
• Each sample/measurement is stored as a binary number
• The binary number for each sample is stored sequentially</td>
<td>3</td>
<td>MP2 do not award frequency of the wave is measured</td>
</tr>
</table>

<table>
<tr>
<td>6</td>
<td>(a)</td>
<td>(ii)</td>
<td>1 mark for each row
<table>
<tr><th>Change</th><th>File size increases</th><th>File size decreases</th><th>Accuracy increases</th><th>Accuracy decreases</th></tr>
<tr><td>Duration changes from 10 minutes to 20 minutes</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Sample rate changes from 44 kilohertz to 8 kilohertz</td><td></td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>Bit depth changes from 8 bits to 16 bits</td><td>✓</td><td></td><td>✓</td><td></td></tr>
</table>
</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>(b)</td>
<td>(i)</td>
<td>T</td>
<td>1</td>
<td>Case sensitive

Mark first letter</td>
</tr>
<tr>
<td>6</td>
<td>(b)</td>
<td>(ii)</td>
<td>Unicode</td>
<td>1</td>
<td>Accept any other valid</td>
</tr>
<tr>
<td>6</td>
<td>(c)</td>
<td></td>
<td>1 mark each to max 3
e.g.
• Height
• Width
• Colour/bit depth
• Date
• Geolocation
• File size
• File type
• Compression type
• Author</td>
<td>3</td>
<td>Accept anything reasonable but not features of image e.g. names of people

Award resolution for height or width, but max 2 for resolution/dimensions/image size, height, width.

'Colour' on its own is NE.
'Size' on its own is NE.

Needs to be what is stored, e.g. date is stored, age of image is not stored.</td>
</tr>
</table>

6	**(d)**	**(i)**	1 mark each to max 2 • Reduces file **size** • Takes less time to transmit // faster to upload // faster to download • Requires less **storage** space (on the server/device) • May otherwise exceed **email** storage • Uses less bandwidth to transmit • Uses less data to send (e.g. mobile data)	2	Mark first answer in each section
6	**(d)**	**(ii)**	1 mark each to max 2 • Data will be **permanently** lost // not all data is recoverable • **Text files** cannot be compressed with lossy • Teacher requires the original/high quality **image/video/sound** files	2	MP2 is for identifying that the files contain text and they cannot be compressed with lossy

Question			Answer	Mark	Guidance
7	(a)	(i)	1 mark for • ROM is non-volatile, RAM is volatile // by description • Content of ROM cannot (usually) be changed, content of RAM can be changed	1	Read whole answer
7	(a)	(ii)	1 mark each to max 2 e.g. • Web browser/application that is **running** • (Parts of the) operating system currently **running** • Current video/film/tv program being watched • Data being downloaded/buffered • Button pressed by the user • Current volume • Current channel being watched • Source being watched (e.g. HDMI1)	2	Allow anything reasonable but must be clearly RAM e.g. not just stores the software/OS (this is secondary storage). Do not award brand names without exemplification.
7	(b)	(i)	1 mark for example e.g. the OS, web browser software, recorded show, user preferences 1 mark for • To store data once the computer is turned off / permanently // for non-volatile storage	2	Allow 2 marks by example, e.g. "To install software that will not be lost when the TV is turned off" gets 1 mark for software and 1 mark for not being lost when turned off. Do not award brand names without exemplification.

7	**(b)**	**(ii)**	1 mark for choice either magnetic or solid state 1 mark per bullet to max 3 for justification e.g. Magnetic: • Large storage capacity • … for storing software/videos/HD • Television unlikely to be moved • … therefore durability/portability not required • Cost to **purchase** is low • … so the TV will be cheaper to **manufacture**/**purchase** • Device will fit in a tv // device is small • Longevity // reliable Solid state: • Large storage capacity • … for storing software/videos/HD • Television may be moved • …therefore durable/robust/portable • Fast **data access** • … television will be more responsive • Cost to **purchase** is low • …so the TV is not too expensive to **manufacture**/**purchase** • Run quieter • Produce less heat • Use less energy • Compact // lightweight • …so tv can be made smaller / lighter	4	Do not award specific device, e.g. hard disk. Question asks for type. But then FT for justification to max 3. If device and type given award, e.g. solid state drive, SSD, magnetic hard disk drive. Mark first secondary storage type given. No secondary storage type, read justification for a type. Do not award this but mark justification (Max 3). Justification must match choice. If type is inappropriate e.g. optical, do not award.

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OCR
Oxford Cambridge and RSA

Friday 27 May 2022 – Afternoon

GCSE (9–1) Computer Science

J277/02 Computational thinking, algorithms and programming

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions.

SECTION A

1 **(a)** Tick (✓) **one** box in each row to identify whether the OCR Reference Language code given is an example of selection or iteration.

OCR Reference Language code	Selection	Iteration

`for i = 1 to 10`
`  print(i)`
`next i`		

`while score != 0`
`  playgame()`
`endwhile`		

`if playerHit() then`
`  score = 0`
`endif`		

`switch bonus:`
`  case 0:`
`  score = 9`
`  case 1:`
`  score = 7`
`  case 2:`
`  score = 5`
`endswitch`		

[4]

(b) Write pseudocode to increment the value held in the variable `score` by one.

.....

..... **[1]**

(c) State the name of each of the following computational thinking techniques.

Breaking a complex problem down into smaller problems.

.....

.....

Hiding or removing irrelevant details from a problem to reduce the complexity.

.....

.....

[2]

2 A fast food restaurant offers half-price meals if the customer is a student or has a discount card. The offer is not valid on Saturdays.

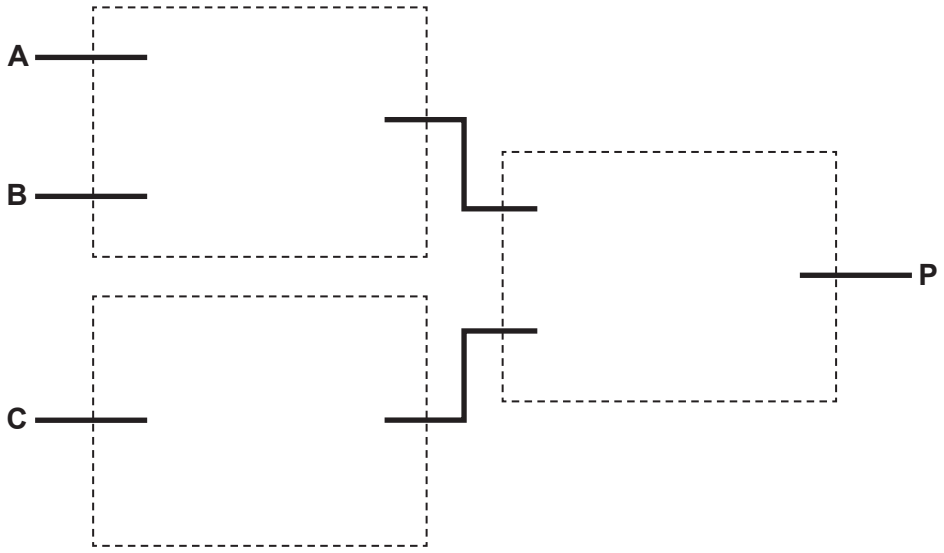
A computer system is used to identify whether the customer can have a half-price meal.

The table identifies the three inputs to the computer system:

Input	Value
A	Is a student
B	Has a discount card
C	The current day is Saturday

(a) The logic system **P = (A OR B) AND NOT C** is used.

(i) Complete the following logic diagram for **P = (A OR B) AND NOT C** by drawing one logic gate in each box.



[3]

(ii) A truth table can be produced for this logic circuit.

Describe the purpose of a truth table.

.....

.....

.....

..... **[2]**

(iii) State how many rows (excluding any headings) would be required in a truth table for the logic expression:

P = (A OR B) AND NOT C

..... **[1]**

(b) The restaurant needs an algorithm designing to help employees work out if a customer can have a half price meal or not. It should:

- input required data
- decide if the customer is entitled to a discount
- output the result of the calculation.

Design the algorithm using a flowchart.

[5]

(c) The restaurant adds a service charge to the cost of a meal depending on the number of people at a table. If there are more than five people 5% is added to the total cost of each meal.

Customers can also choose to leave a tip, this is optional and the customer can choose between a percentage of the cost, or a set amount.

Identify **all** the additional inputs that will be required for this change to the algorithm.

.....

.....

.....

..... **[2]**

(d) Each member of staff that works in the restaurant is given a Staff ID. This is calculated using the following algorithm.

```
01  surname = input("Enter surname")
02  year = input("Enter starting year")
03  staffID = surname + str(year)
04  while staffID.length < 10
05       staffID = staffID + "x"
06  endwhile
07  print("ID " + staffID)
```

(i) Define the term **casting and** give the line number where casting has been used in the algorithm.

Definition .....

.....

Line number .....

[2]

(ii) Complete the following trace table for the given algorithm when the surname "Kofi" and the year 2021 are entered.

You may not need to use all rows in the table.

Line number	surname	year	staffID	Output
01	Kofi			
02		2021		

[4]

3 A program stores the following list of positive and negative numbers. The numbers need sorting into ascending order using a merge sort.

45	12	–99	100	–13	0	17	–27

(a) The first step is to divide the list into individual lists of one number each. This has been done for you.

Complete the merge sort of the data by showing each step of the process.

45	12	–99	100	–13	0	17	–27

[3]

(b) Once the numbers are in order, a binary search can be run on the data.

Describe the steps a binary search will follow to look for a number in a sorted list.

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..... **[4]**

(c) A linear search could be used instead of a binary search.

Describe the steps a linear search would follow when searching for a number that is **not** in the given list.

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.....

..... **[2]**

4 Jack is writing a program to add up some numbers. His first attempt at the program is shown.

```
a = input("Enter a number")
b = input("Enter a number")
c = input("Enter a number")
d = input("Enter a number")
e = input("Enter a number")
f = (a + b + c + d + e)
print(f)
```

(a) Give **two** ways that the maintainability of this program could be improved.

1 .....

.....

2 .....

.....

[2]

(b) Jack's program uses the addition `(+)` arithmetic operator. This adds together two numbers.

(i) State the purpose of each of the arithmetic operators in the table.

Arithmetic operator	Purpose
*	
/	

[2]

(ii) Complete the description of programming languages and translators by writing the correct term from the box in each space.

continues	crashes	debugging	error	executable
high-level	interpreter	language	low-level	many
no	one	stops	with	without

Jack writes his program in a ..... language. This needs to be translated into assembly or machine code before it can be executed. This is done using a translator.

One type of translator is an interpreter. This converts one line of code and then executes it, before moving to the next line. It ..... when an error is found, and when corrected continues running from the same position. This translator is helpful when debugging code.

A second type of translator is a compiler. This converts all of the code and produces an error report. The code will not run until there are ..... errors. The ..... file produced can be run ..... the compiler.

[5]

(c) Jack decides to improve his program. He wants to be able to input how many numbers to add together each time the algorithm runs, and also wants it to calculate and display the average of these numbers.

Write an algorithm to:

- ask the user to input the quantity of numbers they want to enter and read this value as input
- repeatedly take a number as input, until the quantity of numbers the user input has been entered
- calculate and output the total of these numbers
- calculate and output the average of these numbers.

.... **[6]**

SECTION B

We advise you to spend at least 40 minutes on this section.

Some questions require you to respond using either the OCR Exam Reference Language or a high-level programming language you have studied. These are clearly shown.

5 Customers at a hotel can stay between 1 and 5 (inclusive) nights and can choose between a basic room or a premium room.

(a) A typical booking record is shown in the table:

`firstName`	Amaya
`surname`	Taylor-Ling
`nights`	3
`room`	Premium
`stayComplete`	False

(i) State the most appropriate data type for the following fields:

Nights .....

Room .....

[2]

(ii) Give the name of **one** field that could be stored as a Boolean data type.

..... **[1]**

(iii) Booking records are stored in a database table called `TblBookings`.

The following SQL statement is written to display all customer bookings that stay more than one night.

```
SELECT ALL
FROM TblBookings
IF Nights < 1
```

The SQL statement is incorrect.

Rewrite the SQL statement so that it is correct.

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..... **[4]**

(b) When a new booking is recorded, the details are entered into a program to validate the values. The following criteria are checked:

- `firstName` and `surname` are not empty
- `room` is either "basic" or "premium"
- `nights` is between 1 and 5 (inclusive).

If any invalid data is found "NOT ALLOWED" is displayed.
If all data is valid "ALLOWED" is displayed.

(i) Complete the following program to validate the inputs.

You must use **either**:
- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

```
firstName = input("Enter a first name")
surname = input("Enter a surname")
room = input("Enter basic or premium")
nights = input("Enter between 1 and 5 nights")
stayComplete = False
```

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..... **[5]**

(ii) Complete the following test plan to check whether the number of nights is validated correctly.

Test data (number of nights)	Type of test	Expected output
2		ALLOWED
	Boundary	ALLOWED
	Erroneous / Invalid	NOT ALLOWED

[3]

(c) A Basic room costs £60 each night. A Premium room costs £80 each night.

(i) Create a function, `newPrice()`, that takes the number of nights and the type of room as parameters, calculates and returns the price to pay.

You do **not** have to validate these parameters.

You must use **either**:
- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

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..... **[4]**

(ii) Write program code, that uses `newPrice()`, to output the price of staying in a Premium room for 5 nights.

You must use **either**:
- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

.....

.....

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..... **[3]**

(d) The hotel has nine rooms that are numbered from room 0 to room 8.

The number of people currently staying in each room is stored in an array with the identifier `room`.

The index of `room` represents the room number.

Array `room`

Index	0	1	2	3	4	5	6	7	8
Data	2	1	3	2	1	0	0	4	1

The following program counts how many people are currently staying in the hotel.

```
for count = 1 to 8
     total = 0
     total = total + room[count]
next count
print(total)
```

When tested, the program is found to contain **two** logic errors.

Describe how the program can be refined to remove these logic errors.

.....

.....

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.....

..... **[2]**

(e) The hotel car park charges £4 per hour. If the car is electric, this price is halved to £2 per hour.

Write an algorithm to:

- take as input the number of hours the user has parked and whether their car is electric or not
- calculate and output the total price
- repeat continually until the user enters 0 hours.

You must use **either**:
- OCR Exam Reference Language, **or**
- a high level programming language that you have studied.

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..... **[6]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

GCSE

Computer Science

J277/02: Computational thinking, algorithms and programming

General Certificate of Secondary Education

Mark Scheme for June 2022

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 5 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a SEEN annotation to confirm that the work has been seen.

7. Award No Response (NR) if:

- there is nothing written in the answer space

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

   If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response: Not applicable in J277/02

11. **Annotations**

Annotation	Meaning
	Omission mark
	Benefit of doubt
	Cross
	Follow through
	Not answered question
	Benefit of doubt not given
	Repeat
	Tick
	Too vague
	Noted but credit not given, blank pages, pages with no annotation

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>1 mark per correct row

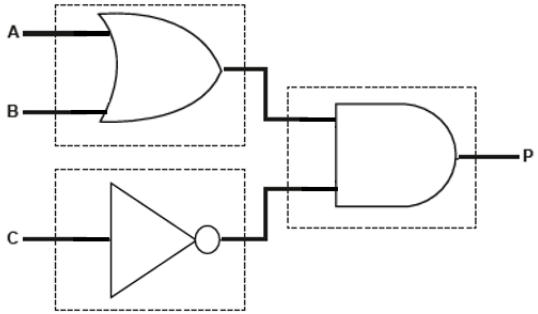
<table>
<tr><th>OCR Reference Language code</th><th>Selection</th><th>Iteration</th></tr>
<tr><td><pre>for i = 1 to 10
    print(i)
next i</pre></td><td></td><td>✓</td></tr>
<tr><td><pre>whilescore != 0
    playgame()
endwhile</pre></td><td></td><td>✓</td></tr>
<tr><td><pre>if playerHit() then
    score = score - 1
endif</pre></td><td>✓</td><td></td></tr>
<tr><td><pre>switch bonus:
    case 0:
        score = 9
    case 1:
        score = 7
    case 2:
        score = 5
endswitch</pre></td><td>✓</td><td></td></tr>
</table></td><td>4
(AO2 1b)</td><td>No mark given if both boxes in a row ticked.

Accept any response (ticks, crosses, etc) that clearly indicates candidate's choice.</td></tr>
<tr><td>1</td><td>(b)</td><td></td><td>• <code>score = score + 1</code> // <code>score +=1</code> // <code>score++</code></td><td>1
(AO3 2b)</td><td>Allow other logically correct answers that result in <code>score</code> increasing by one and being overwritten. Do not accept <code>score + 1 / score = +1</code>

Accept valid structured English answers that refer to score increasing and overwriting the existing value by one. e.g. "score becomes/equals score plus one"

Ignore any superfluous code that does not affect the outcome</td></tr>
<tr><td>1</td><td>(c)</td><td></td><td>• Decomposition</td><td>2</td><td>Correct answer only. Ignore spelling errors.</td></tr>
</table>

			• Abstraction	(AO1 1a)	

Question			Answer	Mark	Guidance
2	(a)	(i)	• A **OR** B • **NOT** C • **AND** gate  	3 (AO2 1b)	1 mark per gate. Correct symbols must be used. NOT gate must have circle for inversion, OR and AND must <u>not</u> have a circle. Mark the **shape** of each gate, not the name written if given. Ignore any writing / notes. Lines do not have to be drawn or joined up, but if they are, gates must have the **correct number of inputs/outputs**. Penalise once then FT.
2	(a)	(ii)	• To show **all possible inputs** (to the logic circuit)… • **…**and the **associated/dependent** output (for each input)	2 (AO1 1b)	For 2nd BP, must be clear that the output is linked to the input values given. "All possible combinations of inputs and outputs" gains the first mark (all possible inputs) but not the second. "The output **for** each possible input" gains both marks
2	(a)	(iii)	• 8 // eight	1 (AO2 1a)	Accept other answers that equate to 8 (e.g. 2^3)

2 (b)

- Start and end/stop with all boxes connected, no boxes that do not lead to another box (no arrows needed)
- Input **three** variables using **parallelogram shape**
- Checks all three criteria (day, student, discount card) using **diamond shape(s)** with two lines from each

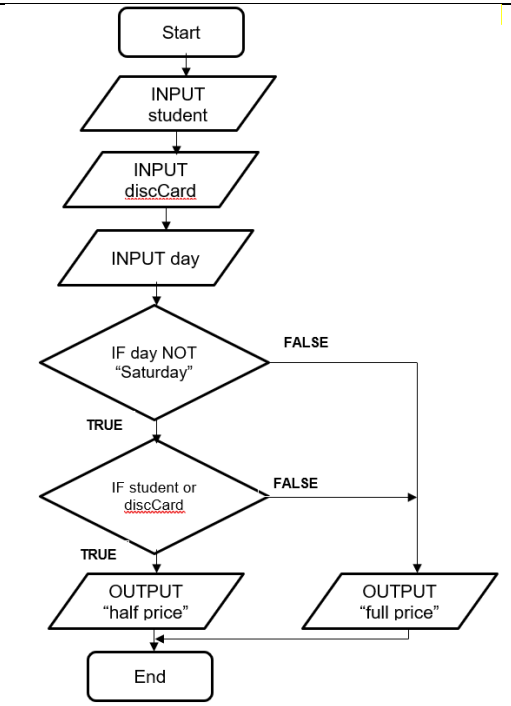
- **…Outputs** "full price" <u>with correct conditions</u> using **parallelogram shape**
- **…Outputs** "half price" <u>with correct conditions</u> using **parallelogram shape**

<u>Guidance for correct outputs</u>

Conditions	Outcome
Not Saturday **and** (either a student or has a discount card).	Half price
Saturday **or** (not a student and doesn't have a discount card).	Full price

Saturday	Student	Discount Card	Outcome
N	N	N	Full price
N	N	Y	**Half price**
N	Y	N	**Half price**
N	Y	Y	**Half price**
Y	N	N	Full price
Y	N	Y	Full price
Y	Y	N	Full price
Y	Y	Y	Full price

5
(AO3 2a)



Question asks for a flowchart. Answers as pseudocode, high level language or other forms are not acceptable 9 (NAQ).

BP 4 and 5 only to be awarded if all decisions ensure correct output and <u>clear what the decisions are</u>. FT for incorrect shapes used or no inputs as long as decisions are logically correct. Must attempt all three decisions.

Allow calculation of half price / full price instead of message but this must still be output.

Inputs / decisions may be presented as individual or combined boxes but must still store as three variables.

Penalise lack of parallelogram for input/output once only then FT

BOD parallelogram shapes if not sure whether input or output as long as context is clear (e.g inputs at start, outputs at end)

<table>
<tr>
<td>2</td><td>(c)</td><td></td>
<td>

Number of people (at the table) // whether there are more than 5 people or not
Choice between percentage and value // actual value of both percentage, value

</td>
<td>2
(AO3 2a)</td>
<td>Ignore additional inputs that would be sensible, such as cost of the meal.

Accept inputs in form of pseudocode / high-level language.

Max 1 if other irrelevant inputs given.

“Whether to leave a tip or not” or “Amount of tip” NE for BP2. Must address both the percentage and value of tip if asked for.
BOD “type of tip” for BP2</td>
</tr>
<tr>
<td>2</td><td>(d)</td><td>(i)</td>
<td>

Convert/change one data type to another
Line 03 // 3 // three

</td>
<td>2
(AO1 1b, AO2 2b)</td>
<td>Do not accept “change to string” – this is the use in this example but not a definition.</td>
</tr>
<tr>
<td>2</td><td>(d)</td><td>(ii)</td>
<td>

Kofi2021 as staffID on line 03
Kofi2021x as staffID on line 05
Kofi2021xx as staffID on line 05
ID Kofi2021xx output on line 07 as first and only output

</td>
<td>4
(AO3 2c)</td>
<td>Max 2 if incorrect order. Ignore misspelling of Kofi

Penalise lack of / errors with line numbers once then FT. Ignore capitalisation. Ignore additional lines unless outcome impacted.

<code>staffID</code> does not have space in. Output does have a space in. Penalise spaces once then FT. Do not penalise unless obvious.

Quotes around answer is OK, but do not allow quotes around partial answers, e.g. <code>"ID" Kofi2021xx</code> is incorrect.
<table>
<tr><th>Line number</th><th><code>surname</code></th><th><code>year</code></th><th><code>staffID</code></th><th>Output</th></tr>
<tr><td>01</td><td>Kofi</td><td></td><td></td><td></td></tr>
<tr><td>02</td><td></td><td>2021</td><td></td><td></td></tr>
<tr><td>03</td><td></td><td></td><td>Kofi2021</td><td></td></tr>
<tr><td>05</td><td></td><td></td><td>Kofi2021x</td><td></td></tr>
<tr><td>05</td><td></td><td></td><td>Kofi2021xx</td><td></td></tr>
<tr><td>07</td><td></td><td></td><td></td><td>ID Kofi2021xx</td></tr>
</table>
</td>
</tr>
</table>

Question			Answer	Mark	Guidance
3	(a)		• Merge into correct **sorted** lists of **size 2** (12 45 **/** -99 100 **/** -13 0 **/** -27 17) • Merge into correct **sorted** lists of **size 4** (-99 12 45 100 **/** -27 -13 0 17) … • …Merge into correct **sorted** list of **size 8** (-99 -27 -13 0 12 17 45 100)	3 **(AO2 1b)**	Do not credit BP3 simply for a sorted list. Groups of numbers must clearly be the correct size. Do not all allow answers that show lists being merged and then sorting in place, this is incorrect.
3	(b)		Any four bullet points for 1 mark each • Select / choose / pick **middle** number (or left/right of middle as even number) and … • **…**check if selected number is **equal to / matches** target number *(not just compare)* • …if searched number is **larger**, discard left half // if searched number is **smaller**, discard right half • Repeat until **number found** • … or remaining list is of size 1 / 0 (number not found)	4 **(AO1 1b)**	Do not allow "split the list in half" on its own as first step, this is incorrect. Can get BP1 and 2 in one step (e.g. "check if the middle number is the one we're looking for") For BP3, accept focussing on correct half Repeat (BP4) must be in the context of an attempt at a binary search. Allow correct reference to recursion. "until number is not in the list" is NE for final BP. Need to explain how this is known.
3	(c)		1 mark each • Starting with the **first value** • Checking **all values in order**	2 **(AO1 1b)**	2nd bullet point must cover both ideas of checking all of the values AND being done in order. "Checks each value" / "one by one" / "step by step" by itself is NE, does not say in order. Do not accept "repeat until value found" for BP2 (question says number is not in the list) "Checks each value from beginning to end" implies order so gets both BP1 and BP2.

Question			Answer	Mark	Guidance
4	(a)		Any two bullet points for one mark each: • Add comments • Name variables sensibly • **Put into** subroutine / procedure / function • Use loop / iteration	2 **(AO2 1b)**	Do not accept indentation (no code to sensibly indent in this example) "Use a subroutine" is not enough. Must be clear that existing code will be put into a new subroutine.
4	(b)	(i)	• Multiplication • Division	2 **(AO1 1a)**	Accept other correct answers that mean the same Accept floor / integer division // division with no remainder (Python v2.x)
4	(b)	(ii)	• high-level • stops // crashes • no • executable • without	5 **(AO1 1b, AO2 1b)**	Ignore spelling errors.

4	**(c)**		• input and stores/uses value with message
			• attempt at repeating…
			• …correctly repeats number of times given as input
			• …correctly take number as input within loop and calculates total of these numbers
			• …correctly calculate an average (total/num)
			• Output both total and average
				6
				(AO3 2b, AO3 2c)
					e.g.
					`num = input("Enter how many numbers")`
					`for x = 1 to num`
					`  temp = input("Enter a number")`
					`  total = total + temp`
					`next x`
					`print(total)`
					`print(total / num)`
					
					If flow chart used, correct shapes needed.
					
					Allow tolerance of 1 with number of loops for BP3 with `for` loops
					
					BP1 requires input with a message (can be two statements, e.g. print and then input or combined. Input must be stored or used.
					
					BP3, 4, 5 must be logically correct to be credited
					Ignore non-initialisation of total
					
					BP 5 can be given as FT as long as an attempt has been made at working out a total within the loop.
					
					BP6 can be given as FT long as attempt made at total and average (not necessarily in a loop)

SECTION B

Note – algorithm questions in Section B (5bi, 5ci, 5cii, 5e) require candidates to answer **using OCR Reference Language or a high-level programming language**. Candidates **cannot** answer using structured English or flowcharts and responses of this nature should be marked as NAQ.

Candidates **do not** need to state which language they are using. Because of this, you must not assume use of a particular language. Mark for logical correctness and **not** for the syntax of any particular language. Ignore case sensitivity. Variable names must be correct/consistent.

Question			Answer	Mark	Guidance
5	(a)	(i)	• Integer • String	2 **(AO3 2a)**	Accept other valid data types from high-level languages (e.g. byte, short for integers) Do not accept descriptions (e.g. “whole number”, “text”). Do not accept “character(s)” for string.
5	(a)	(ii)	• stayComplete	1 **(AO3 2a)**	Ignore spaces or misspelling as long as recognisable.
5	(a)	(iii)	• `SELECT FirstName, Surname, Nights, Room, StayComplete` // `SELECT *` • `FROM TblBookings` • `WHERE` • `Nights > 1` // `Nights >= 2` // `Nights BETWEEN 2 AND 5`	4 **(AO3 1, AO3 2c)**	Order of fields for BP1 not important but must show all fields and be separated by commas. Ignore capitalisation and spacing. Spelling must be correct. Ignore quotes around numeric values or field/table names. Allow other logically valid SQL statements. Check with TL if required. Ignore reference to `stayComplete` or other valid SQL code that would not affect output. Max 3 if in wrong order or if includes any extra invalid code

5	**(b)**	**(i)**	• Checks that **both** `firstname` and `surname` are not empty…
			• Checks that `room` is either "basic" or "premium"…
			• Checks that `nights` is between 1 and 5 (inclusive)…
			
			• …Outputs "NOT ALLOWED" (or equivalent) if <u>any</u> of the 3 checks are invalid (must check all three)
			• …Outputs "ALLOWED" (or equivalent) <u>only</u> if all three checks are valid (must check all three)
			
			Note : output marks are given for if <u>entire system</u> produces the correct output. For example, If a user enters a valid name and room but an invalid number of nights, the system should say "NOT ALLOWED" (or equivalent). If this works and produces the correct response no matter which input is invalid, BP4 should be given.
			
			The same process holds for the valid output – if (and only if) three valid inputs results in an output saying "ALLOWED" (or equivalent), BP5 should be given. Do not give this if ALLOWED is printed when (for example) two inputs are valid and one is invalid.
			
			For any output marks to be given, a sensible attempt must have been made at all three checks. These may not be completely correct (and may have been penalised in BPs 1 to 3) but should be enough to allow the FT marks for output.
				5
				(AO3 2a)
					Must have some attempt at <u>all three checks</u> to give output mark(s). Check for `nights` must check both upper and lower limits.
					
					Iteration can be used as validation if input repeatedly asked for until valid answer given.
					
					<u>Do not accept</u> logically incorrect Boolean conditions such as
					`if firstname or surname == ""`
					
					Do **not** accept <u>></u> or <u><</u> for >=, <=. Ignore capitalisation
					
					e.g.
					`valid = True`
					`if firstname == "" or surname == "" then`
					`  valid = False`
					`end if`
					`if room != "basic" and room != "premium" then`
					`  valid = False`
					`endif`
					`if nights < 1 or nights > 5 then`
					`  valid = False`
					`endif`
					
					`if valid then`
					`  print("ALLOWED")`
					`else`
					`  print("NOT ALLOWED")`
					`endif`
					
					BP1 to 3 can check for valid or invalid inputs. . Pay particular attention to use of AND / OR. Only give marks for output if these work together correctly.
					
					Example above shows checking for **invalid** data. Checks for **valid** data equally acceptable Examples shown below :
					
					• `if firstname != "" and surname != ""`
					• `if room == "basic" or room == "premium"`
					• `if nights >= 1 and nights <= 5`

<table>
<tr>
<td>5</td><td>(b)</td><td>(ii)</td>
<td>

Normal
1 or 5 (not 0 or 6 as says allowed)
Any numeric value except 1 to 5 // any non-numeric input (e.g. “bananas”)

</td>
<td>3
(AO3 2c)</td>
<td>Allow other descriptions that mean normal (e.g. valid / typical / acceptable)

<table>
<tr><th>Test data (number of nights)</th><th>Type of test</th><th>Expected output</th></tr>
<tr><td>2</td><td>Normal</td><td>ALLOWED</td></tr>
<tr><td>1 // 5</td><td>Boundary</td><td>ALLOWED</td></tr>
<tr><td>e.g. 7</td><td>Erroneous/Invalid</td><td>NOT ALLOWED</td></tr>
</table>
</td>
</tr>
<tr>
<td>5</td><td>(c)</td><td>(i)</td>
<td>

Function header for newPrice…
…taking (at least) two parameters
…correctly calculates price based on parameters (if present) <u>within function</u> …
…returns this calculated price

</td>
<td>4
(AO3 2b)</td>
<td>BP1 must be clear that a new function is being defined. E.g. <code>function</code> / <code>def</code> keyword. Allow FT for subsequent marks if not present.

Ignore any code outside attempt at function definition.

Ignore additional parameters. Ignore inputs or additional code as long as these do not overwrite parameters or affect operation of function.

If inputs used instead of parameters, FT for BP3. Allow use of <code>else</code> for second room type in BP3.

Attempt at calculation needed to award BP4. Must return (not output) value. Return can be done e.g. in VB by assigning to function name (e.g. <code>newPrice = price</code>)

e.g.
<pre>
function newPrice(nights, room)
  if room == "basic" then
    price = 60 * nights
  elseif room == "premium" then
     price = 80 * nights
  endif
  return price
endfunction
</pre>
</td>
</tr>
</table>

5	**(c)**	**(ii)**	• Call function newPrice…
			• …with (`"premium", 5)` as parameters
			• …Output **returned value**
				3
				(AO3 2b)
					Order of parameters not important
					
					"premium" must use string delimiters (e.g. "quotes")
					
					e.g.
					`print(newPrice("premium", 5))`
					
					`x = newPrice(5, "premium")`
					`print(x)`
					
					Do not allow function definitions for BP1
					
					Ignore capitalisation of `newPrice`
					
					Candidate could store returned value in a variable and then print this, or store parameters in variables before passing in – these are all acceptable
					
					Ignore any superfluous code given
					
					Do not credit answers where `newPrice` is overwritten prior to use.
					
					Ignore spaces. Allow function call if brackets missing (e.g. `newprice` instead of `newprice()`)

5	**(d)**		• For loop changed to **include 0** • total = 0 moved to **before** loop starts / removed	2 **(AO3 2c)**	Allow loop changed to 0 to 8 or 0 to 9 (Python) Do not accept moving total outside loop, NE (could be moved to after loop which would still be a logic error). Do not accept move to top of loop. Accept corrected code shown. Accept reference to count variable limits for BP1.

5	**(e)**		• Inputs hours AND electric (two separate inputs), storing or using these.
			• Checks if car is electric (IF/Select statement)…
			• …correctly calculates and outputs price (hours * 2 // price / 2) for electric
			• …correctly calculates and outputs price (hours * 4 // electric price * 2) for non-electric
			• Attempt at repetition of BP1 to 4…
			• …until 0 hours entered
				6
				
				(AO3 2c)
					Initialisation of price and hours not necessary, but if present hours must be non-zero for BP6 to be given.
					
					BP5 must include all points attempted. Can still be credited if any of BP1 to 4 not attempted / incorrect.
					
					BP6 can be given as FT even if BP5 (loop) is in the wrong place / does not include all required code
					
					BP6 could be achieved as repeated function calls / recursion
					
					Initial input outside of loop that is then <u>also</u> included within loop is fine. For example, input of hours outside of loop but input is then repeated again at end of loop.
					
					Do not accept `while hours > 0` (could be -1)
					
					Do not penalise answers where 0 is output when loop exits
					
					e.g.
					`while hours != 0`
					`  hours = input("Enter hours")`
					`  electric = input("enter Y for electric or N")`
					`  if electric == "Y" then`
					`  price = hours * 2`
					`  elseif electric == "N" then`
					`  price = hours * 4`
					`  endif`
					`  print(price)`
					`endwhile`

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GCSE

Computer Science

J277/01: Computer systems

General Certificate of Secondary Education

Mark Scheme for June 2023

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the scoris messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

   Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
    - there is nothing written in the answer space or no valid attempt at an answer (e.g. "I don't know")

   Award Zero '0' if:

    - there is an attempt at an answer that is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The scoris **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the scoris messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response: Not applicable in F501
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following:

Descriptor	**Award mark**
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	Meaning
	Omission mark
	Benefit of doubt (must be accompanied with a tick)
	Cross
	Follow through (must be accompanied with a tick)
	Not answered question
	Benefit of doubt not given
	Repeat
	Tick
	Too vague
	Blank pages, pages with no annotation, no attempt to answer the question, page seen on QER
	QER Level 1 mark awarded
	QER Level 2 mark awarded
	QER Level 3 mark awarded

12. Subject Specific Marking Instructions

Mark scheme conventions:

- Each mark point is worth 1 mark unless stated otherwise
- Each mark point can only be awarded once
- A word/phrase that is underlined needs to be exact in the answer to award the mark point
- A word/phrase that is **bold** needs that concept to be in the answer (but can be given in multiple ways) to award the mark point
- 3 dots at the end of one mark point and at the start of the next mark point mean that the second mark point cannot be awarded without the first being awarded, unless the mark scheme states otherwise (for example a reasonable attempt with some inaccuracies)
- 3 dots at the start of a mark point, without 3 dots at the end of the mark point above, means the sentence carries on and there is no dependency
- Any text in brackets is not required to gain the mark point
- Single / means alternative word
- Double // means an alternative statement that is acceptable for the same mark point
- Enlarged font is used for visibility reasons only

Annotating scripts:

- Blank pages at the start of the script need SEEN annotation
- Any questions answered elsewhere (e.g. on the first blank pages, separately on the page) need to be linked within RM Assessor and annotated with ticks/crosses/SEEN as appropriate
- 1 tick for every mark awarded, if a question is given 3 marks there must be 3 ticks (apart from QER question)
- A BOD or FT annotation needs to be accompanied by a tick
- QER question 6 – One annotation from: L1, L2 or L3, according to the level awarded, the page not annotated with the level needs a SEEN annotation. Do not include any ticks, crosses or other annotations on this question – other than SEEN and one from: L1, L2 or L3
- Any answers with no candidate response need a SEEN annotation and NR entered as the mark.
- Any questions where the candidate has not attempted the question e.g. answered 'don't know' need a SEEN annotation and NR entered as the mark.
- All questions must be annotated throughout the marking process.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>1 mark for:
• Binary is used because computers are made of switches that can only be on or off (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
2+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>b</td><td></td><td>1 mark for each completed box
<table><tr><th>Denary</th><th>8-bit binary</th><th>Hexadecimal</th></tr><tr><td>7</td><td>00000111</td><td>7</td></tr><tr><td>49</td><td>00110001</td><td>31</td></tr><tr><td>102</td><td>01100110</td><td>66</td></tr><tr><td>244</td><td>11110100</td><td>F4</td></tr></table></td><td>4</td><td>Must be 8-bits.

Ignore case in hex.

Ignore calculations in answer box.</td></tr>
<tr><td>1</td><td>c</td><td></td><td>1 mark for:
• 200MB (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
2+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>d</td><td></td><td>1 mark for both boxes:
• 4 500 000 bytes (box 1)
4.5 MB (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
1/3+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>e</td><td></td><td>1 mark each:
• Answer (1) 0 0 0 0 1 1 1 1
• Correct working e.g. carrying (might be above, below etc.)
0 1 1 1 0 0 0 1
<u>1 0 0 1 1 1 1 0</u>
0 0 0 0 1 1 1 1
carries: 1 1 1</td><td>2</td><td>Do not award marking for converting each number to denary and adding them together. If the carries are present, and converting to denary is present – award the carries (conversion can be used to check their answer).
Marks are not dependent.</td></tr>
</table>

1	**f**		1 mark each: • Left shift • 3 places	2	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>2</td><td>a</td><td>i</td><td>1 mark for each protocol

<table><tr><th>Task</th><th>Protocol</th></tr><tr><td>Requesting a webpage from a web server</td><td>HTTP // HTTPS</td></tr><tr><td>Entering a username and password to access their bank account</td><td>HTTPS</td></tr><tr><td>Downloading a text document from a web server</td><td>FTP // HTTP // HTTPS</td></tr><tr><td>Checking for new emails in their inbox</td><td>IMAP // POP</td></tr></table></td><td>4</td><td>Mark first answer in each box.

Allow full name to be written e.g. file transfer (protocol).

Accept POP3 or any other version</td></tr>
<tr><td>2</td><td>a</td><td>ii</td><td>1 mark each to max 2:
• Each layer is independent // layers are not reliant on other layers
• One layer can be changed without affecting the others // a layer can function without needing/changing/impacting any other layer // self-contained
• Separates tasks so they can be developed independently
• A developer can focus on only one layer // developer can specialise
• Allows for standards for individual tasks/layers to be developed // for compatibility
• Manufacturers can develop hardware to fit into one particular layer
• To group together similar protocols</td><td>2</td><td>Max 1 in each answer space</td></tr>
<tr><td>2</td><td>b</td><td>i</td><td>1 mark from:
• Uses dedicated/own/internal hardware
// no external/third party hardware/infrastructure
// computers use MAC addresses to communicate within the LAN</td><td>1</td><td></td></tr>
</table>

2	**b**	**ii**	1 mark each to max 4: e.g. • Allows **more** devices to connect … • …for example televisions, mobile phones • Easy to connect (devices) // Easier to setup (wireless connections) // By example e.g. easier for guests to connect their devices • Home is likely small area • … so short distance wireless is sufficient • Devices can move around // can use devices in different areas // can connect from anywhere in the house // can use where wires don't reach // can access from a larger area (than wired) • … by example e.g. student is using a laptop so does not need to be tied to one place // by example e.g. they don't have to disconnect before moving // e.g. they can stay connected whilst moving • Cheaper to **purchase**/**install**/**setup** for new devices // no cost for (new/replacement) wires/hardware • …because no **additional**/**fewer** wires are needed • Fewer trip hazards from trailing wires // reduce risk of damage to cables // fewer cables to damage • More compatible // some devices only have wireless connections	4	Easier/cheaper on their own is NE
2	**b**	**iii**	1 mark each to max 2: e.g. • Prone to interference // by example • Limited range of signal • Slower rate of transmission // less bandwidth // reduced network performance// increased latency // BOD slower connection // more users reduces rate of transmission / bandwidth /performance etc. • Increased risk of **security** concerns // by example e.g. A hacker could connect to the wireless connection • Less stable connection • Higher chance of collisions // Higher error rate	2	MP3 needs to say what is slower / decreased e.g. It's slower, is NE Mark first drawback in each answer space. Less reliable is TV on its own for MP 5

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>3</td><td>a</td><td></td><td>1 mark for each completed space

A character set stores all of the characters that the computer can represent. Each character is given a unique/different binary code.
Lower-case and upper-case letters in a character set are given unique/different/similar binary codes.
One example of a character set is ASCII. This character set uses 8 bits for each character. If the ASCII value for the character 'F' is 70 Then the ASCII value for the character "L" is 76.</td><td>5</td><td>Award the same term used multiple times if used correctly</td></tr>
<tr><td>3</td><td>b</td><td>i</td><td>1 mark:
• Data about the data/image/file</td><td>1</td><td>Question is for a definition, not an example.
If the definition is not clear, for example details about the image, information about the image – this is NE, but read the example to see if it clarifies. For example: 'Information about the image, such as the number of pixels' give a BOD.

Data could be properties/characteristics.</td></tr>
<tr><td>3</td><td>b</td><td>ii</td><td>1 mark each:
• First row: red red purple
• Remainder correct and in correct order

<table><tr><td>red</td><td>red</td><td>purple</td></tr><tr><td>blue</td><td>green</td><td>blue</td></tr><tr><td>purple</td><td>purple</td><td>purple</td></tr><tr><td>red</td><td>green</td><td>blue</td></tr></table></td><td>2</td><td>Ignore case/spelling as long as legible.

If a candidate has completed the table in the incorrect layout e.g. right to left, or bottom to top, then award MP2 as a FT if they have done it all correctly.</td></tr>
<tr><td>3</td><td>b</td><td>iii</td><td>16</td><td>1</td><td>Accept any calculation that equates to 16 i.e. 2^4</td></tr>
</table>

3	**b**	**iv**	1 mark each to max 2: • The **quality** of the image can be improved • The **file** size will increase // takes up more **storage** space // image has/requires/takes up more data • The number of colours that can be represented/used will increase // BOD more colourful	2	Do not award higher resolution, image size increases, clearer image (NBOD) more detailed image (NBOD). Closer to original is NE on its own because there is not an original image in this context. Mark first answer in each answer space.

3	**c**	**i**	1 mark for lossless
			
			1 mark each to max 2 for justification:
			e.g.
			• Lossless will not remove any **data**
			// No **data** is lost with lossless
			// **File**/**data** can be fully reconstructed back to the original
			• Text files require all data to open/be used/work
			// text files will not work if any data is lost
			// lossy cannot (usually) be used on text files
			// none of the required characters / words / spaces / case / formatting / information would be lost
			// the text will remain accurate
			// the text will not have changed meaning
			// the text will still make sense
				3	Do not award an example of lossless for 1st mark (e.g. RLE), but FT for justification.
					
					Do not FT for lossy.
					
					Accept reverse for answers e.g. Lossy will remove data.
					
					If compression type is missing, read justification and if clearly stated which type is used then award justification.
					
					MP1 requires reference to the data (or equivalent) not information.
					MP2 requires reference to the text file context and information is allowed.
					
					If not valid compression – 0 marks.

3	**c**	**ii**	1 mark for lossy 1 mark each to max 2 for justification e.g.: • Will reduce the **file size more/significantly** (than lossless) • Image will only lose **quality** // changes may **not be noticed** by the user // remove **unnoticeable/unnecessary** detail/content	3	Do not award an example of lossy for 1st mark (e.g. reduce resolution), but FT justification. Do not award lossless but FT for justification for lossless: e.g. • Quality/detail of the image can be retained • No data will be lost (permanently) • File size may still be a substantial reduction If compression type is missing, read justification and if clearly stated which type is used then award justification. Do not award how the file can be compressed e.g. reduce number of colours – unless they also state that this change will not be noticed. MP1 it compresses the file more is NE – compression is in the question, the candidate needs to explain what this means. If not valid compression – 0 marks.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>4</td><td>a</td><td></td><td>1 mark for each row

<table>
<tr><th>Threat</th><th>Anti-malware</th><th>Penetration testing</th><th>Encryption</th><th>Firewall</th></tr>
<tr><td>Spyware</td><td>✓</td><td></td><td></td><td>(✓)</td></tr>
<tr><td>Brute-force attack</td><td></td><td>(✓)</td><td></td><td>✓</td></tr>
<tr><td>Data interception</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>SQL injection</td><td></td><td>✓</td><td></td><td>(✓)</td></tr>
</table></td><td>4</td><td>(✓) can be present, or not</td></tr>
<tr><td>4</td><td>b</td><td></td><td>1 mark for threat
1 mark each to max 2 for description
e.g.
• Threat: Social engineering
• Using deception to manipulate users
• …to gain personal data

• Threat: Shoulder surfing (threat or expansion)
• Watching a person entering a password
• …and using it to access an account

• Threat: Phishing
• Fake emails sent to person // click on link from fake email
• Person sends personal data // gives away personal data

• Threat: Pharming
• Software that redirects user to fake website // use of a fake website
• Person enters personal data // gives away personal data

• Threat: Denial of service // DOS // DDOS
• Multiple requests sent to a server (simultaneously) // server is flooded with requests
• More requests than the server can process // uses all of the bandwidth available
• Server cannot respond // server crashes/denies access // stops access to a network // slows access to a network

• Threat: Hacker
• Person gaining unauthorised access to a system/account</td><td>3</td><td>If threat is clearly wrong do not FT.

If no threat given, read description for name of threat. If no name, do not award.

If threat is vague award matching description.

Allow social engineering as the threat – naming and description of phishing/pharming/shoulder surfing in the description.

Ransomware – MP3 cannot be awarded for 'ransom' on its own without reference to it being paid.

For actions that the malware/virus etc. can carry out – award any feasible action.</td></tr>
</table>

			• To delete/damage/access data • Threat: Virus/malware • Software that replicates/spreads • Fills disk space • Deletes/corrupts data // allows unauthorised access • Threat: Trojan • Malware disguised as legitimate software • Once installed acts as a virus // by example of action e.g. deleting files / allows unauthorised access • Threat: Worm • Software that replicates across a network • Uses up all the bandwidth • Threat: Ransomware • Encrypts/corrupts/locks access to data • Cannot access data without **paying** a fee**/**money // **pay** fee/money to get them back/decrypted // Cannot access data without meeting demands • Threat: Physical threat // by example • Damage to hardware • Deletes/corrupts data		

5	**a**	**i**	1 mark each
			Primary
			• to store (active) **data/instructions/software/OS** that the **processor** needs to **access**
			// without primary the computer won't be able to start up/work
			// (ROM) so the start-up instructions are not deleted when the computer turns off
			// (RAM) to store the **currently** running **data**/**software**/**instructions**
			// (Cache) to store **frequently** used **data/instructions**
			
			Secondary
			• to store **data**/**files long-term**/**permanently**
			// without secondary the user's files will not be stored when the power is turned off
			// store **data** not currently being used
				2	Question is not what they store, but why they are needed.
					
					Secondary NBOD 'to backup data' without reference to the long-term/permanence

5	**a**	**ii**	1 mark for device, 1 mark for data • Hard drive // SSD // USB (memory) stick // Flash memory card // CD // DVD etc. • E.g. Images created // documents // software // files // data moved from RAM to virtual memory	2	Allow any secondary device. BOD 'optical disc' Question asks for device not type of device e.g. magnetic/optical/solid state is NE. Award example even if incorrect secondary storage. USB on its own is NE

<table>
<tr>
<td>5</td>
<td>a</td>
<td>iii</td>
<td>1 mark for each row.
<table>
<tr><th>Statement</th><th>True (✓)</th><th>False - correct the statement</th></tr>
<tr><td>A section of primary storage is partitioned to act as virtual memory</td><td></td><td>A section of secondary storage is partitioned to act as virtual memory</td></tr>
<tr><td>Data from ROM is transferred into VM</td><td></td><td>Data from RAM is transferred into VM</td></tr>
<tr><td>VM is needed when RAM is full, or nearly full</td><td>✓</td><td></td></tr>
<tr><td>Data from VM is transferred back to secondary storage when needed</td><td></td><td>Data from VM is transferred back to RAM when needed</td></tr>
</table>
</td>
<td>4</td>
<td>Allow a description of the error in column 2, e.g.
in row 1: 'primary should be secondary'

Accept HDD/SSD for secondary storage for the 1st row.

Do not accept primary for RAM (rows 2 and 4).</td>
</tr>
<tr>
<td>5</td>
<td>b</td>
<td></td>
<td>1 mark from:

Performs housekeeping actions
Monitor / manage / maintain a computer system
Help the computer run smoothly/efficiently
To diagnose/fix/identify problems with a computer system

</td>
<td>1</td>
<td>Do not award example on its own</td>
</tr>
</table>

5	**c**	**i**	1 mark for identification: • Artist's computer // computer uploading the images // BOD The artist 1 mark each for justification to max 2: e.g. • Sends the files/data for storage/to the **host**/web **server** // the files are stored on the web **server** • Performs the user's actions … • .. and sends the results to the web **server** • Sends a **request** to the web **server**… • … to **store**/**upload** its files • It does not store data for others to access • Confirmation of upload/error is received (from server) for display	3	Incorrect computer, do not award justification. Be careful the justification is talking about the upload of images to the web server, not the download. Accept host for web server. If 'user's computer' is given for identification, this is NE – read on for justification. If 'user viewing the website' or similar is given this is incorrect.
5	**c**	**ii**	1 mark for identification: • Web server 1 mark each for justification to max 2: e.g. • The images/data are stored on / uploaded to / sent to / hosted on the web server • Web server receives a request (from the artist's computer to upload the images) • Web server executes/responds to the request // Web server is doing the processing/handling the (request to) upload • Web server returns confirmation/error of the processing/upload	3	If computer is incomplete or inaccurate e.g. server/website instead of web server. Do not award computer, but award justification. Allow FT in justification if the same inaccurate term is used, for example 'website' is given as computer (NE), but justification is: 'images are sent to the website' (FT for website instead of web server). Incorrect computer, do not award justification.

5	**d**	**i**	1 mark each: e.g. • Authors can earn money • …by selling for a fee // using licences to stop unauthorised use • No-one can see the code • …users cannot edit/change the software // by example inserting malware • …so it cannot be copied/resold/shared • More **control** over intellectual property // by example e.g. restrict users, restrict what can be done with the software without permission	4	Benefit is to artist and programmer – not user. Mark the answer as a whole. Do not award reference to ownership/copyright because both allow copyright of the code/program.
5	**d**	**ii**	1 mark for point, 1 for expansion: e.g. • Users can **view/edit** the (source) code // Users can **edit** the program/software • …to **tailor/improve/adapt** it to do what they need/want • …so errors can be fixed (by anyone) • …users can learn how the software works • Freely accessible • …do not have to pay • …can redistribute … • …with changes	2	Benefit to users not artist and programmer
6			**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times underdeveloped.	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** Some points may cover more than one 'issue'. Legal issues: • DPA needs to be followed or company could be fined e.g. Customers informed the system is used Data held for specified

			The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact and most are showing reasonable recognition of influencing factors. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit		time/reasons Data kept secure • Centre is private property so customers can choose not to enter • Can be used to identify people committing crimes e.g. theft, used as evidence, make sure the correct people are caught. Ethical issues: • Users feel safer because they know any actions are being monitored and help/action will be taken if needed • If users have not done anything then there is no reason to be tracked/recorded so should not impact them • Users feels unsafe because they are being watched • Users may be unaware they are being recorded - need to be informed, give consent • Users do not know where the videos/data about them and their movements is stored/how it is used - DPA reference Privacy issues:

					• Users may feel it is an invasion of privacy • Users are in a public place and can be legally recorded by anyone anyway • Users may feel like they are being watched all the time • Users have not given their permission to be tracked • Users may not know the system exists

Question			Answer	Mark	Guidance
7			1 mark for example: e.g. • Auto lights • Auto window wipers • Sat nav // GPS • Airconditioning // climate control • Radio/entertainment/infotainment system/media system • Lane assist • Engine management system • Auto-park • Cruise control • Auto-brake • Follow-me • Dashcam 1 mark each to max 2 for explanation. • **Limited** functions // by example e.g. the system **only** checks the light and turns lights on/off • **Dedicated** microprocessor // by example e.g. there is a microprocessor that is only checking the lights • Hard to change function // by example e.g. the user cannot make the light system do any other role	3	Allow anything that could be reasonably within a car. If example is not clear if it's an embedded system, read explanation for justification e.g. hazard lights – could be embedded if they are activated automatically when the car crashes. Award the example in the explanation if this occurs. If justification is generic features of an embedded system max 1 for explanation. Do not award 'built into the car/larger machine' because this is in the question.

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GCSE

Computer Science

J277/02: Computational thinking, algorithms and programming

General Certificate of Secondary Education

Mark Scheme for June 2023

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 5 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses
When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
    - there is nothing written in the answer space or no valid attempt at an answer (e.g. "I don't know")

Award Zero '0' if:

- there is an attempt at an answer that is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. **Annotations**

Annotation	Meaning
	Omission mark
	Benefit of doubt (must be accompanied with a tick)
	Cross
	Follow through (must be accompanied with a tick)
	Not answered question
	Benefit of doubt not given
	Repeat
	Tick
	Too vague
	Blank pages, pages with no annotation, no attempt to answer the question, page seen on QER

11. **Subject Specific Marking Instructions**

Mark scheme conventions:

- Each mark point is worth 1 mark unless stated otherwise
- Each mark point can only be awarded once
- A word/phrase that is underlined needs to be exact in the answer to award the mark point
- A word/phrase that is **bold** needs that concept to be in the answer (but can be given in multiple ways) to award the mark point
- 3 dots at the end of one mark point and at the start of the next mark point mean that the second mark point cannot be awarded without the first being awarded, unless the mark scheme states otherwise (for example a reasonable attempt with some inaccuracies)
- 3 dots at the start of a mark point, without 3 dots at the end of the mark point above, means the sentence carries on and there is no dependency
- Any text in brackets is not required to gain the mark point
- Single / means alternative word
- Double // means an alternative statement that is acceptable for the same mark point
- Enlarged font is used for visibility reasons only

Annotating scripts:

- Blank pages at the start of the script need SEEN annotation
- Any questions answered elsewhere (e.g. on the first blank pages, separately on the page) need to be linked within RM Assessor and annotated with ticks/crosses/SEEN as appropriate
- 1 tick for every mark awarded, if a question is given 3 marks there must be 3 ticks
- A BOD or FT annotation needs to be accompanied by a tick
- Any answers with no candidate response need a SEEN annotation and NR entered as the mark.
- Any questions where the candidate has not attempted the question e.g. answered 'don't know' need a SEEN annotation and NR entered as the mark.
- All questions must be annotated throughout the marking process.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>1 mark per row

<table>
<tr><th>Statement</th><th>Low-level</th><th>High-level</th></tr>
<tr><td>The same language can be used on computers that use different hardware</td><td></td><td>✓</td></tr>
<tr><td>It allows the user to directly manipulate memory</td><td>✓</td><td></td></tr>
<tr><td>It allows the user to write English-like words</td><td></td><td>✓</td></tr>
<tr><td>It always needs to be translated into object code or machine code</td><td></td><td>✓</td></tr>
</table></td><td>4
(AO1 1b)</td><td>No mark if more than 1 tick for that row.

Allow other indications of choice (e.g. cross) as long as clear.</td></tr>
<tr><td>1</td><td>(b)</td><td></td><td><u>total</u> = num1 + num2</td><td>1
(AO3 2b)</td><td>Allow other logically valid responses that result in <code>total</code> storing the correct value. Accept other suitable assignment operators (e.g. ←)

e.g.
<code>total = sum(num1, num2)</code>

<code>total = num2 + num1</code>

<code>x = num1 + num2</code>
<code>total = x</code>

Ignore any values given to the variable. Ignore capitalisation and minor misspelling. Ignore superfluous code that does not affect outcome.</td></tr>
</table>

Question			Answer	Mark	Guidance
1	(c)	(i)	`print(12 ^ 2)`	1 (AO2 1a)	Accept ** or other sensible operator that indicates raising to a power. If pseudocode operator given, must be a single word/symbol (e.g. `pow`), not containing spaces.
1	(c)	(ii)	`if number MOD 2 == 0 then`	1 (AO2 1a)	Accept **%** or other sensible operator that indicates modulus If pseudocode operator given, must be a single word/symbol (e.g. `modulo`), not containing spaces.
1	(c)	(iii)	`difference = measurement1 - measurement2`	1 (AO2 1a)	Accept other sensible operator that indicates subtraction. If a pseudocode operator given, must be a single word/symbol (e.g. `minus`), not containing spaces.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr>
<td>1</td><td>(d)</td><td></td>
<td>1 mark each:
• Start is set to 3 on line 01 and 3 is output on line 03.
• 2, 1 and 0 are output on next 3 iterations with start updated to 2, 1, 0, -1 on correct line numbers.
• Finished is output on line 06

<table>
<tr><th>Line</th><th>start</th><th>Output</th><th></th></tr>
<tr><td>01</td><td>3</td><td></td><td rowspan="2">BP1</td></tr>
<tr><td>03</td><td></td><td>3</td></tr>
<tr><td>04</td><td>2</td><td></td><td rowspan="8">BP2</td></tr>
<tr><td>03</td><td></td><td>2</td></tr>
<tr><td>04</td><td>1</td><td></td></tr>
<tr><td>03</td><td></td><td>1</td></tr>
<tr><td>04</td><td>0</td><td></td></tr>
<tr><td>03</td><td></td><td>0</td></tr>
<tr><td>04</td><td>-1</td><td></td></tr>
<tr><td>06</td><td></td><td>Finished</td><td>BP3</td></tr>
</table>
</td>
<td>3
(AO3 2c)</td>
<td>Ignore lines 02 and 05 in answer unless these change or output any values.

Candidate may repeat start value when unchanged, this is acceptable.

Penalise incorrect or missing line numbers or additional output once only then FT. This includes where variable change and output appear on the same line.

-1 must not be output for BP2

Penalise missing or incorrect output once only for BP1 and FT for missing or incorrect output for BP2.

Finished may be with or without quotes. Ignore case or minor spelling error.

Max 2 marks if any incorrect output or changes to <code>start</code>.

Do not accept calculated values of start (e.g. <code>3-1</code>)</td>
</tr>
</table>

Question			Answer	Mark	Guidance
2	(a)		1 mark each: Syntax error • Error in the rules/grammar (of the program language). • Program does **not** (fully) **run / translate / execute / start** (BOD) Logic error • Produces incorrect / unexpected **result/output** • Program **runs/does not crash**	**2** (AO1 1a)	Question asks for a definition. Examples may strengthen the response but are not acceptable by themselves. Do not allow “error/problem in the code, does not work / does not do what designed/intended to do” for either, this applies to both. “Error in the syntax” or “error in the logic” are NE even with examples

Question			Answer	Mark	Guidance
2	(b)		Line number • 02 Correction • `for scoreCount = 0 to scores.length - 1` Line number • 03 Correction • `total = scores[scoreCount] + total` • `total = total + scores[scoreCount]` • `total += scores[scoreCount]`	**4** (AO3 2c)	1 mark for each line number correctly identified. 1 mark for each correction. Correction must match line number. If wrong line number, do not mark correction. If no line number, mark correction only. Do not penalise if response removes `-1` from `scores.length` as long as it starts at 0. Do not penalise potential off by 1 errors for looping (Python). Do not penalise case or minor spelling errors as long as intention is clear. Allow description of change that would be made (e.g. “change 1 to 0”) First correction is fixing indexing error so element 0 is included. This could be done on line 03 e.g. `scores[scoreCount-1].` Second correction is fixing addition of total. If both errors fixed on line 03, full marks should be given. e.g. **`total = total + scores[scoreCount-1]`**

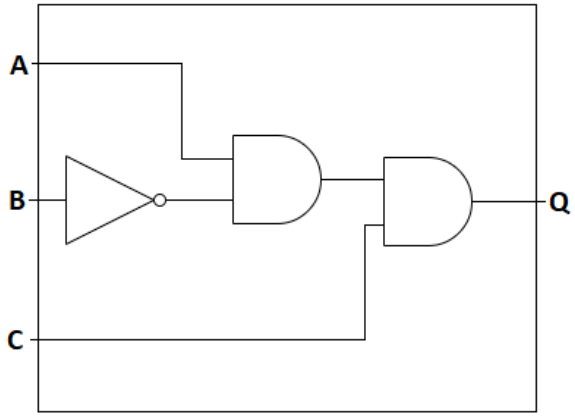
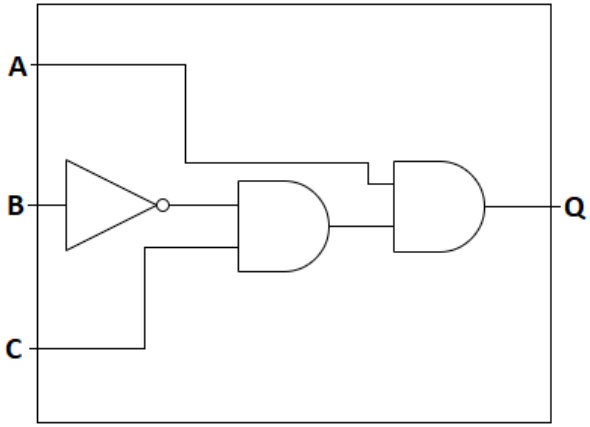
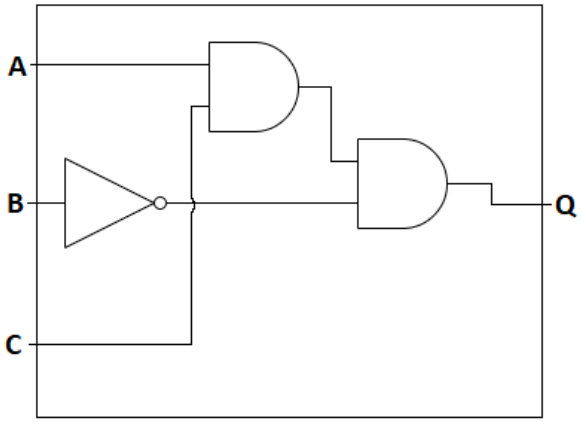
Question			Answer	Mark	Guidance
3	(a)		1 mark each • stores/holds **data/value/name/`names[pos]`** • …so (value) can be changed / swapped / moved / overwritten / inserted • …without being lost. • will be assigned to `names[pos-1]`	**2** (AO2 1b)	Do not allow answers that clearly refer storing the <u>position / index</u> (or any other out of context data) for BP1; it is the name itself that is being stored, not the position. If unclear, allow BOD. e.g. do not allow "holds the values of the index / holds value for position of the name". Allow FT for subsequent points.
3	(b)		1 mark • **do not know** how many iterations / swaps needed • **do not know** (at run time) how many times the value will **change positions** • **do not know** how many times a condition-controlled loop will need to **run** / **execute** 1 mark • condition controlled loops run while/until a condition **is true** / **is false** / until a condition **is met** • repeats while value in [pos-1] is larger than value in [pos] // while (further) swap needed • will swap value until in **correct position** // will swap whilst in **incorrect position**	**2** (AO2 1b	Max 1 from each section, 2 marks total. Do not allow "while names are in the wrong order". BP4 must have reference to <u>checking</u> a condition / condition being met, not just having a condition.

Question			Answer	Mark	Guidance
			• More efficient than / does not need to iterate as many times as **count controlled / for loop**		
3	**(c)**	**(i)**	1 mark each for insertion and bubble sort, max 2 Insertion sort: • inserts/moves values into **correct position** • inserts value **once** (then in correct position) • stops when end of array reached // completes in one **pass** through the array • moves items down the array / left • start of array becomes sorted first • creates a sorted array **within** an array // has a sorted/unsorted **partition / section / list** • starts on 2nd value • more efficient/faster than bubble sort • … because fewer iterations / comparisons (on average) • … when data more scrambled Bubble sort : • compares/swaps **pairs** of values • value is **repeatedly** moved/swapped (until in correct position) • repeats if a swap has been made // needs multiple passes	**2** (AO1 1b)	Answer must reference both bubble sort and insertion sort for 2 marks except if efficiency mark plus expansion given. Allow reference to big O for efficiency discussion. Only award efficiency once. Only award fewer iterations once Do not accept “completes in one iteration” for insertion sort. Accept list / data / values / etc for array. “when data more scrambled” only makes sense when discussing efficiency/speed, do not give marks for saying that either can handle data that is more scrambled (they both can sort data however it is arranged). Do not accept “bubble/insertion sort does not” for 2nd mark.

Question			Answer	Mark	Guidance
			• will complete a final iteration once sorted (to check for no swaps needed) • moves items up the array • end of array becomes sorted first • moves/bubbles the highest value to the top • less efficient/slower than insertion sort (on large sets of values) • … more iterations / comparisons (on average) • … when data more scrambled		
3	**(c)**	**(ii)**	1 mark each to max 2 e.g. • Both produce a sorted list / array • Both work in place / without duplicating data / without using divide and conquer • Both need a temporary variable • Both swap values • Both use loops / iteration / repeats • Both loops are nested / inside each other • Both (may) need multiple passes • Both use selection • Both work with an array / list data structure • Both work from left to right • Both build up **sorted list** one item at a time (after every pass) • Both compare (pairs of) **values** • Both (typically) **less efficient / slower** than merge sort (or other sorting algorithms)	**2** (AO1 1b)	Allow reference to both sorting / putting items into order for BP1. "Allows sorting of numbers and strings" meets BP1 Allow answers relating to not needing additional memory as BP2. Allow "breaking into smaller lists" as divide and conquer for BP2. If answer is a statement (e.g. "uses loops"), assume candidate is talking about both algorithms doing this.

Question			Answer	Mark	Guidance
			• Both inefficient / slow for **larger / unsorted** lists **//** efficient for **small** / (nearly) **sorted** lists • Both start by comparing first two values		

4	**(a)**		1 mark each, max 2 if not fully correct circuit. • NOT B • AND gate with A / C as one **direct** input… • …Second AND gate with other (unused) A / C as **direct** input **and** output of previous stage as other input Fully correct circuit is any of : • Q = (A AND NOT B) AND C • Q = A AND (NOT B AND C) • Q = (A AND C) AND NOT B See examples below :	**3** (AO3 2a)	Shapes of logic gates must be correct. NOT gate must include circle for inversion. No other gates should include circle. AND gates must have two different inputs, NOT gate must have one input. All gates must have one output. Correct system will always have **NOT B** and two other AND gates correctly joined. Accept alternative systems that produce the correct output. Accept (BOD) three input AND gate for BP2 and BP3 if used correctly. OK if inputs/outputs not joined up to A/B/C/Q as long as intention clear. If lines cross on diagram, give BOD. If (A AND C) AND NOT B drawn, allow NOT B as first input for BP3.

			 Q = (A AND NOT B) AND C  A AND (NOT B AND C)  (A AND C) AND NOT B		
	(b)		1 mark each • Logic gate 1: **OR** • Logic gate 2: **AND**	**2** (AO2 1a)	Allow **A OR B** // **B OR A** for logic gate 1 Allow **A AND B** // **B AND A** for logic gate 2 If logic statement provided with multiple gates (e.g. A OR B AND C) this is incorrect. Allow use of symbols (e.g. ∨, + for OR, ∧, **.** for AND) Allow correct drawing of logic gates.

Question			Answer	Mark	Guidance
5	(a)	(i)	1 mark each to max 2 • Check the program works (as intended) • meets user requirements. • gives the correct **output** / **result** • Find / detect / check for errors / bugs • Check the program does not crash // is robust // executes / runs • To try and break the program // destructive testing • Test for / improve usability / user experience / performance // check user feedback is **suitable** • Allow any errors to be fixed // make changes / improvements as a result of testing • Ensure no problems / issues fixed **when released**. • Defensive design considerations / anticipating misuse / so cannot be misused	**2** (AO1 1b)	Allow answers that explain what would happen if not tested (e.g. “there might be bugs”)

Question			Answer	Mark	Guidance
5	(a)	(ii)	1 mark for name, 1 mark for matching description e.g. • Final / terminal testing… • … Completed at the end of development / before release. • … to test the product as a whole. • Iterative / incremental testing… • …completed during development. • …after each module is completed. • … test module in isolation • Normal testing… • …test using data that should be accepted // • …test that is expected to work / pass • Boundary / Extreme testing… • …test using data that is on the edge of being acceptable / unacceptable. • …test highest / lowest value • Invalid / Erroneous testing… • …test using data that should be **rejected** / is not acceptable / causes an error	**2** (1 AO1 1a), (1 AO2 1b)	Allow other sensible descriptive names for testing. Description must match test type. Must be a description and not just an example, but example may support description. Do not accept descriptions that simply repeat type of test without further clarification (e.g. “boundary, testing the boundary”). Allow : • Black box testing… • …testing **without** access / knowledge of a system’s workings. • White box testing… • …testing **with** access / knowledge of system’s workings. Allow other sensible / valid types of testing. Do not accept examples of validation (e.g. type test, range check) “data that is not expected” is NE for invalid/erroneous unless clarified.

Question			Answer	Mark	Guidance
5	(a)	(iii)	1 mark for feature 1 mark for matching description e.g. • Translator / compiler / interpreter … • … convert to **low-level/machine code** • …allow program to be executed / run • …produce executable file (only for compiler) • …stops execution when error found (interpreter only) • Run-time environment / output window… • …allows **program / code** to be run / executed • …shows output of the **program / code** • Error reporting / diagnostics • … identify **location/detail** of errors • …suggests fixes • Debugger … • …find errors • Stepping … • … execute/run the program line by line • Variable watch…	**4** (AO2 1b)	Allow other sensible names for features. Description must add more than is given in the identification of the feature to be awarded. For example, “keyword highlighting, highlights keywords” is 1 mark for the feature only. If compiler and interpreter given as two distinct features, allow both (with suitable descriptions). Do not allow translator and compiler/interpreter. Description must match feature. “finding errors” is NE for description of error reporting. Allow sensible references to AI where appropriate. Sensible description of use needed. Allow other sensible features of an IDE (e.g. line numbering, auto indent, collapsed blocks, etc) with suitable description. For text editor / error diagnostics / debugger, allow other sensible features listed as features in the mark scheme as description (e.g. “text editor,

Question			Answer	Mark	Guidance
			• … see the **contents/data** held in variables • Break points … • … will allow the program to stop **at a chosen / set position** • Text/code editor… • …allows program code to be **written** / **entered / changed** • …allows errors to be fixed • Pretty printing // keyword highlighting… • … allows keywords / variables to be coloured / identified • Keyword completion // syntax suggestion… • …suggests code/syntax when first part entered.		provides pretty printing", "debugger, provides stepping")

Question			Answer	Mark	Guidance
5	(b)		1 mark for method, 1 mark to max 2 for each use e.g. • Range check • … checks **upper/max / lower/min / boundaries** • … make sure the players **answer / input** is between sensible limits (e.g. 20 or less, between 2 and 20 inclusive) // not negative • …by example of program code • Type check • … making sure the data inputted is of the correct **data type** • … make sure **answer / input** is an **integer** (or equivalent e.g. whole number) • Presence check • … making sure a value is inputted / not blank • … reference to **answer / input** • …by example of program code • Length check • … **limit** number of **characters** // check **maximum** / **minimum string** length • … **answer / input** must be **1 or 2 characters**	**6** (4 AO2 1b) , (2 AO1 1a)	Validation must be applied to the rules of the game as given; **do not** accept uses related to input not asked for (e.g. names, passwords, etc). Do not accept uses that simply repeat the name of the check (e.g. “range check, checks a range of numbers”) For range check, values must be sensible (e.g. 1 to 50), and allow input of 2 to 20. Do not allow 1 / 10 (answer could be over this). For length check, must be clear that the **string** version of the data input is being checked to award use marks (e.g. characters not digits). Accept alternative names or descriptions (e.g. existence check, boundary check) but name of check must be sensible. Mark each answer as a whole, ignore method/use headings. Do not accept defensive design elements (e.g. input sanitisation, authentication)

Question			Answer	Mark	Guidance
			• …by example of program code • Format check • … making sure the data inputted follows a **set pattern** • … checking **answer / input** consists of **only** 1 or 2 numeric digits • …by example of program code • Look up / table check • … making sure the data inputted is one from an **allowed set of values** • … checking that **answer / input** is one of **[2, 3…20]** inclusive • …by example of program code		Examples of program code can be actual code (e.g. `if inp>=2 and inp<=20`) or identification of technique (e.g. “use IF statement / Case statement to limit values to between 1 and 20”). Do not accept code just showing casting.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>5</td><td>(c)</td><td></td><td>1 mark each to max 6

• Initialise / declare <code>score</code> (to zero) before use, outside of any loop
• Generates 2 random numbers between 1 and 10
• Inputs answer from user displaying suitable numbers
• Checks if input is correct answer…
• … if correct adds 1 to <code>score</code>
• Repeats BP2 to 5 three times (for bullet points attempted)
• Outputs <code>score</code> after reasonable attempt at counting</td><td>6
(AO3 2b)</td><td>No need to cast data to string/integer.

If random numbers chosen, BP3 must use these. If no random numbers chosen, allow manually setting values

BP6 can be awarded for either a loop repeating 3 times or the same code written out 3 times

BP5 can be given FT if sensible attempt at BP4

Do not award BP6 if same numbers used for every question. Must pick new values each time.

Do not penalise potential off by 1 errors for looping (Python) or random number generation

Example answer

<pre>score = 0
for count = 1 to 3
   num1 = random(1, 10)
   num2 = random(1, 10)
   ans = input("What is” +num1 + " + " +
num2 + "?")
   if ans = num1 + num2 then
      score = score + 1
   end if
next count
print("You scored " + score)</pre></td></tr>
</table>

Section B

<table>
<tr>
<td>6</td>
<td>(a)</td>
<td></td>
<td>1 mark for each row

<table>
<tr><th>Variable</th><th>Boolean</th><th>Char</th><th>String</th><th>Integer</th><th>Real</th></tr>
<tr><td>UserName</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>EmergencyPhone</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>DoorSensor</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>DoorTime</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
</table>
</td>
<td>4
(AO3 2a)</td>
<td>No mark if more than 1 tick on a row.

Allow other indications of choice (e.g. cross) as long as clear.</td>
</tr>
<tr>
<td>6</td>
<td>(b)</td>
<td></td>
<td>1 mark each:
• Attempt at using selection / condition controlled loop
• Checking if system armed // while system armed
• If Door Sensor active OR Window Sensor active (both checks required)
• calling SoundAlarm correctly</td>
<td>4
(AO3 2b)</td>
<td>Selection could be done using IF statement, case statement or any other sensible valid method.

Allow reference to <code>AlarmActivated</code> or equivalent instead of <code>SystemArmed</code>

Ignore any inputs or modification of variables.

Allow True / False as strings. Allow checking against strings (e.g. <code>if SystemArmed == "active"</code>)

Allow checking armed/disarmed for BP2 and BP3

Only award BP4 if SoundAlarm correctly called / not called in every situation. If issues on previous lines (e.g. lack of brackets where needed) means this is not the case, do not award BP4.</td>
</tr>
</table>

					Checking could be done by evaluating variable directly (`if SystemArmed`) or by comparison (`if SystemArmed == True`)
					
					Example answer 1
					
					`if SystemArmed then`
					`  if DoorSensorActive then`
					`  SoundAlarm()`
					`  else if WindowSensorActive then`
					`  SoundAlarm()`
					`  endif`
					`endif`
					
					Example answer 2
					
					`while SystemArmed then`
					`  if DoorSensorActive then`
					`  SoundAlarm()`
					`  else if WindowSensorActive then`
					`  SoundAlarm()`
					`  endif`
					`endif`
					
					Example answer 3
					
					`if SystemArmed and (DoorSensorArmed or WindowSensor) then`

					SoundAlarm()
					endif
					
					Note – above example needs brackets,
					
					if SystemArmed and DoorSensorArmed or WindowSensor then
					
					is not logically valid for this scenario (will sound alarm when not armed if window sensor is active)
					
					<u>Example answer 4</u>
					
					if SystemArmed and DoorSensorArmed
					SoundAlarm()
					else if SystemArmed and WindowSensorArmed
					SoundAlarm()
					endif

6	**(c)**	**(i)**	1 mark for • Line 04	**1** (AO3 1)	
6	**(c)**	**(ii)**	1 mark from • sensorType • sensorNumber • sensorID	**1** (AO3 1)	Do not penalise case, spacing or minor misspellings.
6	**(c)**	**(iii)**	1 mark for • Boolean	**1** (AO3 1)	Ignore minor misspelling. Accept Bool.

6	**(c)**	**(iv)**	1 mark from • Line 01 • Line 02 • Line 03 • Line 05	**1** (AO3 1)	
6	**(c)**	**(v)**	1 mark each • Selection • Sequence	**2** (AO3 1)	Ignore minor spelling errors / differences Do not accept examples (e.g. IF)
6	**(d)**		1 mark each • `SELECT SensorID` // `SELECT *` • `FROM events` • `WHERE Length > 20 AND sensorType = "Door"` // `WHERE sensorType = "Door" AND Length > 20`	**3** (AO3 2c)	Max 2 if out of order or anything extra that affects the output. BP1 can select multiple fields as long as `SensorID` is included. Ignore case. Only penalise spaces if obvious. Field names must be correct. "door" must be in quotation marks for BP3. Allow quotation marks for field names and table name BP3 can use == or = for equivalence. Allow alternative WHERE clauses that are logically correct (e.g. `WHERE length >=21`)

<table>
<tr>
<td>6</td>
<td>(e)</td>
<td></td>
<td>1 mark each
• Define procedure SaveLogs…
• …with two valid parameters
• Open file (for write/append) …
• … using the file name passed in as parameter
• Write data to file…
• …using the data passed in as parameter
• Close file</td>
<td>6
(AO3 2b)</td>
<td>Must be clear that answer is a procedure definition, do not credit calling procedure for BP1. Allow function definition.

If parameters are later overwritten, do not credit BP2 but FT for BP4 and 6.

Closing text file does not need reference to file name/object – e.g. “<code>close file</code>” is enough. However, if given reference must be correct.

If code given outside of procedure, do not give BP4 and BP6

Allow FT for multiple occurrences of same mistake (e.g. not using filename correctly for open and close)

<u>Example answer</u>

<pre>procedure SaveLogs(data, filename)
   logFile = open(filename)
   logFile.writeLine(data)
   logFile.close()
endprocedure</pre></td>
</tr>
<tr>
<td>6</td>
<td>(f)</td>
<td>(i)</td>
<td>1 mark for:
• Casting / cast</td>
<td>1
(AO3 2a)</td>
<td>Accept type casting Do not accept conversion. Do not accept examples of casting.</td>
</tr>
</table>

6	**(f)**	**(ii)**	1 mark each to max 6 • Input date and store in variable / use directly • Access **all** seven (indexes 0 to 6) events in array // loop for each event in array • Attempt at selection… • …to compare `date` input against `date` <u>in array</u> (element 0) • …adding `length` (element 3) <u>from array</u> to the total <u>if dates match.</u> • Outputting <u>calculated</u> total and date in appropriate message(s) <u>at the end</u>	**6** (AO3 2b)	BP2 can be achieved either by iteration accessing each event or manually repeating code to access each event. Must be 0 to 6, not 1 to 7. Allow reference `to events` (table given) or `arrayEvents` (2D array) in answer as long as used consistently. BP2 loop allow off by one errors (Python), looping to array length or array length – 1. Allow `for each item` in array or any other suitable loop. BP4 and BP5 allow array reference as either column major or row major. Output can either be once at the end or on every iteration, as long as it is output at the end. Only give output mark if attempt made to **calculate** total <u>within the algorithm</u>. Do not penalise capitalisation or minor misspellings of variable names.

					Example answer 1
					
					`total = 0`
					`date = input("Please enter date")`
					`for count = 0 to events.length-1`
					`  if events[0, count] == date then`
					`  total = total + events[3,count]`
					`  endif`
					`next count`
					`print("There were " + total + "`
					`events on " + date)`
					
					Example answer 2
					
					`total = 0`
					`date = input("Please enter date")`
					`for item in events:`
					`  if item[0] == date then`
					`  total = total + item[3]`
					`  endif`
					`next count`
					`print("There were " + total + "`
					`events on " + date)

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J277/01: Computer systems

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the

highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
    - there is nothing written in the answer space

- there is nothing of relevance to the question written in the answer space

Award Zero '0' if:

- anything is written in the answer space and is related to the question and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. *Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.*

10. For answers marked by levels of response: Not applicable in F501
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	Meaning
A	Omission mark
BOD	Benefit of doubt (must be accompanied with a tick)
	Cross
FT	Follow through (must be accompanied with a tick)
NAQ	Not answered question
NBOD	Benefit of doubt not given
REP	Repeat
	Tick
TV	Too vague
SEEN	Blank pages, pages with no annotation, no attempt to answer the question, page seen on QER
L1	QER Level 1 mark awarded
L2	QER Level 2 mark awarded
L3	QER Level 3 mark awarded

12. Subject Specific Marking Instructions

Mark scheme conventions:

- Each mark point is worth 1 mark unless stated otherwise
- Each mark point can only be awarded once
- A word/phrase that is underlined needs to be exact in the answer to award the mark point
- A word/phrase that is **bold** needs that concept to be in the answer (but can be given in multiple ways) to award the mark point
- 3 dots at the end of one mark point and at the start of the next mark point mean that the second mark point cannot be awarded without the first being awarded, unless the mark scheme states otherwise (for example a reasonable attempt with some inaccuracies)
- 3 dots at the start of a mark point, without 3 dots at the end of the mark point above, means the sentence carries on and there is no dependency
- Any text in brackets is not required to gain the mark point
- Single / means alternative word
- Double // means an alternative statement that is acceptable for the same mark point
- Enlarged font is used for visibility reasons only

Annotating scripts:

- Blank pages at the start of the script need SEEN annotation
- Any questions answered elsewhere (e.g. on the first blank pages, separately on the page) need to be linked within RM Assessor and annotated with ticks/crosses/SEEN as appropriate
- 1 tick for every mark awarded, if a question is given 3 marks there must be 3 ticks (apart from QER question)
- A BOD or FT annotation needs to be accompanied by a tick
- QER question 4 – One annotation from: L1, L2 or L3, according to the level awarded, the page not annotated with the level needs a SEEN annotation. Do not include any ticks, crosses or other annotations on this question – other than SEEN and one from: L1, L2 or L3. A single cross can be used when there is nothing of credit and 0 marks (instead of NR) is being awarded.
- Any answers with no candidate response need a SEEN annotation and NR entered as the mark.
- Any questions where the candidate has not attempted the question e.g. answered 'don't know' need a SEEN annotation and NR entered as the mark.
- All questions must be annotated throughout the marking process.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>1 mark each
<table><tr><th>8-bit Binary</th><th>Denary</th></tr><tr><td>11110000</td><td>240</td></tr><tr><td>01101001</td><td>105</td></tr><tr><td>00011110</td><td>30</td></tr></table></td><td>3</td><td>Binary must be 8-bits</td></tr>
<tr><td>1</td><td>b</td><td></td><td>1 mark each
<table><tr><th>Statement</th><th>Answer</th></tr><tr><td>The smallest denary number that can be represented by a 4-bit binary number.</td><td>0</td></tr><tr><td>The largest denary number that can be represent by a 6-bit binary number.</td><td>63</td></tr><tr><td>The maximum number of different colours that can be represented with a colour depth of 7-bits</td><td>128</td></tr><tr><td>The minimum number of bits needed to represent 150 different characters in a character set.</td><td>8</td></tr></table></td><td>4</td><td>Accept calculations that equate to the same answer.

Accept any number of 0s for the first answer.</td></tr>
<tr><td>1</td><td>c</td><td></td><td>11110000</td><td>1</td><td>Ignore leading 0s</td></tr>
</table>

1	**d**		1 mark for an example 2-digit hex number **correctly** converted into denary. 1 mark each to max 2 for describing/showing each stage. Either: Multiplying: • **Multiply** the **left/first** digit by **16** • **Add** value of **second** digit (without additional calculation) Or: Converting: • Convert each digit into **4-bit binary** • Combine and convert the **8-bit binary** to denary	3	No marks for converting denary to hex. If the example has an inaccurate result, for example they have converted A to 11. They can still get the method marks. No requirement to show how letters are used.
1	**e**		1 mark for correct working (4 carries) 1 mark for answer 01111010 Working showing carries e.g. 01101011 00001111 01111010 1 1 1 1	2	Do not award working mark for conversion to denary and back. Carries must be on the correct values, but could be above, below etc.

Question			Answer	Mark	Guidance
2	a	i	1 mark for each valid IP v4: • 4 groups of denary numbers between 0 and 255 separated by full stops (example v4: 123.16.46.72) v6 • 8 groups of hex numbers between 0 and FFFF separated by colons. Double colon can appear **once** and replaces any number of groups of consecutive 0000 (example v6: 0252:5985:89ab:cdde:a57f:89ad:efcd:00fe) (example v6: F513:8C:2A::999:0000 expanded would be F513:8C:2A:0000:0000:0000:999:0000)	2	V6 Each hex number can be between 1 and 4 digits
2	a	ii	1 mark each to max 2 • (usually presented in) hexadecimal / denary / binary • 6 groups of numbers // 12 (hex) numbers • … each group has paired/2-digit (hex) numbers / 8 bit binary number • 48 bits long • Separated by colons/hyphens • (The first half/part) contains the **manufacturer ID** // (first half/part) identifies the manufacturer • (The second half/part) contains the **serial number** // (second half/part) identifies the device	2	MP1 'numbers' is NE Allow both marks for a valid example. NB '6 pairs of numbers' gets MP2 and MP3. '4 pairs of numbers' gets MP3

2	**b**	**i**	1 mark each for benefit 1 for application to max 4 e.g. • Fast connection/speed // high bandwidth // consistent bandwidth • … e.g. reduce delays at check in // by example for airport • Secure // unlikely to have unauthorised access/hacked // data transmissions are likely to be safe • …e.g. so that data about passengers/staff/aeroplanes is not intercepted // by example for airport • Little interference // little chance of data loss // reliable • … e.g. flight status is received without delay // by example for airport • Long range transmission • … e.g. airport has a large floor area/terminals // by example for airport	4	Mark in pairs. Mark each benefit space to the candidates' benefit. An expansion/application for a benefit can be awarded in the other answer space. 1 benefit and 1 expansion for each answer space. Max 2 marks per answer space. **Max 3** marks if expansions have no direct application to the **airport** and its **computers** connecting using **wired** connections. If the second expansion is not applied, annotate with **^** NOT cost. The question is not a comparison to wireless, but accept answers worded in this way. Fast on its own is NE. 'faster to connect' is NE because this could

					be to set up the connection as opposed to the bandwidth.
2	**b**	**ii**	1 mark each to max 3 e.g. • Staff do not need to be in one-place // movement of staff // can work whilst moving to another part of the airport // can be accessed from any location (in range) • Staff can be more responsive to customers/requests • Allows a larger number of connections/devices // more scalable … • … without the disruption/cost of installing more cables • Some devices do not allow physical/wired connection // allow wider range of type of device (or by example such as vehicles/mobile devices/aeroplanes) • Easier to add/connect more devices • Do not need to find/use a physical connection/wire // can allow you to connect in a place where there isn't a cable/connection • For use as a backup if the wired connection fails	3	Do not award cost on its own. Do not award range on its own. Allow explanation of how a wireless network will benefit the passenger as well as the airport and staff. Allow in reverse if clear, for example wired restricts staff to one location.
2	**c**	**i**	1 mark each for drawing showing: • 5 computers, 2 printers and 1 switch **all clearly labelled** • All devices directly connected to the **switch** // all computers connected to **switch** and each printer to a switch/computer(s) • Only 8 devices **and** no additional connections other than to the switch (or central device, or printers to only one computer each)	3	Allow any type of computer e.g. PC, laptop. Do not accept client for computer. MP1 there must be at least 5 computers, at least 2 printers, at least 1 switch

2	**c**	**ii**	1 mark for benefit e.g. • Easier to add new nodes // easier to setup BOD • Central device can monitor/control **transmissions** • Faster data transmission • Fewer data collisions • One connection/computer breaks the network still works • Less cost of **cables** 1 mark for drawback e.g. • Switch fails the network fails // reliant on a central device (working) // single point of failure • Extra cost of **central device/switch**	2	Speed, cheaper etc. on its own is NE Server is irrelevant. Read whole benefit and award a valid benefit. Read whole drawback and award a valid drawback. Do not award contradictory statements.
2	**c**	**iii**	1 mark each to max 3 e.g. • Connects the devices together in the network // allows devices to communicate in the network • **Receives** data from (all) devices in the star topology • Record/register/store the address of devices connected to it … • …in a table • Uses MAC address of devices • Direct data **to destination** • …if address not recorded transmit to all devices	3	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>3</td><td>a</td><td></td><td>1 mark for function and 1 name for task

<table>
<tr><th>Function</th><th>Task</th></tr>
<tr><td>Memory management // managing memory</td><td>Moves data from secondary storage to RAM</td></tr>
<tr><td>Peripheral management</td><td>• Receiving data from input devices
• Transmitting data to output devices
• Installing/downloading device drivers
• Allows communication from input device / to output device</td></tr>
<tr><td>File management // managing files</td><td>Allows the user to create, name and delete folders</td></tr>
<tr><td>User interface</td><td>• Outputting data to the user
• Receiving input from the user
• Allows user to communicate/interact with/control the computer
• Creating/displaying/allowing interaction with a GUI/command prompt interface</td></tr>
</table></td><td>4</td><td>BOD storage for memory in the first function.

Peripheral: allow input and output devices by example.

File management, do not award folder management.

The task for peripheral management needs to extend 'manage' i.e. 'manage output devices' is NE.</td></tr>
<tr><td>3</td><td>b</td><td></td><td>1 mark for each term

encryption software changes data using a key. If the changed data is intercepted it cannot be understood. This software does not stop the data from being intercepted.

defragmentation software analyses the data on a disk to find files that have been split and stored in separate locations. The split files are moved to be consecutive in storage and the free space is moved together. This does not provide more storage space on the disk, instead it makes the access of the data faster because the read head does not have to move as far to access the next part of the file.</td><td>6</td><td>Encryption
Key
Understood
Defragmentation
Consecutive
Access

Mark first answer in each space.</td></tr>
</table>

Question			Answer	Mark	Guidance
4			**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* The answer covers all required elements (legal/ethical, benefits, drawbacks) given in the question about open source **and** proprietary and includes a recommendation with justification. The top of the band makes a clear and structured recommendation to the programmer. **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact on most areas, showing reasonable recognition of influencing factors. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* The answer includes one or more from legal/ethical, benefits, drawbacks for open source **and** proprietary. Alternatively, the answer could have a justified recommendation without clearly referencing the bullet points in the question. **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** Licence features Open source – (usually free), can access/change source code, redistribute Proprietary – purchase at a cost, cannot access/change code Legal and ethical issues: • Both provide copyright • Open source – allows more people to take code and possibly change to resell, or adapt in their own programs to resell or claim as their own (reverse for proprietary) • Open source – allows more people access to the game because there is likely no cost (reverse for proprietary) Benefits and drawbacks: • Open source – wider customer base, more exposure, users can alter to make it better/fix

			candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* The answer is limited to the facts about open source **and/or** proprietary. **0 marks** No attempt to answer the question or response is not worthy of credit		bugs, limited documentation, little financial gain • Proprietary – allows programmer to earn money, gives more control over what happens with the program, usually well tested, more restrictions for copyright, cannot be adapted to meet user needs, Decision: Either would be appropriate, justification needs to be clearly for the scenario

5	**a**	**i**	1 mark for The amplitude of the wave is measured at set intervals	1	2+ ticks = 0 marks
5	**a**	**ii**	1 mark each to max 2 • The number of bits per sample will change // by example e.g. there will be more/less bits per sample • The file size will change // by example e.g. the file size will increase/decrease • There will be a change in the accuracy of each sample/amplitude/sound // by example e.g. more precise amplitudes // by example e.g. a wider/smaller range of amplitudes can be recorded • The quality will change // there will a different amount of distortion // by example e.g. the quality will improve/decline	2	MP3 needs to be clearly a wider range of amplitudes can be recorded i.e. more different values. **Not** that there are more **amplitudes/samples per second.** MP3 – 'more amplitudes can be measured' is BOD, but 'more amplitudes measured per second' is incorrect. BOD 'sound' for 'amplitude' e.g. for MP3 "a larger range of sounds can be recorded."

5	**b**	**i**	No mark for type. Accept the type by example e.g. HDD for magnetic. 1 mark each for each point matching to type given to max 4 Magnetic e.g. • (Usually) cheaper cost to purchase per unit of data • Sufficient/good durability for what is needed • … computer unlikely to move (regularly) // by example • Sufficient/fast speed of access • …no significant delays in storing/reading data • (Long-term) reliable // longevity • …unlikely to need to purchase another //unlikely to break from over-use • High capacity • … e.g. file size of sound files can be large // allows the musician to store files with higher bit depth Solid state e.g. • Cost often equates to magnetic per quantity // not expensive per unit of data • Durable // robust // no moving parts • …so computer can be moved without risk of losing data • Fast **speed of access** of data • … no significant delays in storing/reading data // musician does not have to wait for files to load/store • High capacity // (nearly the) same/higher capacity than magnetic • …file size of sound can be large • Small in physical size • … device is portable // can fit in a smaller type of computer • Produces less sound when running • … so the musician distracted • Requires little/less power (compared to others) • … so running costs are reduced • Drives do not get fragmented files • … drives do not need to be defragged // constant access time	4	MP1 needs to be cost per unit e.g. it costs less per GB than other storage types. Not just 'it is cheap to buy'. Allow reverse argument for each e.g. for magnetic, why they have not chosen solid state. For example: 'magnetic is not as robust but the computer will not be moved' gets 1 mark for the not moving, and 1 mark for solid state's robustness is not required. If there is no type give on line 1. Read the answer to look for a type and then award justification. If there is not type identified anywhere in the answer, 0 marks.
5	**b**	**ii**	1 mark for Optical	1	BOD optic. Do not award an example of optical storage
5	**b**	**iii**	1 mark for 200 000 KB	1	2+ ticks = 0 marks

5	**b**	**iv**	1 mark for the answer 3 GB 1 for working e.g. • 3 * 1000 / 1000 • 3 * 1000 • 3000 / 1000 • 3 / 1000 • 0.003 * 1000	2	Allow 2.9296875 (or approximated) for division by 1024. Allow addition of metadata e.g. 10% added. This can be awarded for both working and answer. Not all of the working needs to be correct to get the working mark. Ignore mention of MB/GB in the working.
6	**a**		1 mark each • **Data/instructions** are fetched from **memory/RAM/primary storage** • **Data/instructions** are stored using the registers // **correct example** of a register storing address/data • **Data/instructions** are decoded // **Data/instructions** are split into opcode and operand • **Data/instructions** are **executed/processed** • **ALU** performs the logical/arithmetic calculations	2	MP4 BOD carried out etc. for executed. Ignore inaccurate references to registers and components (other than MP2 correct example of a register).

6	**b**		1 mark for naming register, 1 for matching purpose • Program counter // PC • **Stores** the **address** of the **current/next** instruction to be fetched // **stores** the **address** of the instruction for the **current/next** FE **cycle** • Memory address register // MAR • **Stores** the **address** of the **current/next** instruction/data to be fetched // **stores** the **address** where data/instruction is to be stored • Memory data register // MDR • **Stores** the **data/instruction** fetched from memory // **stores data/instruction** to be stored in memory // stores the **data/instruction** located in the **memory** location in the **MAR** • Accumulator // ACC • **Stores** the **result** of calculations // **stores data currently** being processed / by example // **stores** the result from the ALU	4	Careful that the purpose is not an action such as fetches, takes, retrieves. Read full purpose and award a correct point Accept • Current instruction register//CIR//Instruction register//IR • Stores the instruction currently being executed BOD memory buffer register for MDR. If there is no register but the register is given in the purpose column, award the purpose if accurate. If the answer in the register column is incorrect, do not mark purpose. For PC and MAR, accept 'pointer' for storing address Accept memory address, memory data
6	**c**		1 mark each to max 3 • Clock speed • Cache size • Number of cores	3	'clock' 'cache' 'speed' 'cores' on its own is NE.

7	**a**		1 mark each to max 3 • Has a specific purpose // it only performs one/limited task // dedicated to the Follow Me system • Built within a larger device/car • **Dedicated**/specific/its own hardware / sensors • Has a microprocessor • Built-in operating system/software // software is all in firmware/ROM • …it's instructions/operation does not/is hard to change/update • It is a control system // it is automated	3	MP2 BOD reference to it being 'built into' 'something' reasonable
7	**b**	**i**	1 mark each to max 2 • Start-up instructions // BIOS // bootstrap // where to find the OS • Firmware // Program/instruction to run the Follow Me system // Instructions for operation • Example of data being stored e.g. the maximum speed, the min distance • Operating System // OS	2	MP2 'programs' on its own is NE MP3, Allow two marks for examples of instructions or data. For example both marks can be given for: 1 – The maximum speed 'Follow Me' can operate 2 – The minimum distance the car in front can be
7	**b**	**ii**	1 mark each to max 3 e.g. • Current distance from car in front • Set distance from car in front • Current speed of vehicle • Current speed of vehicle in front • Reading from sensor • Driver actions (e.g. moving wheel/braking) • Direction the car (in front) is travelling (e.g. turning)	3	'speed' or 'distance' on its own is NE BOD reference to a camera taking images of what is in front
7	**b**	**iii**	1 mark each to max 2 • Only stores a small amount of data in **RAM** // only stores specific/few items in **RAM** • …unlikely to run out of **RAM** // there is enough space in **RAM** • No secondary storage to use/needed as VM • Few/one program/instructions running at a time // no memory intensive tasks • Dedicated hardware will be optimised for system // **RAM** is designed to meet the system's requirements	2	

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

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01223 553998

Alternatively, you can email us on

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Please get in touch if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.

GCSE

Computer Science

J277/02: Computational thinking, algorithms and programming

General Certificate of Secondary Education

Mark Scheme for June 2024

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PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
    - there is no attempt to answer the question (including blank responses and comments such as "I don't know")

   Award Zero '0' if:
    - An attempt is made in the answer space but this is not worthy of credit.

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response (not applicable in J277/02):
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	Meaning
	Omission mark
	Benefit of doubt (must be accompanied with a tick)
	Cross
	Follow through (must be accompanied with a tick)
	Not answered question
	Benefit of doubt not given
	Repeat
	Tick
	Too vague
	Blank pages, pages with no annotation, no attempt to answer the question, page seen on QER

12. **Subject Specific Marking Instructions**

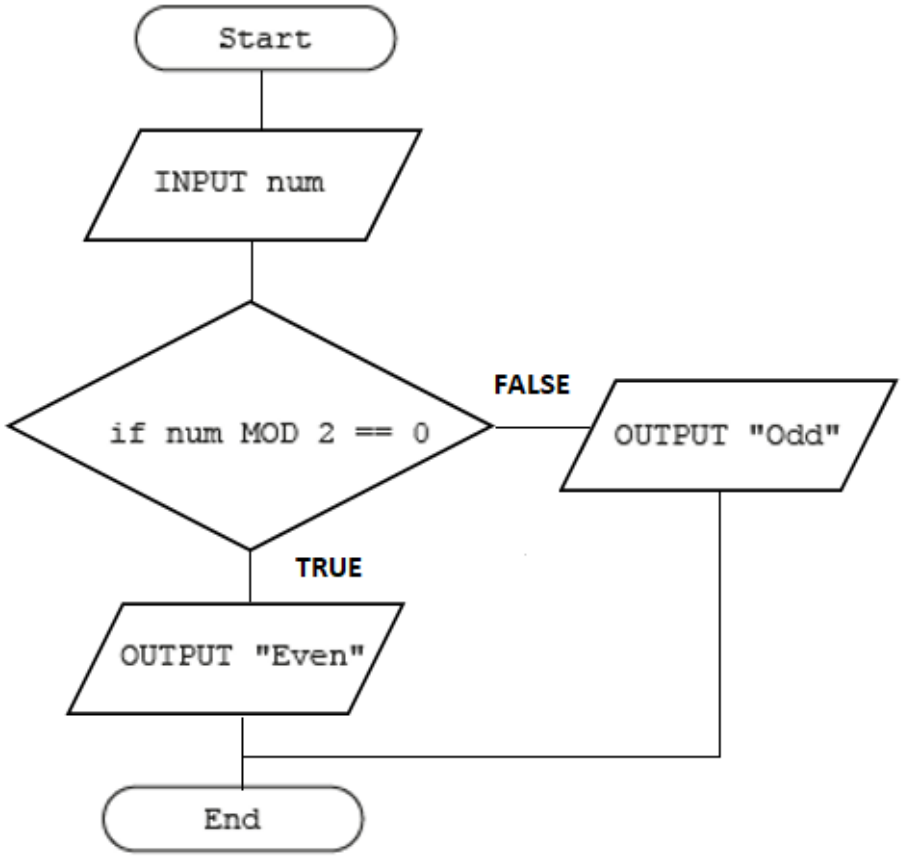
Mark scheme conventions:

- Each mark point is worth 1 mark unless stated otherwise
- Each mark point can only be awarded once
- A word/phrase that is underlined needs to be exact in the answer to award the mark point
- A word/phrase that is **bold** needs that concept to be in the answer (but can be given in multiple ways) to award the mark point
- 3 dots at the end of one mark point and at the start of the next mark point mean that the second mark point cannot be awarded without the first being awarded, unless the mark scheme states otherwise (for example a reasonable attempt with some inaccuracies)
- 3 dots at the start of a mark point, without 3 dots at the end of the mark point above, means the sentence carries on and there is no dependency
- Any text in brackets is not required to gain the mark point
- Single / means alternative word
- Double // means an alternative statement that is acceptable for the same mark point
- Enlarged font is used for visibility reasons only

Annotating scripts:

- Blank pages at the start of the script need SEEN annotation
- Any questions answered elsewhere (e.g. on the first blank pages, separately on the page) need to be linked within RM Assessor and annotated with ticks/crosses/SEEN as appropriate
- 1 tick for every mark awarded, if a question is given 3 marks there must be 3 ticks.
- A BOD or FT annotation needs to be accompanied by a tick
- Any answers with no candidate response need a SEEN annotation and NR entered as the mark.
- Any questions where the candidate has not attempted the question e.g. answered 'don't know' need a SEEN annotation and NR entered as the mark.
- All questions must be annotated throughout the marking process.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td></td><td></td><td>
<table>
<tr><th rowspan="2">Keyword</th><th colspan="2">Programming construct</th></tr>
<tr><th>selection</th><th>iteration</th></tr>
<tr><td>if</td><td>✓</td><td></td></tr>
<tr><td>for</td><td></td><td>✓</td></tr>
<tr><td>while</td><td></td><td>✓</td></tr>
</table>
</td><td>3
(AO1)</td><td></td></tr>
</table>

2			• Correct shape for **all three** inputs AND outputs (parallelogram) • Correct shape for decision (diamond) • True and False // Yes and No labelled **correctly** *(true/Yes linking to "Even")* • **All** lines joined up correctly and link to End.  	4 (AO2)	No need for arrows – lines are acceptable. BOD for correct answers that include a loop back to the start

3	**(a)**		Max 1 mark for definition that is clearly different from a logic error. • (an error that) breaks the **rules/grammar** of the **programming language** • Stops the program from **running** // does not allow program to **run** // crashes the program // does not allow program to **translate** Suitable example for 1 mark, e.g. • misspelling **key word** (e.g. **`printt`** instead of **`print`**) • Missing / extra symbol (e.g. missing bracket, missing semicolon) • Mismatched quotes • Invalid variable or function names (e.g. variable starting with a number or including a space) • Incorrect use of operators • Use of reserved keywords for variables (e.g. **`print = 3`**) • Incorrect capitalisation of keywords (e.g. **`P`**`rint` instead of `print`) • Incorrect indentation (of code blocks) • Missing concatenation (e.g. `print(score x)`)	2 (AO1)	BOD code/program etc for BP1 Do not allow answers linked to data types. "incorrect grammar" by itself is NE Do not allow “stop working”, "does not work", etc – TV. Do not accept missing quotation marks e.g. `print(hello)` (could be a variable name) BOD given code that could cause a syntax error in a high-level language.

3	**(b)**		1 mark each
			• line 03
			• `total = num1 + num2`
			
			• Line 04
			• `if total >= 10 and total <=20 then`
			
			Allow other logical equivalent code e.g.
			`total = int(num1) + int(num2)`
			`if 10 <= total <= 20`
				4 (AO3)	Allow other logical corrections that will fix the problem identified and does not introduce any further errors.
					
					Allow descriptions of changes as long as clear exactly what will change. Do not allow ambiguous descriptions of changes to code.
					
					Ignore missing `then` from line 04.
					
					Ignore capitalisation.

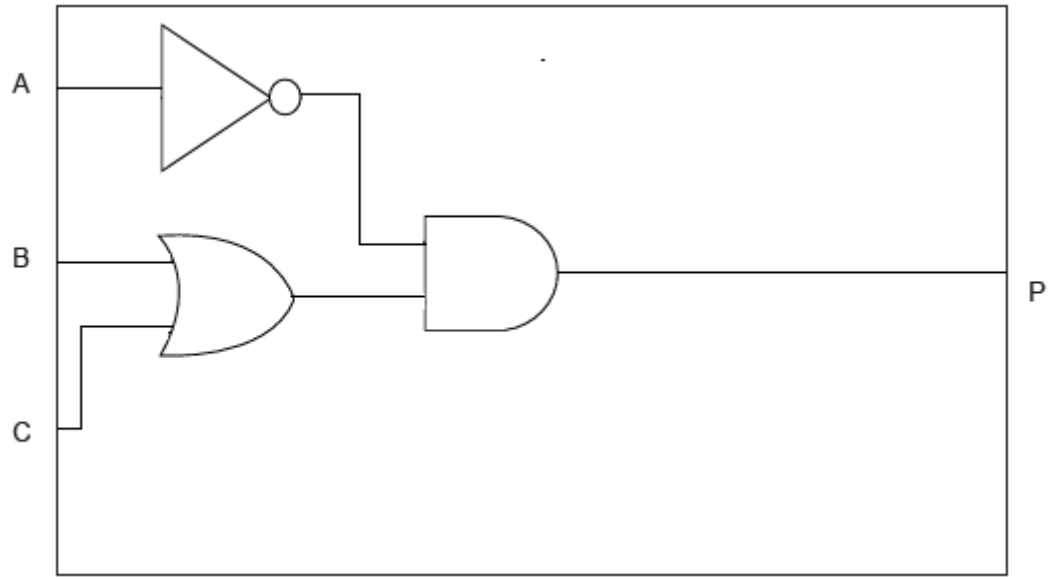
3	**(c)**	**(i)**	1 mark each • Compare to / pick out middle value (which is 6) • **discard only left side // retain only right side** (because 6 < 10)… • …Compare to / pick out (middle value which is) **10**	3 (AO2)	BP1 can be given for generic answer. BP2 and 3 must be linked to data set given For BP2, must remove 1, 2,5 and 6 from list if discussing individual numbers. Allow FT for BP3 if this done incorrectly.

		(ii)	• Data must be sorted / in order	1 (AO1)	
		(iii)	• Merge sort	1 (AO1)	
4	**(a)**		Input e.g. • **Name / keyword** for video (to be searched for) // search **text** • **Controls** for watching video (e.g. play / pause) • **Rating** given to video Output e.g. • Video to be watched // audio • **Results** of search • (total / overall / average) rating of video • Number of views (of video) • Confirmation of data entry / data validity • Messages to user // example messages (e.g "enter a rating", "your rating has been saved") in **quotation marks**	2 (AO1)	1 mark for a suitable input, 1 mark for a suitable output Allow input / print pseudocode statements if meets mark point(s). Does not have to be valid pseudocode. Do not allow examples of inputs (e.g. "music videos")

4	**(b)**		Only 1 method asked for. Could be name and description/example or description and example • Authentication • …checking users allowed to access the site / know identity of users • … by example (e.g. username and password) • Anticipating misuse // preventing misuse • ….stopping the user breaking / hacking into the system • …by example (e.g. restricting entry to integers) • Validation • …check / only allow sensible data to be entered / check data is sensible • …by example (e.g. restrict ratings to 1 to 10 / presence check / format check) • Input sanitisation • …removing invalid/special characters • …by example (e.g. remove quotation marks / semicolons) • Maintainability • ...ensuring program is able to be understood by others • ...by example (e.g. modularisation / comments)	2 (AO1)	Allow validation / input sanitisation / passwords as expansion of anticipating misuse. Allow mark for description with no / incorrect name Allow any 2 points from mark scheme as long as clearly linked to a single defensive design method.

5	**(a)**		1 mark per group of 2 rows	4 (AO2)	Accept True / False etc.

A	**B**	**C**	**P**	
0	0	0	**0**	1 mark
0	0	1	**1**	
0	1	0	**0**	1 mark
0	1	1	**1**	
1	0	0	**0**	1 mark
1	0	1	**1**	
1	1	0	**1**	1 mark
1	1	1	**1**	

5	**(b)**		1 mark each • NOT A • B OR C • AND gate with **two inputs**  	3 (AO3)	**Max 2** if not logically correct or any additional / missing gates. Shapes of gates must be correct with correct number of inputs. Ignore annotation of gate names. NOT gate must include circle. Other gates must not include circle.

<table>
<tr>
<td>6</td>
<td>(a)</td>
<td></td>
<td>1 mark for each output
<table>
<tr><td>print(message.upper)</td><td>ABCD1234 (upper case)</td></tr>
<tr><td>print(message.left(4))</td><td>abcd (lower case)</td></tr>
<tr><td>print(int(message.right(4))*2)</td><td>2468</td></tr>
</table>
</td>
<td>3
(AO2)</td>
<td>Case must be correct but BOD if ambiguous.

Allow quotation marks in answer.</td>
</tr>
<tr>
<td>6</td>
<td>(b)</td>
<td></td>
<td>1 mark per bullet point :
• storing both strings correctly in word1 and word2
• correct concatenation (word1 then word2)...
• …storing in variable message

Example
<pre>word1 = "Hello"
word2 = "Everyone"
message = word1 + word2</pre>
</td>
<td>3
(AO3)</td>
<td>Accept & / + / . etc as valid methods of concatenation. Allow use of sensible concatenation functions e.g. concat() . Do not allow commas.

Do not allow == for assigning value to string. Do not allow spaces in variable names. Penalise once then FT.

Ignore additional code given. Ignore case.

Reasonable attempt at BP2 needed to access BP3.</td>
</tr>
</table>

7	**(a)**		1 mark each to max 2 • (machine code) does not need to be translated / compiled / interpreted • Direct control of **hardware / memory** • Faster execution time • Code can be optimised / shorter code / use less memory • Can program for specific hardware • **Assembly language** is fast to translate.	2 (AO1)	"More efficient" by itself is TV. Mark first answer on each line. BP6 relates to Assembly language being a one-to-one direct mapping to machine code.
7	**(b)**		1 mark each to max 3 • Can produce an **executable file** • program/code **runs/executes** faster (than interpreted version) • end users do not need translator • Can be run **again/multiple times** without re-translating // only needs to translate **once** • **End users** have no access to **source code** // distributed **with no source code.**.. • …cannot steal/copy/modify code/program • Shows **all/multiple** errors // shows errors **at the end** (of compilation) // creates **error file** • Compiler can optimise the code	3 (AO1)	Allow in reverse (e.g. "interpreter translates every time") Do not allow "no access to source code" unless clearly talking about end user. Allow if in context of distribution. Do not allow descriptions of how a compiler translates (e.g. "translates whole code in one go") "Faster / quicker" by itself is TV

8	**(a)**		2 marks max per group • Meaningful **identifiers** // meaningful variable names • ...to describe/show what they **store // purpose** of variable • An example of a meaningful variable identifier <u>for this algorithm</u> • Comments • ...to make it easier for other programmers to **follow** / **understand** (part of) the code // explains what the code does // easier to **debug** • An example of a suitable comment <u>for this algorithm</u> • Use of subroutines • ...to **reuse** blocks of code // make code easier to follow • An example of a subroutine <u>for this algorithm</u> • Use of constants • ...to store data that will not change (during program execution) // so data can be changed in one place only • An example of a constant <u>for this algorithm</u> (e.g. store 512 as a constant)	4 (AO2)	Do not accept "what variables do" – incorrect verb, variables store/hold data. BOD notes (and alternatives) for comments. Do not allow instructions. Do not allow indentation (already done in program given) Allow whitespace / **blank** lines (same expansions as comments) Do not award expansion without being clear which method is being discussed. “Makes it easier to understand” by itself is TV.

<table>
<tr>
<td>8</td>
<td>(b)</td>
<td></td>
<td>1 mark each to max 6
• Appropriate use of both parameters and no additional inputs / incorrect overwrites that affect outcome of algorithm
• Attempt at selection…
• …correctly checking if <code>direction</code> is "left" and subtracting 5 from <code>position</code> (or equivalent)
• …correctly checking if <code>direction</code> is "right" and adding 5 to <code>position</code> (or equivalent)
• Ensuring position (or equivalent) is between 1 and 512 inclusive
• Returning the updated position

<u>Example</u>
<pre>
if direction == "left" then
  position = position - 5
elseif direction == "right" then
  position = position + 5
endif

if position < 1 then
  position = 1
elseif position > 512 then
  position = 512
endif

return position
</pre>
</td>
<td>6
(AO3)</td>
<td>Allow <code>else</code> for BP3/4 (validated in question 8a)

Allow <=, >= and equivalents (e.g. <= 0) for BP5.

Do not award BP5 if before BP3 and 4 (otherwise will alter position value)

BP6 only to be given if attempt made at calculating new position. Calculation can be partial/incorrect.

Ignore repeat of function header / end.

Accept flowchart / structured English but must not just repeat the question.

If response uses loop to incorrectly change position multiple times, do not award BP1 (incorrect overwrite)

For minor syntax errors (e.g. missing quotation marks or == for assignment, spaces in variable names) penalise once then FT.</td>
</tr>
</table>

Section B

Question			Answer	Mark	Guidance
9	(a)	(i)	• String • Integer • Real / Float	3 (AO3)	Accept alternative equivalent correct data types (e.g. single/double/decimal for BP3) Do not accept char for BP1
		(ii)	• `theTeam.length() - 1` // `5` • `count` • `studentName` • `True`	4 (AO3)	Accept 6 // `theTeam.length()` for BP1 (Python). Accept alternative length functions e.g. len() Accept **`count = 5`** (and equivalents) for BP1. Accept "True" for BP4. Do not allow obvious spaces in variable names. Ignore capitalisation.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td>(b)</td><td></td><td>

<code>javelinThrow</code> set to 14.3 on line 01 <u>and</u> <code>yearGroup</code> set to 10 on line 02
<code>score</code> set to 2 on line 06
<code>score</code> set to 4 on line 11
"The score is 4" output on line 13 with no additional outputs (allow input statements)

<u>Example</u>
<table>
<tr><th>Line number</th><th>javelinThrow</th><th>yearGroup</th><th>score</th><th>Output</th></tr>
<tr><td>01</td><td>14.3</td><td></td><td></td><td></td></tr>
<tr><td>02</td><td></td><td>10</td><td></td><td></td></tr>
<tr><td>06</td><td></td><td></td><td>2</td><td></td></tr>
<tr><td>11</td><td></td><td></td><td>4</td><td></td></tr>
<tr><td>13</td><td></td><td></td><td></td><td>The score is 4</td></tr>
</table>
Answer may include lines where no changes or output happens (i.e. lines 3, 4, 5, 7, 8, 9, 10, 12).

Where variable doesn't change, current value may be repeated on subsequent lines.
</td><td>4
(AO3)</td><td>Max 3 if in wrong order or additional (incorrect) changes. Penalise line numbers once then FT.

Allow FT for BP4 for current value of <code>score</code>.

BP4 must <u>not</u> include comma. Ignore superfluous spaces. Ignore quotation marks.

Treat any entry in output column as an output, even if "x", "-" or "0".</td></tr>
</table>

Question			Answer	Mark	Guidance

	(c)	(i)	• inputs a value from the user and stores/uses
			• checks min value (>= 40.0 // < 40)
			• checks max value (<=180.0 // > 180)
			• …outputs **both** valid / not valid correctly based on checks
			
			Example 1 (checking for valid input)
			`h = input("Enter height jumped")`
			`if h >= 40 and h <= 180 then`
			`  print("valid")`
			`else`
			`  print("not valid")`
			`endif`
			
			Example 2 (checking for invalid input)
			`h = input("Enter height jumped")`
			`if h < 40 or h > 180 then`
			`  print("not valid")`
			`else`
			`  print("valid")`
			`endif`
				4 (AO3)	Answers using `AND/OR` for BP2 and BP3 must be logically correct e.g. `if height >=40 and height <=180`. Do not accept `if height >=40 and <=180`
					
					Answers using OR will reverse output for BP4 (see examples).
					
					BP4 needs reasonable attempt at **either** BP2 or BP3. Need to be sure what is being checked to be able to decide which way around valid/invalid should be.
					
					Allow FT for BP4 if reasonable attempt at validating (must include at least one boundary)
					
					Ignore conversion to int on input. `input` cannot be used as a variable name.
					
					Greater than / less than symbols must be appropriate for a high-level language / ERL. Do not accept => (wrong way around) or ≥ (not available on keyboard). No obvious spaces in variable names. Penalise once and then FT.

Question			Answer	Mark	Guidance
	(c)	(ii)	• Any normal value (between 40 and 180 inclusive) • 40.0 // 180.0 • Any value less then 40 // any value greater that 180 // any non-numeric value	3 (AO3)	No need to include decimals, e.g. accept 50. Ignore cm if given. Answer must be actual data (e.g. 50) and **not** description of data (e.g. "a value between 40 and 180"). If descriptions given, do not accept this as non-numeric for BP3
	(d)		• `TeamName` only in first space • `TblResult` in second space • `WHERE` • `...YearGroup = 11`	4 (AO3)	Max 3 if not in correct order / includes other logical errors. Ignore capitals. Do not accept * or additional fields for BP1 Spelling must be accurate (e.g. not TblResult**s**). No spaces in field names, penalise obvious spaces once and then FT. Allow quotation marks around field names, table name and 11 Accept == for BP4 (invalid SQL but works in some environments)

Question			Answer	Mark	Guidance
	(e)	(i)	• any **example** of simplification/removing data or focussing on data (in the design) Examples : - "focus on student names and events" - "ignore data such as students' favourite subjects" - "store year groups instead of ages or DOB" - "shows student IDs instead of full student details"	1 (AO3)	Must be applicable to this program (in the context of students and a sports day), **not** a generic description of what abstraction is. Give BOD where this is unclear.
		(ii)	• any **example** of breaking down the **program** into sections/subroutines • any **example** of breaking down the **database** into tables Examples : - "splits the program up into different events" - "separates the validation routines into subroutines" - "breaks the database down into a table per event"	1 (AO3)	Must be applicable to this program, not a generic description of what decomposition is. Give BOD where this is unclear. Do not give answers discussing splitting into **fields** (e.g. split into StudentID, YearGroup, etc). BOD if answer discusses one table but suggests other tables could be used. Do not give answers relating simply to data being split into smaller groups unless this clearly relates to how data is decomposed into **tables** in the DB. Allow reference to sports day to mean sports day program.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td>(f)</td><td></td><td>

Input team name AND score and store / use separately
Attempt at using iteration…
…to enter team/score until "stop" entered
Calculates highest score
Calculates winning team name…
…Outputs highest score and team name

<u>Example 1</u>
<pre>
highscore = 0
while team != "stop"
    team = input("enter team name")
    score = input("enter score")
    if score > highscore then
        highscore = score
        highteam = team
    endif
endwhile
print(highscore)
print(highteam)
</pre>
<u>Example 2 (alternative)</u>
<pre>
scores = []
teams = []
while team != "stop"
    team = input("enter team name")
    score = input("enter score")
    scores.append(score)
    teams.append(team)
endwhile
highscore = max[scores]
highteam = teams[scores.index(highscore)]
</pre>
</td><td>6
(AO3)</td><td>For BP3, allow "stop" to be entered for either team name or score (or both). Allow third input (e.g. "do you wish to stop?")

Allow use of <code>break</code> (or equivalent) to exit loop for BP3.

Allow use of recursive function(s) for BP2/3.

Initialisation of variables not needed - assume variables are 0 or empty string if not set.

Ignore that multiple teams could get the same high score, assume only one team has the highest score.

BP4/5 could be done in many ways – see examples. Allow any logically valid method. Allow use of max/sum functions and use of arrays/lists.

FT for BP6 if attempt made at calculating highest score/name

If answer simply asks for multiple entries (not using iteration), BP2 and 3 cannot be accessed but all others available.</td></tr>
</table>

Question			Answer	Mark	Guidance
			`print(highscore)` `print(highteam)`		For minor syntax errors (e.g. missing quotation marks or == for assignment, spaces in variable names) penalise once then FT. `input` cannot be used as a variable name.

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GCSE (9-1) Computer Science
J277/01 Computer Systems

MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 80

Version:
Last updated: 10/6/20

(FOR OFFICE USE ONLY)

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the scoris messaging system, or by email.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (eg 'can't do', 'don't know')
   - OR if there is a mark (eg a dash, a question mark) which isn't an attempt at the question

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question)

8. The scoris **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your team leader, use the phone, the scoris messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:
    - to determine the level – start at the highest level and work down until you reach the level that matches the answer
    - to determine the mark within the level, consider the following

The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.
Using 'best-fit', decide first which set of BAND DESCRIPTORS best describes the overall quality of the answer. Once the band is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement*.

Highest mark: If clear evidence of all the qualities in the band descriptors is shown, the HIGHEST Mark should be awarded.

Lowest mark: If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the bands below and show limited evidence of meeting the criteria of the band in question) the LOWEST mark should be awarded.

Middle mark: This mark should be used for candidates who are secure in the band. They are not 'borderline' but they have only achieved some of the qualities in the band descriptors.
Be prepared to use the full range of marks. Do not reserve (e.g.) high Band 3 marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the band descriptors, reward appropriately.
*When only two marks are available (low mark band) only use Highest and Lowest mark guidance for 'best-fit'.

11. **Annotations**

Annotation	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
^	Omission mark
BOD	Benefit of doubt
C	Subordinate clause/Consequential error
	Cross
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	Benefit of doubt not given
P	Point being made
REP	Repeat
	Slash
	Tick

12. Subject Specific Marking Instructions

LEVELS OF RESPONSE QUESTIONS:

	AO2.1a	AO2.1b
High (thorough) (6 – 8 marks)	Precision in the use of terminology. Knowledge shown is consistent and well-developed. Clear appreciation of the question from a range of different perspectives making extensive use of acquired knowledge and principles of computer science.	Understanding of concepts is consistently applied to context enabling a logical and sustained argument to develop. Examples used enhance rather than detract from response.
Middle (reasonable) (3 – 5 marks)	Awareness of the meaning of the terms in the question. Knowledge is sound and effectively demonstrated. Demands of question understood although at times opportunities to make use of acquired knowledge and concepts are not always taken	Understanding of concepts is shown and is applied to context. There is clear evidence that an argument builds and develops through the response but there are times when opportunities are missed to use an example or relate an aspect of understanding to the context provided.
Low (basic) (1 – 2 marks)	Confusion and inability to deconstruct terminology as used in the question. Knowledge partial and superficial. Focus on question narrow and often one-dimensional.	Inability to apply understanding of key concepts in any sustained way to context resulting in tenuous and unsupported statements being made. Examples if used are for the most part irrelevant and unsubstantiated.
0 marks	No response or no response worthy of credit.	No response or no response worthy of credit.

	Assessment Objective
AO1	Demonstrate knowledge and understanding of the key concepts and principles of computer science.
AO1 1a	Demonstrate knowledge of the key concepts and principles of computer science.
AO1 1b	Demonstrate understanding of the key concepts and principles of computer science.
AO2	Apply knowledge and understanding of key concepts and principles of computer science.
AO2 1a	Apply knowledge of key concepts and principles of computer science.
AO2 1b	Apply understanding of key concepts and principles of computer science.

Where bullets are in the MS, it is 1 mark per bullet. Each bullet can only be awarded once in a response.

Where there is an 'e.g.' at the start of a set of bullets, this indicates that there are many possible marks and too many that can be listed here.

Ellipses (…) at the start of a bullet without Ellipses at the end of the previous bullet mean that the sentence reads on from the previous bullet.
e.g.

- Mark point 1
- …Mark point 2

Ellipses (…) at the start of a bullet, and ellipses at the end of the previous bullet meant that MP2 cannot be awarded if MP1 is not awarded.

- Mark point 1 …
- …Mark point 2

Any text that is underlined must be present in the format given
e.g.
Number of clock cycles

Any text that is emboldened, the idea of that term/phrase must be present but not in this exact format
e.g.
Prevents **unauthorised** access

A single forward slash means that there are alternative words that are acceptable in that sentence
e.g.
An example threat is a virus/spyware/unauthorised access

A double forward slash means that these are alternatives for the same MP. If a candidate gives both sides of the // then there is still only 1 mark awarded for that MP
e.g.
More instructions can be executed per second // by calculation

Question			Answer	Mark	Guidance
1	a	i	1 mark e.g. All the different characters a computer can represent	1	'The set of characters' is repeating the question and not enough
1	a	ii	256	1	
1	a	iii	1 mark for working, 1 mark for answer e.g. 2000 * 8 = 16000 bits 16000/8 = 2000 bytes 2000/1000 = 2 Kilobytes	2	Ignore any overheads e.g. adding 10%
1	a	iv	UNICODE	1	
1	b		01001010	1	cao
1	c		1 mark for adding 1 to J: binary 01001011 // converting J to hexadecimal and adding 1 1 mark for answer 4B	2	Allow 1 mark for converting J into 4A without adding 1
1	d		1 mark for left 1 mark for 3 places	2	Ignore any reference to arithmetic/logical
2*			**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** <u>Diagnosis</u> • Search records faster • Identify range of possibilities based on symptoms • Identify patterns • More accurate/automated/AI equipment • May miss some symptoms, or suggest incorrect results <u>Treating</u> • AI/Automated surgery e.g. can control from another country • …access to specialists who are not local • Technology may be subject to hacking

			underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact on most areas, showing reasonable recognition of influencing factors. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit		• Error in software could have fatal consequences • May have little human interaction <u>Storage</u> • Centralised storage • All medical people can access all information about patients from all people involved in care • Concerns over privacy and security of communication of data e.g. if central storage is accessed personal information may be leaked

<table>
<tr>
<td>3</td>
<td>a</td>
<td>i</td>
<td>1 mark for correct ticks and gaps on each row
<table>
<tr><th>Statement</th><th>MAR</th><th>MDR</th><th>Cache</th><th>Program Counter</th><th>RAM</th></tr>
<tr><td>It stores a single address</td><td>✓</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>It stores frequently used instructions</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>It is a register</td><td>✓</td><td>✓</td><td></td><td>✓</td><td></td></tr>
<tr><td>It stores all currently running data and instructions</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
</table>
</td>
<td>4</td>
<td>If extra ticks on each row, 0 marks for that row</td>
</tr>
<tr>
<td>3</td>
<td>a</td>
<td>ii</td>
<td>1 mark for register e.g. accumulator
1 mark for description e.g. stores the result of arithmetic operations</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>b</td>
<td></td>
<td>1 mark per bullet
• faster/higher clock speed
• 3.2GHz will run more Fetch-Execute (F-E) cycles per second
• …therefore the more instructions can be executed per second // by calculation</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>1 mark for each completed term

Embedded systems have limited functions. They are

often built into a larger machine. Two examples of

embedded systems are a washing machine and</td>
<td>4</td>
<td></td>
</tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>automated lights in a car.</td><td></td><td></td></tr>
<tr><td>5</td><td>a</td><td></td><td>1 mark for 2 correct ticks
2 marks for all 4 correct ticks

<table>
<tr><th></th><th>True</th><th>False</th></tr>
<tr><td>Each colour has a unique binary code</td><td>✓</td><td></td></tr>
<tr><td>Metadata stores the colour of each pixel in the image</td><td></td><td>✓</td></tr>
<tr><td>A bitmap is made of pixels</td><td>✓</td><td></td></tr>
<tr><td>The higher the colour depth, the smaller the number of different colours that can be displayed</td><td></td><td>✓</td></tr>
</table>
</td><td>2</td><td>2 ticks in 1 row is incorrect</td></tr>
</table>

<table>
<tr><td>5</td><td>b</td><td>i</td><td>1 mark for working, 1 mark for answer
1000*3
= 3000 images</td><td>2</td><td></td></tr>
<tr><td>5</td><td>b</td><td>ii</td><td>1 mark for suitable type i.e. solid state // magnetic
1 mark per bullet to justification to max 2
solid state e.g.:
Large enough capacity
Can move computer without damaging storage
Faster access speeds
magnetic e.g.:
Largest capacity
Do not need to move computer so moving parts do not matter
More reliable long-term</td><td>3</td><td></td></tr>
<tr><td>5</td><td>b</td><td>iii</td><td>1 mark for 2 correct ticks
2 marks for all 3 or 4 correct ticks
3 marks for all correct
<table><tr><th></th><th>True</th><th>False</th></tr><tr><td>The sample rate is the number of times the amplitude is recorded per second</td><td>✓</td><td></td></tr><tr><td>The smaller the bit depth the smaller the range of sounds recorded</td><td>✓</td><td></td></tr><tr><td>The larger the sample rate the larger the bit depth</td><td></td><td>✓</td></tr><tr><td>The frequency and pitch of the sound wave are measured</td><td></td><td>✓</td></tr><tr><td>Sound is stored using pixels</td><td></td><td>✓</td></tr></table></td><td>3</td><td>2 ticks in 1 row is incorrect</td></tr>
<tr><td>5</td><td>c</td><td>i</td><td>1 mark per bullet to max 2
Reduces the file size…
…takes up less space on the server</td><td>2</td><td></td></tr>
</table>

			• Faster upload to server • Faster download for users		

5	**c**	**ii**	1 mark for lossy 1 mark per bullet to max 2 • Lossy will most likely reduce the file size by a large amount than lossless • Lossy will remove data that is not noticeable // the changes will allow for further reduction without the user noticing	3	Award FT marks for justifying lossless appropriately to max 2
5	**d**		Copyright designs and patents act	1	
6	**a**		LAN // Local area network	1	
6	**b**	**i**	1 mark per bullet Max 4 for similarities, max 4 for differences Similarities: • They both connect devices • …they receive data from the devices • …they determine the correct destination for the data • …they transmit the data to its destination Differences: • A switch uses MAC addresses • A router uses IPs • A switch corrects nodes/computers • A router connects networks/Internet • A router stores the addresses of devices attached… • …a switch records the addresses as they are accessed // a switch has to look for correct address before sending	6	
6	**b**	**ii**	1 mark per bullet • Clearly labelled switch • 2 laptops, 4 phones, 2 TVs • All devices connected to switch and nothing else	3	Connections can be wired or any identifiable wireless connection. Ignore any additional devices

<table>
<tr>
<td>6</td>
<td>c</td>
<td></td>
<td>1 mark for each completed box
<table>
<tr><th>Form of attack</th><th>Description of attack</th><th>Method of prevention</th></tr>
<tr><td>Brute-force attack</td><td>A program attempting all possible password combinations</td><td>Strong password // set number of password attempts // firewall</td></tr>
<tr><td>Data interception</td><td>Data transmission being read by unauthorised user/program</td><td>Encryption</td></tr>
<tr><td>Malware//Virus//Trojan etc.</td><td>Software that damages/deletes data</td><td>Anti-virus</td></tr>
</table>
</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>a</td>
<td></td>
<td>1 mark per bullet to max 3

Takes less time to read/access a file because the data/files/pages are contiguous
…. so it does not need to move as far to read the next piece of data/file/page
…because it is in the next memory location
Takes less time to save new data/files because there is larger free space together
…so it does not need to split the data/file
… and can store them in contiguous spaces

</td>
<td>3</td>
<td></td>
</tr>
</table>

<table>
<tr><td>7</td><td>b</td><td></td><td>1 mark per row

<table>
<tr><th>Action</th><th>Memory management</th><th>Peripheral management</th><th>File management</th><th>User management</th></tr>
<tr><td>Creating a new folder to store documents in</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>Moving data from Virtual Memory to RAM</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Renaming a file</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>Reading data from a scanner</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Changing the password required to log onto the computer</td><td></td><td></td><td></td><td>✓</td></tr>
</table></td><td>5</td><td>No mark awarded if 2+ ticks on each row</td></tr>
<tr><td>7</td><td>c</td><td>i</td><td>1 mark per bullet to max 2
• Free of charge
• They can adapt it / add features</td><td>2</td><td></td></tr>
<tr><td>7</td><td>c</td><td>ii</td><td>1 mark per bullet to max 2
• She can charge customers // She can earn a profit
• She can restrict what users can do /// users can't edit it</td><td>2</td><td></td></tr>
<tr><td>7</td><td>d</td><td>i</td><td>1 mark per bullet to max 3
e.g.
• She can access the program from anywhere
• … does not need to carry a storage device with her
• Security/backup is (likely) managed for her
• …does not need to manually backup his work</td><td>3</td><td></td></tr>
<tr><td>7</td><td>d</td><td>ii</td><td>1 mark per bullet to max 3
e.g.
• If there is no Internet access he cannot access his work
• Transmission may not be secure
• …his work could be intercepted
• Security is out of his control
• …it may not be backed up/kept safe</td><td>3</td><td></td></tr>
</table>

OCR
Oxford Cambridge and RSA

Practice Paper

GCSE (9–1) Computer Science

J277/01 Computer Systems

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **12** pages.

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions.

1 The ASCII code for the character J is the denary number 74.

(a) **(i)** State what is meant by a character set.

.....

..... **[1]**

(ii) ASCII has 8 bits per character.

Identify the maximum number of different characters that ASCII can represent.

..... **[1]**

(iii) A text file uses the ASCII character set. The text file has 2000 characters in it.

Calculate an estimate of the file size of the text file in Kilobytes. Show your working.

.....

.....

.....

..... Kilobytes

[2]

(iv) Identify **one** other character set.

..... **[1]**

(b) Write the 8-bit binary number for the ASCII character J in the following boxes:

[1]

(c) Give the hexadecimal number for the ASCII character K.
Show your working.

.....

.....

.....

..... **[2]**

(d) A binary shift can be performed on a binary integer.

Identify which shift will multiply a number by 8.

..... **[2]**

2* The use of digital technology in medicine is constantly evolving.

Discuss the impact of digital technology on medicine including:

- diagnosing patients
- treating patients
- storage of records.

.... **[8]**

3 **(a)** **(i)** The table has **five** components of a computer, and **four** statements.

Tick (✓) **one or more** boxes in each row to identify which component(s) each statement describes.

Statement	**MAR**	**MDR**	**Cache**	**Program Counter**	**RAM**
It stores a single address					
It stores frequently used instructions					
It is a register					
It stores all currently running data **and** instructions					

[4]

(ii) Identify the name of **one** register **not** given in **part (a)(i)** and describe its purpose.

Register .....

Purpose .....

.....

[2]

(b) Computer A has a single core, 3.2 GHz processor.
Computer B has a single core, 1.2 GHz processor.

Explain why Computer A will usually run faster than Computer B.

.....

.....

.....

..... **[2]**

4 The following paragraph describes embedded systems.

Complete the paragraph by selecting terms from the list and writing them in the correct places. Not all terms are used.

actuator	applications	change	functions	laptop	larger
lights	microprocessor	processor	range	smaller	washing machine

Embedded systems have limited …… . They are often built into a …… machine. Two examples of embedded systems are a …… and automated …… in a car.

[4]

5 Layla is an artist. She draws images by hand. The image is then scanned and stored on a computer.

(a) The table has **four** statements about the storage of images on a computer.

Tick (✓) **one** box in each row to identify if the statement is true or false.

	True	**False**
Each colour has a unique binary code		
Metadata stores the colour of each pixel in the image		
A bitmap is made of pixels		
The higher the colour depth, the smaller the number of different colours that can be displayed		

[2]

(b) Layla stores her images on a secondary storage device.

(i) Each image has a fixed size of 1 MB. The storage device has a capacity of 3 GB.

Calculate how many images can be saved on the storage device. Show your working.

.....

.....

..... images

[2]

(ii) Layla uses the images to make videos. These videos are stored on her computer's internal storage device.

Identify the most appropriate type of storage device for Layla to use in her computer. Justify your choice.

Type of storage device .....

Justification

.....

.....

.....

.....

[3]

(iii) The videos include sound. The table has **four** statements about the storage of sound in a computer.

Tick (✓) **one** box in each row to identify if the statement is true or false

	True	False
The sample rate is the number of times the amplitude is recorded per second		
The smaller the bit depth the smaller the range of sounds recorded		
The larger the sample rate the larger the bit depth		
The frequency and pitch of the sound wave are measured		
Sound is stored using pixels		

[3]

(c) Layla uploads her images and videos to a website.

(i) Explain why Layla compresses the images and videos before uploading them.

.....

.....

.....

..... **[2]**

(ii) Layla wants to reduce the file size of the images and videos by the largest amount possible.

Identify the method of compression that would be most appropriate. Justify your choice.

Compression method ……

Justification

.....

.....

.....

..... **[3]**

(d) Layla wants to protect her images so they cannot be copied by other people.

Identify which legislation can help protect Layla's images.

..... **[1]**

6 Amir has a home network that includes two laptop computers, four mobile phones, and two televisions.

(a) Identify the type of network Amir has at home.

..... **[1]**

(b) The network uses a star topology with a central switch. The switch has an integrated wireless access point (WAP).

(i) Describe the similarities and differences between a switch and a router.

Similarities .....

.....

.....

.....

.....

.....

Differences .....

.....

.....

.....

.....

.....

[6]

(ii) Draw the star topology for Amir's home network. Clearly label each device.

[3]

(c) Amir wants to protect the computers on his network from threats such as unauthorised access.

The following incomplete table contains a form of attack, description and method of preventing each attack.

Complete the table by writing the missing Forms of attack, Descriptions and Methods of prevention.

Form of attack	Description of attack	Method of prevention
	A program attempting all possible password combinations	
Data interception		
		Anti-virus

[6]

7 Eve's computer has system software including an Operating System and Utility Software.

(a) Eve runs the defragmentation program on her computer.

Explain why Eve's computer is more efficient after the program has been run.

.....

.....

.....

.....

.....

..... **[3]**

(b) Tick (✓) **one** box in each row to identify which function of the Operating System deals with each action.

Action	Memory management	Peripheral management	File management	User management
Creating a new folder to store documents in				
Moving data from Virtual Memory to RAM				
Renaming a file				
Reading data from a scanner				
Changing the password required to log on to the computer				

[5]

(c) Eve uses a computer to write a computer game. She wants people to be able to download her program online.

Eve is choosing between an open source and proprietary licence.

(i) Give **two** benefits to the customers of Eve choosing an open source licence.

1 .....

.....

2 .....

.....

[2]

(ii) Give **two** benefits to Eve of choosing a proprietary licence.

1 .....

.....

2 .....

.....

[2]

(d) Eve stores her computer program on the cloud whilst working on it.

(i) Describe the benefits to Eve of storing the program on the cloud.

.....

.....

.....

.....

.....

..... **[3]**

(ii) Describe the drawbacks to Eve of storing the program on the cloud.

.....

.....

.....

.....

.....

..... **[3]**

END OF QUESTION PAPER

PLEASE DO NOT WRITE ON THIS PAGE

OCR
Oxford Cambridge and RSA

Practice Paper

GCSE (9-1) Computer Science
J277/02 Computational thinking, algorithms and programming

MARK SCHEME

Duration: 1 hour 30 minutes

MAXIMUM MARK 80

Version:
Last updated: 16/6/20

(FOR OFFICE USE ONLY)

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AO1	Demonstrate knowledge and understanding of the key concepts and principles of computer science.
AO1 1a	Demonstrate knowledge of the key concepts and principles of computer science.
AO1 1b	Demonstrate understanding of the key concepts and principles of computer science.
AO2	Apply knowledge and understanding of key concepts and principles of computer science.
AO2 1a	Apply knowledge of key concepts and principles of computer science.
AO2 1b	Apply understanding of key concepts and principles of computer science.
AO3	Analyse problems in computational terms: • to make reasoned judgements • to design, program, evaluate and refine solutions.
AO3 1	To make reasoned judgements (this strand is a single element).
AO3 2a	Design solutions.
AO3 2b	Program solutions.
AO3 2c	Evaluate and refine solutions.

Annotations

Annotation	Meaning
BP	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
^	Omission mark
BOD	Benefit of doubt
C	Subordinate clause/Consequential error
	Cross
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	Benefit of doubt not given
P	Point being made
REP	Repeat
	Slash
	Tick

COMPONENT 2 SECTION B SYNTAX GUIDANCE

In Section B, certain questions require candidates to answer in either the OCR Exam Reference Language or the high-level programming language they are familiar with. The information in this section provides generic guidelines in relation to the marking of these questions.

Where a response requires an answer in OCR Exam Reference Language or a high-level programming language, a candidate's level of precision will be assessed. These questions are designed to test both a candidate's programming logic and understanding of core programming structures.

Marks will be given for correctly using syntax to represent core programming constructs which are common across all programming languages. The construct must be present in a recognisable format in a candidate's answer.

Where the response requires a candidate to respond using the OCR Exam Reference Language or a high-level programming language, answers written in pseudocode, natural English or bullet points **must not** be awarded marks.

The guidance below covers the elements of each core construct. As guidance, several examples are provided for each. These examples are not exclusive but do present a variety of acceptable ways taken from a range of different languages.

Concept		Examiner Guidance
Commenting		

`//`	`//This function squares a number`
	`function squared(number)`
	`  squared = number^2`
	`  return squared`
	`endfunction`
	`//End of function`
		• Other examples allowable, e.g.:
		  ○ # this is a comment
		  ○ /* this is another comment */

Variables		

`=`
`const`
`global`
	`x = 3`
	`name = "Louise"`
	`const vat = 0.2`
	`global userID = "Cust001"`
		• Variables and constants are assigned using the = operator
		• Constants are assigned using the `const` keyword (or similar)
		• Identifiers should **not** have clear spaces within them or start with numbers
		• String values must use quotation marks (or equivalent)
		• Assignment must use =, :=, ← (or a suitable alternative)
		• variable identifier must be on the left when using OCR Exam Reference Language and the value to be assigned on the right
		• Some languages allow the value on the left- and the identifier on the right-hand side
		• Variables and constants are declared the first time a value is assigned. They assume the data type of the value they are given
		• Variables and constants that are declared inside a function or procedure are local to that subroutine
		• Variables in the main program can be made global with the keyword global
		• For input, a suitable command word for input and a variable identifier to assign data to (if required)
		e.g.
		`INPUT identifier`
		`identifier = INPUT`

Input/Output		

`input(…)`
 	
`print(…)`
	`myName = input("Please enter a name")`
	
	`print("My name is Noni")`
	`print(myArray[2,3])`
		• For output, a command word for output (e.g. output, print, cout)
		• Data to be output. If this is a string then quotation marks (or equivalent) are required
		• If multiple items are to output, a suitable symbol for concatenation such as +, &.

Casting		

`str()`
 	
`int()`
 	
`real()`
`bool()`
	`str(345)`
	
	`int("3")`
	
	`real("4.52")`
	`bool("True")`
		• Variables can be typecast using the int str and float functions

Iteration		

`for … to …`
 	
`next …`
 	
`for … to … step …`
 	
`next …`
	`for i=0 to 9`
	`  print("Loop")`
	`next i`
	
	`for i=2 to 10 step 2`
	`  print(i)`
	`next i`
	
	`for i=10 to 0 step -1`
	`  print(i)`
	`next i`
		• `for` keyword
		• …with counter variable
		• Identification of number of times to iterate
		• Clear identification of which section of code will be repeated (e.g. using indentation, next keyword or equivalent, {braces})

`while …`
 	
`endwhile`
 	
`do`
 	
`until …`
	`while answer != "Correct"`
	`  answer = input("New answer")`
	`endwhile`
	
	`do`
	`  answer = input("New answer")`
	`until answer == "Correct"`
		• `While / do..until` key words or equivalent
		• …with logical comparison
		• clear identification of which section of code will be repeated (e.g. using indentation, endwhile/until keyword or equivalent, braces)

Selection		

`if … then`
`elseif … then`
`else`
`endif`
	`if answer == "Yes" then`
	`  print("Correct")`
	`elseif answer == "No" then`
	`  print("Wrong")`
	`else`
	`  print("Error")`
	`endif`
		• `if` key word followed by logical comparison
		• key word for `elseif` or equivalent followed by logical comparison
		• key word for `else` or equivalent with no comparison
		• clear identification of which section of code will be executed depending upon decision

`switch … :`
`  case … :`
`  case … :`
`  default:`
`endswitch`
	`switch day :`
	`  case "Sat":`
	`  print("Saturday")`
	`  case "Sun":`
	`  print("Sunday")`
	`  default:`
	`  print("Weekday")`
	`endswitch`
		• May be referred to differently in some languages. The format to the left will be used in all questions
		• `switch/select` key word or equivalent followed by variable/ value being checked
		• key word for each case followed by variable/ value to compare to
		• key word for default case (last option)
		• clear identification of which section of code will be executed depending upon decision

String handling/operations		
`.length`	`subject = "ComputerScience"` `subject.length` **gives** `the value 15`	• Suitable key word to indicate length and string identifier e.g. **`len(string)`**

`.substring(x , i)`
`.left(i)`
`.right(i)`
	`subject.substring(3,5)` **returns** `"puter"`
	`subject.left(4)` **returns** `"Comp"`
	`subject.right(3)` **returns** `"nce"`
		• Suitable string and characters required identified
		• Use of key words such as **`left, right, mid`**, etc, are all acceptable as long as these are precise
		• Treating a string as an array of characters is acceptable

`+` (concatenation)	`print(stringA + string)` `print("Hello, your name is : " + name)`	• Alternate symbol used indicate two strings or values are being concatenated is acceptable e.g. `stringA & stringB` or `stringA.stringB` • Use of comma e.g. `print(stringA, stringB)` is acceptable to output multiple values but examiners should be aware that this is not concatenation.
`.upper` `.lower`	`subject.upper` **gives** `"COMPUTERSCIENCE"` `subject.lower` **gives** `"computerscience"`	• Suitable key word to indicate string to be converted and whether this is to be converted to upper or lower case e.g. **`lower(stringname)`**
`ASC(…)` `CHR(…)`	`ASC(A)` **returns** `65` (numerical) `CHR(97)` **returns** `'a'` (char)	• Suitable keyword to indicate conversion and whether this is to or from ASCII. Where converting from ASCII, an integer value must be given and where converting to ASCII, a single character must be given.

File handling		
`open(…)` `.close()`	`myFile = open("sample.txt")` `myFile.close()`	• `open` keyword (or equivalent) • `read` or `write` clearly identified • `write` or read keyword (or equivalent) • `close` file keyword (or equivalent) • `newFile` keyword (or equivalent)
`.readLine()`	`myFile.readLine()` **returns** the next line in the file	
`.writeLine(…)`	`myFile.writeLine("Add new line")`	

`.endOfFile()`	`while NOT myFile.endOfFile()`
	`  print(myFile.readLine())`
	`endwhile`	

`newFile()`	`newFile("myText.txt")`	

Arrays		
`array colours[…]`	`array colours[5]`	• Array identifier • Index number to be accessed in square brackets, rounded brackets or curly braces (all acceptable)
	`array colours = ["Blue", "Pink", "Green", "Yellow", "Red"]`	• Array identifier assigned to initial values in one step
`array gameboard[…,…]`	`array gameboard[8,8]`	• For 2D arrays, the two indices should be given in one bracket separated by a comma **or** in two separate brackets, e.g. **`gameboard[4,6]`** **`gameboard[4][6]`** Where 2D arrays are represented by tables in a question, candidates are expected to use the **same** row/column or column/row format as given in the question. **This will always be given.**
`names[…] = …`	`names[3] = "Noni"`	
`gameboard[…,…] = …`	`gameboard[1,0] = "Pawn"`	

Sub programs		

`procedure name (…)`
 	
`endprocedure`
	`procedure agePass()`
	`  print("You are old enough to ride")`
	`endprocedure`
	
	`procedure printName(name)`
	`  print(name)`
	`endprocedure`
	
	`procedure multiply (num1, num2)`
	`  print(num1 * num2)`
	`endprocedure`
		• `function` or `procedure` key word (or equivalent)
		• … followed by identifier
		• Any parameters passed in are contained within brackets and come after identifier name
		• Clear identification of which section of code is contained within the subroutine (e.g. indentation, **`endsub`** key word, braces)

`procedure(parameters)`	`agePass()`
	
	`printName(parameter)`
	
	`multiply(parameter1, parameter2)`	

`function name (…)`
`  …`
`  return …`
`endfunction`
	`function squared(number)`
	`  squared = number^2`
	`  return squared`
	`endfunction`
		• **functions only**: a suitable method of returning a value (e.g. `return` keyword or assignment of value to function identifier)
		
		e.g.
		`def newfunction(x,y)`
		`  total = x + y`
		`  newfunction = total`

`function(parameters)`	`print(squared(4))`
	
	`newValue = squared(4)`	

Random numbers		

`random(…,…)`	`myVariable = random(1,6)`
	
	`myVariable = random(-1.0,10.0)`
		• **`random`** key word (or equivalent)
		• identification of either smallest and largest number to be chosen **or** just largest number
		
		e.g.
		`randnumber(10)`
		`rand(1,6)`

Comparison operators			
`==`	Equal to	`<=`	Less than or equal to
`!=`	Not equal to	`>`	Greater than
`<`	Less than	`>=`	Greater than or equal to

Boolean operators	
`AND`	Logical AND
`OR`	Logical OR
`NOT`	Logical NOT

Arithmetic operators	
`+`	Addition
`-`	Subtraction
`*`	Multiplication
`^`	Exponent
`/`	Division
`MOD`	Modulus
`DIV`	Quotient

- = or == are both acceptable for equal to.
- <> is acceptable for not equal to.
- Care must be taken by candidates to ensure that > and < are not mixed up.
- Candidates must understand that < and > are non-inclusive, so that <9 does not include 9. This is different than <=9 which is inclusive and therefore does include 9.
- Alternative symbols for arithmetic operators are acceptable where these appear in other high-level languages (such as % for MOD or ** for exponentiation).

- 6 x 5 is not an acceptable alternative for multiplication.
- Alterative logical operators are acceptable where these appear in other high-level languages (such as **`&&`** for **`AND`**).
- Alternative Arithmetic Operators may be used as well (such as % for modulus).
- Candidates must be aware that logical operators must be used correctly:

`if x > 0 AND x < 10` is logically correct.
`if x > 0 AND < 10` is **not** logically correct.

Section A

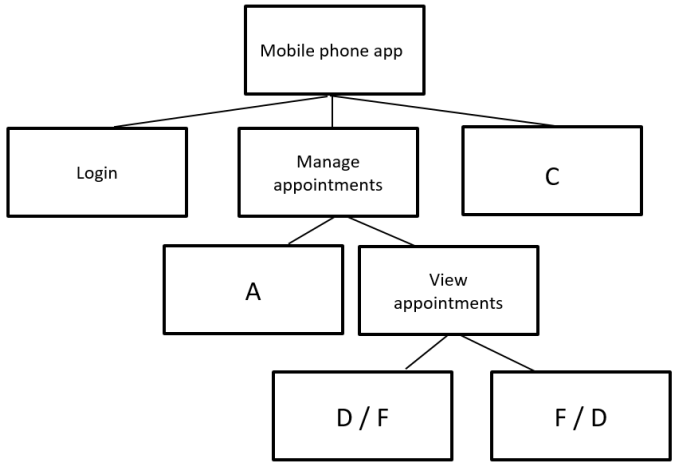
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td>i</td><td>One mark per row

<table><tr><th>Statement</th><th>High-level language</th><th>Low-level language</th></tr><tr><td>Uses English-like keywords such as <code>print</code> and <code>while</code>.</td><td>✓</td><td></td></tr><tr><td>Must be translated before the processor can execute code.</td><td>✓</td><td></td></tr><tr><td>Code written is portable between different processors</td><td>✓</td><td></td></tr><tr><td>Requires the programmer to understand the processor's registers and structure</td><td></td><td>✓</td></tr></table></td><td>4</td><td>Accept other markings that indicate a choice has been made (e.g. a cross, etc)</td></tr>
<tr><td></td><td>b</td><td></td><td>1 mark per bullet, max 4

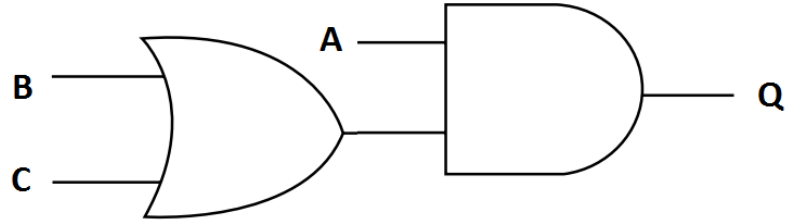
e.g.
• Editor
• …to enable program code to be entered / edited

• Error diagnostics / debugger
• …to display information about errors / location of errors / suggest solutions

• Run-time environment
• …to enable program to be run / to check for run-time errors / test the program</td><td>4</td><td>Allow other tools available in an IDE with suitable expansion (e.g. breakpoints, watch window, stepping, pretty printing, etc)</td></tr>
</table>

Question			Answer	Mark	Guidance
2	a		1 mark per bullet, max 4 • C • A • D/F • F/D	4	D, F may be swapped around. e.g. 
	b	i	• An error that does not cause the program to crash // produces unexpected output	1	
		ii	1 mark per bullet, max 4 • Line 02 // empty = 0 • Will reset empty to 0 on each iteration of the loop • Line 07 // print (“empty”) • Will print out the string “empty” instead of the value held in the variable	4	Mark in pairs
	c	i	1 mark per bullet, max 4 • Compare 5 (middle value) **to 7** • 5 is smaller than 7 / 7 is larger than 7 so… • discard lower part of list / repeat with upper part of list • …compare 7 to 7 (item found)	4	**Do not accept generic answers that do not refer to the data given.**

		ii	1 mark per bullet, max 2 • List of size 1 to compare • …and item not matched to search term	2	Do not accept answers relating to "end of list" – this is linear search.
		iii	• More efficient // Less time taken (to find item) // fewer comparisons to make (with large lists)	1	Accept reference to big O notation as equivalent to more efficient.

Question			Answer	Mark	Guidance
3	a		• OR gate with two inputs // AND gate with two inputs • Diagram as shown in guidance with no additional gates	2	

	b		• Logically compares A AND // correct nested IF
			• …B OR C // correct sequential IF
			• Output in both cases (with attempt at selection).
				3	`A = input("Is the customer 15 or over?")`
					`B = input("Does the customer have a ticket?")`
					`C = input("Does the customer money to buy a ticket")`
					`if A AND (B OR C) then`
					`    print ("allowed")`
					`else`
					`    print ("not allowed")`
					`endif`
					
					Accept answers where inputs are given as strings e.g :
					
					`if A == "Yes" AND (B == "Yes" OR C == "Yes") then`
					`    print ("allowed")`
					`else`
					`    print ("not allowed")`
					`endif`

	c		• `freeseats` called with "`Red`" • …returned value assigned to variable `redseats`	2	`redseats = freeseats("Red")`

					"Red" must use suitable string delimiters (e.g. speech marks) if directly passing the string. Do not penalise case.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>4</td><td>a</td><td>i</td><td>• Hiding / ignoring / removing detail // focussing on certain parts of a problem</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>• Focus on age / number of miles
• Ignore other factors (such as make, model, etc)</td><td>1</td><td>Allow other examples of factors to ignore / remove for BP2</td></tr>
<tr><td></td><td></td><td>iii</td><td>• Ensures only certain users can access the system
• Using password / other example of authentication technique</td><td>2</td><td>Allow other examples of authentication for BP2</td></tr>
<tr><td></td><td>b</td><td>i</td><td>1 mark per bullet, max 4

• Miles and age input <u>separately</u>
• Checks for valid mileage
• Checks for valid age
• Checks <u>both</u> are greater than / greater than equal to zero
• …correctly outputs both True and False</td><td>5</td><td>BP2 and 3 must check for both ends of range – must check that input data is not negative.

Allow FT for BP4 if already penalised under BP2 and/or 3 and output is otherwise correct.

e.g.

<pre>miles = input("enter miles driven")
age = input("enter age of car")
valid = True
if miles > 10000 or miles < 0 then
    valid = False
elseif age > 5 or age < 0 then
    valid = False
endif
print(valid)</pre></td></tr>
<tr><td></td><td></td><td>ii</td><td>1 mark per row, max 3
• Normal : miles (0 – 9,999), age (0 - 5)
• Erroneous/Invalid: miles (less than 0, larger than 9,999), age (less than 0 / more than 5) // non-numeric data
• Boundary : miles (-1/0 / 9,999 / 10,000), age (-1/0 / 5/6)</td><td>3</td><td>Specific data must be given, not a description
e.g.

<table><tr><td></td><td>Miles</td><td>Age</td></tr><tr><td>Normal</td><td>7,000</td><td>3</td></tr><tr><td>Erroneous</td><td>12,000</td><td>7</td></tr><tr><td>Boundary</td><td>10,000</td><td>5</td></tr></table></td></tr>
</table>

		iii	• During development // whilst writing the program // before development is complete.	1	

	c		1 mark per bullet, max 6
			
			• Inputs the current battery charge percentage
			• Outputs “full” if 100%
			• Calculates the amount to charge
			• Calculates the time in minutes…
			• …converts to hours and minutes
			• Outputs the time in hours and minutes
				6	Allow output of 0 hours 0 minutes if full.
					Allow answers referencing decimal parts (e.g. 0.8 = 80%)
					BP5 can be attempted in many ways (e.g. DIV and MOD, repeated division, etc)
					Allow FT for BP6 if reasonable attempt at conversion for BP5 has been given.
					
					e.g.
					`charge = input("enter battery charge")`
					`if charge == 100 then`
					`  print(“full”)`
					`else`
					`  time = (100-charge) * 10`
					`  hours = time DIV 60`
					`  mins = time MOD 60`
					`  print (hours, mins)`
					`endif`

Section B

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>5</td><td>a</td><td></td><td>One mark per correct choice

• SELECT ItemCode, ItemName
• FROM tblStock
• WHERE Price >=60</td><td>3</td><td>Accept other markings that indicate a choice has been made (e.g. a cross, etc)</td></tr>
<tr><td></td><td>b</td><td>i</td><td>One mark if two correct, two marks if four correct, three marks if all correct.

<table>
<tr><th>Price input</th><th>Test type</th><th>Expected price output</th></tr>
<tr><td>50</td><td>Normal</td><td>50</td></tr>
<tr><td>100</td><td>Boundary</td><td>100</td></tr>
<tr><td>150</td><td>Normal</td><td>130</td></tr>
<tr><td>200</td><td>Boundary</td><td>180</td></tr>
<tr><td>250</td><td>Normal</td><td>210</td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>One mark per bullet point

• Input and store price
• Check if price is > 200…
• …if true, reduce price by 40
• Check if price is >100 and not >200…
• ...if true, reduce price by 20
• Output price</td><td>6</td><td><u>High-level programming language / OCR Exam Reference Language response required</u>

Do not accept pseudocode / natural language.

BP3 and BP5 only to be given if sensible check for price being over the appropriate threshold. BP4 must check that price is both larger than 100 and not larger than 200; do not give mark for simply checking price is larger than 100. This may be implicit (e.g. using <code>elseif</code>).

e.g.
<pre>price = input("enter price")
if price > 200 then
    price = price - 40
elseif price > 100 then
    price = price - 20
endif
print(price)</pre></td></tr>
</table>

<table>
<tr>
<td></td>
<td>c</td>
<td></td>
<td>One mark per bullet point

• checking both values (e.g. <code>or</code> changed to <code>and</code> if appropriate)
• <code>if</code> statement in correct format (e.g. checking against <code>stocklevel</code> for each condition)
• <code>if</code> statement uses correct comparisons (e.g. <code>>=</code> and <code><=</code>)
• <code>print</code> statements in correct position
• <code>print</code> statements include string delimiters (e.g. speech marks) around both string outputs</td>
<td>5</td>
<td><u>High-level programming language / OCR Exam Reference Language response required</u>

Do not accept pseudocode / natural language.

e.g.

<pre>stocklevel = input("Enter stock level")
if stocklevel >= 5 and stocklevel <= 25 then
    print("In demand")
else
    print("Not in demand")
endif</pre>
alternative example

<pre>stocklevel = input("Enter stock level")
if stocklevel < 5 or stocklevel > 25 then
    print("Not in demand")
else
    print("In demand")
endif</pre>
As a matter of principle, a candidate who refines the program to work fully but in a different format to that specified should gain full marks.</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>i</td>
<td>One mark per bullet point, in the correct place

• <code>size</code> // <code>len(discountcodes-1)</code>
• <code>code</code>
• <code>price</code> // <code>newprice</code>
• <code>[x,1]</code> // <code>[x][1]</code>
• <code>return newprice</code> // <code>checkdiscount = newprice</code></td>
<td>5</td>
<td>e.g.

<pre>function checkdiscount(price, code)
    newprice = price
    size = len(discount)-1
    for x = 0 to size
        if discount[x,0] == code then
            newprice = price - discount[x,1]
        endif
    next
    return newprice
endfunction</pre></td>
</tr>
</table>

	d	**ii**	One mark per bullet point, maximum 2 marks • `newprice` • `size` • `x`	2	Do not penalise capitalisation Accept price, code, discount

	d	**iii**	• asks for price **and** discount code to be input
			• …passes both to the checkdiscount() function as parameters…
			• ...stores / uses returned value
			• calculates total of all prices entered/returned
			• repeats until 0 is entered as price
			• outputs calculated total
				6	**High-level programming language / OCR Exam Reference Language response required**
					
					Do not accept pseudocode / natural language.
					
					BP3 allow total of prices entered as FT if candidate does not achieve BP2
					
					e.g.
					
					`total = 0`
					`do`
					`  price = input("Enter a price")`
					`  code = input("Enter a discount code")`
					`  newprice = checkdiscount(price, code)`
					`  total = total + newprice`
					`until price == 0`
					`print(total)`
					
					alternative example
					
					`total = 0`
					`price = 1`
					`while price != 0`
					`  price = input("Enter a price")`
					`  code = input("Enter a discount code")`
					`  total = total + checkdiscount(price, code)`
					`endwhile`
					`print(total)`

OCR
Oxford Cambridge and RSA

GCSE (9–1) Computer Science

J277/02 Computational thinking, algorithms and programming

Practice – Morning/Afternoon

Time allowed: 1 hour 30 minutes

7826949044

Do not use:
- a calculator

First name									
Last name									
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.
- You should spend at least 40 minutes on Section B.

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions.

SECTION A

1 **(a)** Tick (✓) **one** box in each row to identify whether the statement refers to a high-level language or a low-level language.

Statement	High-level language	Low-level language
Uses English-like keywords such as `print` and `while`		
Must be translated before the processor can execute code		
Code written is portable between different processors		
Requires the programmer to understand the processor's registers and structure		

[4]

(b) A translator is a common tool found in an Integrated Development Environment (IDE).

Describe **two** other common tools or facilities that an IDE can provide.

1 .....

.....

.....

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[4]

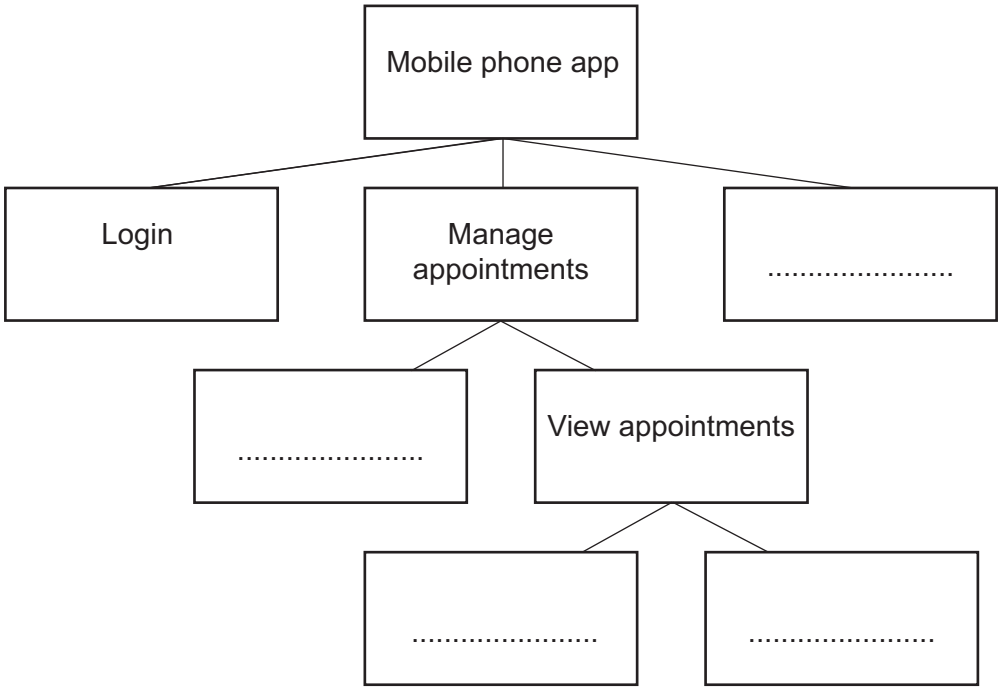
2 A school uses a mobile phone app to allow parents to book appointments for parents' evenings.

Parents must log in before they can use the system. They then choose to book a new appointment, view all appointments already made or update their personal details. If parents choose to view their appointments, they can either view them on-screen or print them off.

(a) A structure diagram has been used to design the mobile phone app.

Write **one** letter from the following table in each space to complete the structure diagram.

Letter	Task
A	Book new appointment
B	Check attendance of child
C	Update personal details
D	View appointments on-screen
E	Log out of the system
F	Print a paper copy of appointments



[4]

(b) At the parents' evening, each parent can book up to five appointments with teachers. Appointments for one student are stored in a one-dimensional array with the identifier `appointments`.

In the array, each element is either the name of a teacher or an empty string where no appointment has been made.

An example for one student is shown:

```
array appointments = ["Miss E", "", "Mr C", "Mr B", ""]
```

The following code shows an algorithm to count up how many empty slots remain in the array and output this value.

```
01  for i = 0 to 4
02        empty = 0
03        if appointments[i] == "" then
04              empty = empty + 1
05        endif
06  next i
07  print("empty")
```

(i) The algorithm contains logic errors.

Define the term logic error.

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..... **[1]**

(ii) Identify the line number of **two** logic errors in the code in **part (b)** and explain why each is an error.

Logic error 1 .....

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Explanation .....

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Logic error 2 .....

.....

Explanation .....

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[4]

(c) Each teacher has the assessment grades for each student. These grades are stored in numerical order.

(i) The grades for one student are shown:

2	**3**	**4**	**5**	**6**	**7**	**8**

Show the steps that a binary search would take to check whether the student has achieved a grade 7 in any assessment.

Your answer must refer to the grades provided.

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..... **[4]**

(ii) Explain how a binary search would determine that a value does not appear in a given array.

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..... **[2]**

(iii) Give **one** advantage of a binary search over a linear search.

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..... **[1]**

3 A cinema uses the following criteria to decide if a customer is allowed to see a film that has a 15 rating:

Customers have to be 15 years of age or older to see the film. They also need to either have a ticket or have the money to buy a ticket.

The table shows the inputs to the system that will output whether the customer can watch the film.

Input	Criteria (True / False)
A	The customer is 15 or over
B	The customer has a ticket
C	The customer has the money to buy a ticket

(a) Draw this system using logic gates.

[2]

(b) Complete the following algorithm to output whether the customer is allowed to see the film or not.

```
A = input("Is the customer 15 or over?")
B = input("Does the customer have a ticket?")
C = input("Does the customer have money to buy a ticket?")
```

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..... **[3]**

(c) The cinema has three screens: "Red", "Black" and "Yellow".

The function `freeseats()` counts how many seats are available in each screen. The name of the screen is passed in as a string parameter and the number of free seats is returned as an integer.

Write code using the function `freeseats()` to find the number of seats available in screen Red and assign this to a variable with identifier `redseats`.

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..... **[2]**

4 A car dealership uses a computer system to record details of the cars that it has for sale. Each car has a make, model, age and number of miles driven.

(a) Each car is given a star rating of 1 to 5, based on the age of the car and the number of miles it has been driven. This rating is recorded in the computer system.

(i) Define the term abstraction.

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..... **[1]**

(ii) Give **one** example of how abstraction has been used in the design of this star rating system.

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..... **[1]**

(iii) Explain how authentication could be used as part of the defensive design considerations for this computer system.

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..... **[2]**

(b) The car dealership only sells cars that have fewer than 10 000 miles and are 5 years old or less.

(i) Write an algorithm that will:

- ask the user to enter the number of miles and the age of a car
- validate the input to check that only sensible values that are in the given range are entered
- output `True` if valid data has been entered or `False` if invalid data has been entered.

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..... **[5]**

(ii) The validation routine from **part (b)(i)** must be tested with normal, erroneous and boundary test data.

Identify suitable test data for each type of test.

	Miles	**Age**
Normal		
Erroneous		
Boundary		

[3]

(iii) Identify when iterative testing is performed.

.....

..... **[1]**

(c) The car dealership sells electric cars, which require charging before they can be driven. Charging the battery by 1% takes 10 minutes.

For example, a battery has 80% charge. It would take 200 minutes, or 3 hours and 20 minutes to charge to 100%.

Write an algorithm that:

- asks the user for the current battery charge percentage
- outputs `"full"` for a battery currently at 100%
- calculates how long this battery would take to charge
- outputs this in hours and minutes.

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SECTION B

We advise you to spend at least 40 minutes on this section.

Some questions require you to respond using either the OCR Exam Reference Language or a high-level programming language you have studied. These are clearly shown.

5 OCR Tech is an online shop that sells electronics such as TVs and game consoles.

(a) Items for sale are stored in the database table `tblStock`. An extract of this table is shown.

ItemCode	ItemName	Price (£)	Stock
GSC5	GameStation5 console	249.99	102
TV4K	4K Television	499.99	18
ABRR	Audiobook reader	59.99	27
NAGC	TV streaming stick	24.99	192

`tblStock`

Tick (✓) **one** box in each section to identify the correct SQL statement to select the item code and item name for all items that have a price of £60 or over.

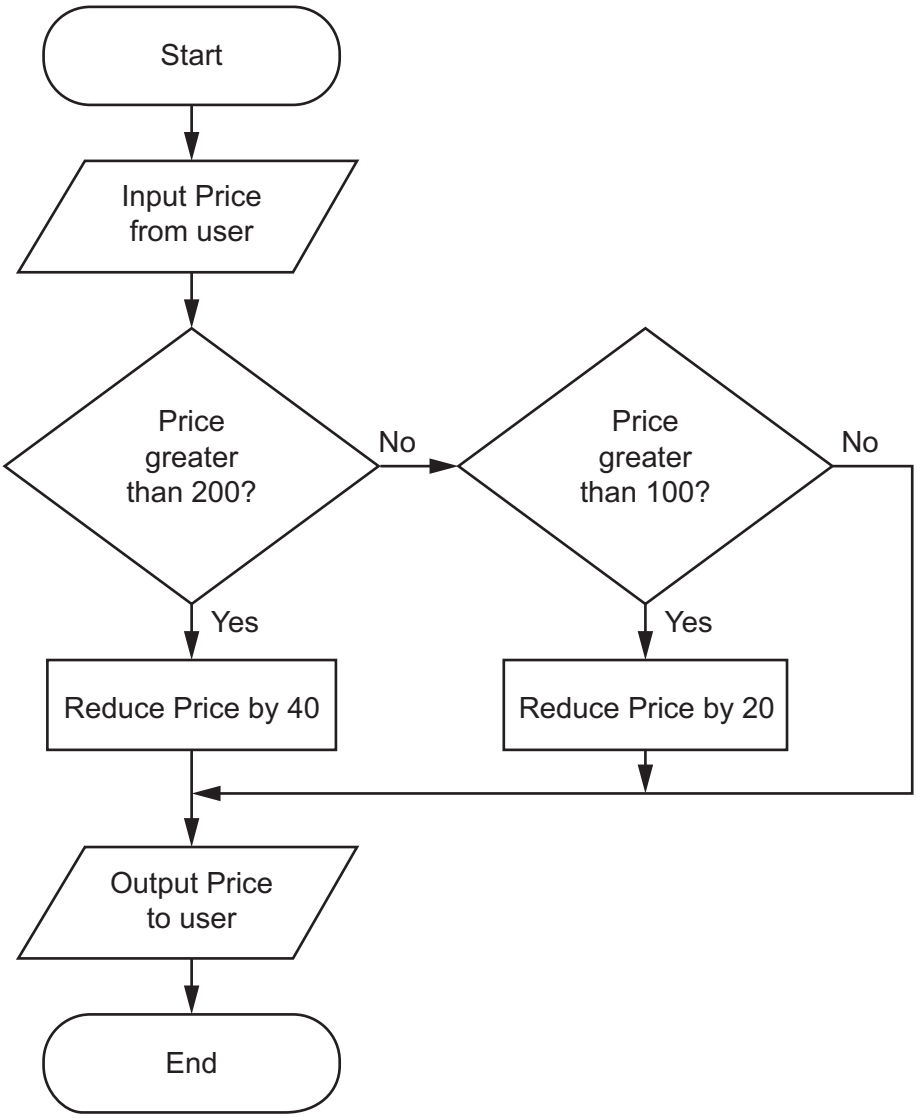
	Tick (✓) **one** box
`SELECT ItemCode AND ItemName`	
`SELECT ItemCode, ItemName`	
`SELECT ItemCode & ItemName`	

	Tick (✓) **one** box
`FROM tblStock`	
`FROM table`	
`FROM database`	

	Tick (✓) **one** box
`WHERE Price <= 60`	
`WHERE Price > 60`	
`WHERE Price >= 60`	

[3]

(b) The following flowchart shows an algorithm to calculate the price of an item during a sale period.



(i) Complete the following test plan for the algorithm.

Price input	Test type	Expected price output
50	Normal	
100	Boundary	
150	Normal	
200	Boundary	
250	Normal	

[3]

(ii) Rewrite the algorithm from **part (b)**.

You must use **either**:

- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied

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..... **[6]**

(c) An item is classified as "In demand" if OCR Tech have between 5 and 25 inclusive in stock.

A program is written that allows the user to input the current stock level and output whether the item is in demand or not.

```
stocklevel = input("Enter stock level")
if stocklevel >= 5 or =< 25 then
      print(Not in demand)
else
      print(In demand)
endif
```

The program contains syntax and logic errors.

Refine the program to correct the errors and write the refined version of the program.

You must use **either**:
- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied

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..... **[5]**

(d) Customers can use a discount code to reduce the price of their purchase. Valid discount codes and their value (in pounds) are stored in a global two-dimensional (2D) array with the identifier `discount`. The following table shows part of this 2D array.

	0	1
0	PVFC7	10
1	CPU5	5
2	BGF2	15

For example, `discount[2,0]` holds discount code BGF2 and `discount[2,1]` holds the discount of 15 pounds.

A function searches through the 2D array and applies the discount to the price. The price and discount code are passed in as parameters. The algorithm design is not complete.

(i) Complete the design for the algorithm.

```
function checkdiscount(price, code)
    newprice = price
    size = len(discount) - 1
    for x = 0 to .....
        if discount[x,0] == ..... then
            newprice = ..... - discount[.....]
        endif
    next x
    .....
endfunction
```

[5]

(ii) Identify **two** variables used in this function design.

1 .....

2 .....

[2]

(iii) Write a program that:

- asks the user for an item price and discount code
- uses the `checkdiscount()` function from **part (d)(i)** to calculate the price of the item after any discount has been applied
- repeats bullet points 1 and 2 until a price of 0 is entered
- outputs the total cost of all items entered, after any discounts have been applied.

You must use **either**:
- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied

[6]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

OCR
Oxford Cambridge and RSA

Friday 19 May 2023 – Afternoon

GCSE (9–1) Computer Science

J277/01 Computer Systems

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

1 Computers represent data in binary form.

(a) Tick (✓) **one** box to identify the statement about binary that is true.

☐ Binary digits can only be the values 0, 1 and 2

☐ The left-most bit of a binary integer has the smallest value

☐ Binary is used because computers are made of switches that can only be on or off

☐ The smallest whole number that can be stored in 8 bits is the number 1

[1]

(b) Complete the table by writing the missing denary, 8-bit binary or hexadecimal values.

Denary	8-bit binary	Hexadecimal
	00000111	7
49		31
	01100110	66
244	11110100	

[4]

(c) Tick (✓) **one** box to identify the largest file size.

- ☐ 2 000 000 bytes
- ☐ 2300 KB
- ☐ 200 MB
- ☐ 0.1 GB

[1]

(d) Tick (✓) **two** boxes to identify the two file sizes that are equal to each other.

- ☐ 4 500 000 bytes
- ☐ 450 KB
- ☐ 4.5 MB
- ☐ 0.45 GB

[1]

(e) Complete the binary addition by adding these two 8-bit binary numbers.

Show all your working.

```
  0 1 1 1 0 0 0 1
+ 1 0 0 1 1 1 1 0
  ---------------
```

[2]

(f) Identify the binary shift that has been applied to the 8-bit binary number 10110000 to get the result 10000000.

.....

..... **[2]**

2 A student is performing a range of actions on the internet using their computer.

(a) A range of protocols are used for the transmission of data by the student's computer, and the web servers they are accessing.

(i) Complete the table by identifying the most appropriate protocol for each of the tasks the student is performing.

Task	Protocol
Requesting to view a news webpage from a web server	
Entering a username and password to access their bank account	
Downloading a text document from a web server	
Checking for new emails in their inbox	

[4]

(ii) Some protocols have layers.

Give **two** reasons why protocols have layers.

1 .....

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2 .....

.....

[2]

(b) The student's computer is part of their home Local Area Network (LAN). The LAN currently only has wired connections.

(i) One characteristic of a LAN is that they are set up over a small geographical area.

Give **one** other characteristic of a LAN.

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..... **[1]**

(ii) Describe the benefits of the student changing their home LAN to include wireless connections.

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..... **[4]**

(iii) State **two** drawbacks of changing their home LAN to include wireless connections.

1 .....

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2 .....

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[2]

3 Binary numbers can represent different forms of data.

(a) One form of data is characters.

Complete the description of how computers represent characters in binary using the given list of terms. Not all terms will be used.

2	4	8	9	16	32	256	
71	72	74	76	78	80	81	
all	different	identical	one	repeated	similar	some	unique

A character set stores ..... of the characters that the computer can represent. Each character is given a ..... binary code. Lower-case and upper-case letters in a character set are given ..... binary codes.

One example of a character set is ASCII. This character set uses ..... bits for each character. If the code value for the character 'F' is 70 then the code value for the character 'L' is ..... .

[5]

(b) Binary numbers can also represent images.

The table shows the colours that are used in an image and the binary value for each colour.

Colour	Binary value
Red	0000
Green	0010
Blue	1000
Purple	0110

The metadata states that the image is 3 pixels wide by 4 pixels high.

The data in the file starts in the top left of the image and goes from left-to-right, top-to-bottom.

(i) State what is meant by **metadata** in an image file.

.....

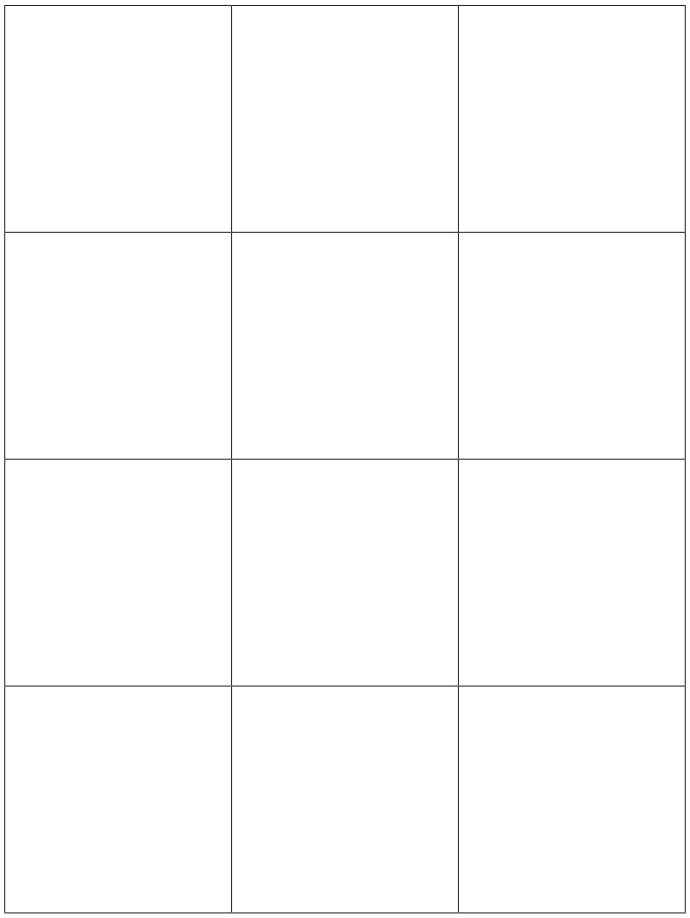
..... **[1]**

(ii) The binary data stored for the image is given:

000000000110100000101000011001100110000000101000

A grid is given for the image. Each square is one pixel.

Write the name of the colour in each square that the pixel will show for this image.



[2]

(iii) A colour depth of 4 is used. This means 4 bits are used to store the colour for each pixel.

State the maximum number of different colours that can be represented in 4-bits.

..... **[1]**

(iv) The colour depth is increased to 2 bytes.

State **two** effects that this change can have on the image.

1 .....

.....

2 .....

.....

[2]

(c) A student has a text document and an image file that need to be compressed separately.

The student needs to reduce the file size of both of these files as much as possible.

(i) Identify the most suitable type of compression for the **text** document. Justify your choice.

Type of compression .....

Justification .....

.....

.....

.....

[3]

(ii) Identify the most suitable type of compression for the **image** file. Justify your choice.

Type of compression .....

Justification .....

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.....

[3]

4 **(a)** Tick (✓) **one or more** boxes on each row to identify all of the methods that can help to prevent each threat.

Threat	Anti-malware	Penetration testing	Encryption	Firewall
Spyware				
Brute-force attack				
Data interception				
SQL injection				

[4]

(b) Name **and** describe **one** threat to a computer system that is not given in **question 4(a)**.

Threat .....

Description .....

.....

.....

.....

[3]

5 An artist has a computer that they use to create images.

Their computer has both hardware and software.

(a) The hardware includes primary and secondary storage.

(i) Explain why a computer needs both primary **and** secondary storage.

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..... **[2]**

(ii) Give **one** example of a secondary storage device that the artist's computer will have **and** an example of the data that will be stored on it.

Secondary storage device .....

Example data .....

.....

[2]

(iii) The computer has Virtual Memory (VM).

The table has four statements about VM. Not all of the statements are correct.

Tick (✓) the **True** column for the statements that are correct.

Re-write any statement that is incorrect in the **False** column by changing the statement to make it true.

Statement	True (✓)	False – rewrite the statement to make it true
A section of primary storage is partitioned to act as virtual memory		
Data from ROM is transferred into VM		
VM is needed when RAM is full, or nearly full		
Data from VM is transferred back to secondary storage when needed		

[4]

(b) The computer has an operating system and utility software.

State the need for utility software in a computer.

.....

..... **[1]**

(c) The artist uploads images to be displayed on a website. This is a client-server relationship.

(i) Identify the computer that is acting as the client in this scenario **and** justify your choice.

Client computer .....

Justification .....

.....

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[3]

(ii) Identify the computer that is acting as the server in this scenario **and** justify your choice.

Server computer .....

Justification .....

.....

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.....

[3]

(d) The artist is working with a programmer on the development of a new piece of software.

The software will allow users to edit images on devices such as mobile telephones.

They are considering releasing the software as open source instead of proprietary.

(i) Describe **two** benefits to the artist and programmer of releasing the software as proprietary.

1 .....

.....

.....

.....

2 .....

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[4]

(ii) Describe **one** benefit to the users of releasing the software as open source.

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..... **[2]**

6* A shopping centre has a security system that includes CCTV cameras to record activities in the centre. The security system is being upgraded to include the use of facial recognition to identify, track the movements of and record individuals throughout the shopping centre.

Discuss the positive and negative impacts of this upgrade including:

- ethical issues
- privacy issues
- legal issues

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..... **[8]**

7 A car comes with many embedded systems, for example parking sensors.

Identify **one** other embedded system that could be found in a car and explain why this is an embedded system.

Example embedded system .....

Explanation .....

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[3]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

OCR
Oxford Cambridge and RSA

Thursday 25 May 2023 – Afternoon

GCSE (9–1) Computer Science

J277/02 Computational thinking, algorithms and programming

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

SECTION A

1 **(a)** The table contains four statements about programming languages.

Tick (✓) **one** box in each row to identify whether each statement describes a low-level programming language or a high-level programming language.

Statement	Low-level	High-level
The same language can be used on computers that use different hardware		
It allows the user to directly manipulate memory		
It allows the user to write English-like words		
It always needs to be translated into object code or machine code		

[4]

(b) The variables `num1` and `num2` store integers.

Write pseudocode to add the integers stored in `num1` and `num2`. Store the result in a variable with the identifier `total`

.....

..... **[1]**

(c) Three incomplete pseudocode algorithms are given with a description of the purpose of each algorithm.

Write the missing arithmetic operator for each algorithm.

(i) Outputting 12 to the power of 2.

```
print(12 ..... 2)
```

[1]

(ii) Working out if a number is odd or even.

```
number = 53
if number ..... 2 == 0 then
   print("Even number")
else
   print("Odd number")
endif
```

[1]

(iii) Finding the difference between two measurements.

```
measurement1 = 300

measurement2 = 100

difference = measurement1 ..... measurement2
```

[1]

(d) Read the following pseudocode algorithm:

```
01  start = 3
02  do
03    print(start)
04    start = start - 1
05  until start == -1
06  print("Finished")
```

Complete the following trace table for the given algorithm.

Line number	`start`	Output

[3]

2 This pseudocode algorithm totals all the numbers in the 0-indexed array `scores`

```
01  total = 0
02  for scoreCount = 1 to scores.length - 1
03      scores[scoreCount] = total + total
04  next scoreCount
05  print(total)
```

The function `length` returns the number of elements in the array.

The algorithm contains several errors.

Two types of errors in a program are syntax and logic errors.

(a) State what is meant by a syntax error and a logic error.

Syntax error .....

.....

Logic error .....

.....

[2]

(b) Identify **two** logic errors in the pseudocode algorithm.

Write the refined line to correct each error.

Error 1 line number .....

Corrected line .....

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Error 2 line number .....

Corrected line .....

.....

.....

[4]

3 An insertion sort is one type of sorting algorithm.

A student has written a pseudocode algorithm to perform an insertion sort on a 1D array `names`.

```
names = ["Kareem", "Sarah", "Zac", "Sundip", "Anika"]
for count = 1 to names.length - 1
    pos = count
    while (pos > 0 and names[pos] < names[pos - 1])
        temp = names[pos]
        names[pos] = names[pos - 1]
        names[pos - 1] = temp
        pos = pos - 1
    endwhile
next count
```

(a) Describe the purpose of the variable `temp` in the insertion sort pseudocode algorithm.

.....

.....

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..... **[2]**

(b) An insertion sort contains a nested loop; a loop within a loop. In this pseudocode algorithm the outer loop is a count-controlled loop and the inner loop is a condition-controlled loop.

Explain why the inner loop needs to be a condition-controlled loop.

.....

.....

.....

..... **[2]**

(c) A bubble sort is another type of sorting algorithm.

(i) Describe **one** difference between an insertion sort and a bubble sort.

.....

.....

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..... **[2]**

(ii) Describe **two** similarities between an insertion sort and a bubble sort.

1 .....

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2 .....

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[2]

4 A garden floodlight system uses inputs from sensors and switches to decide whether it should be turned on.
The table shows the inputs into the system and the meaning of each input value:

Letter	Input device	Input of 1	Input of 0
A	Motion sensor	Motion is detected	Motion is not detected
B	Light sensor	Light levels indicate it is daytime	Light levels indicate it is nighttime
C	Light switch	The switch is turned on	The switch is turned off

The floodlight (Q) is designed to be on (Q = 1) when the switch is turned on and the motion sensor detects motion at nighttime.

(a) Draw a logic diagram for the floodlight.

[3]

(b) Identify the logic gates for truth table 1 and truth table 2.

Truth table 1:

A	B	Output
0	0	0
0	1	1
1	0	1
1	1	1

Logic gate 1: .....

Truth table 2:

A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

Logic gate 2: .....

[2]

5 Charlie is developing an adding game. The rules of the game are:

- the player is asked 3 addition questions
- each question asks the player to add together two random whole numbers between 1 and 10 inclusive
- if the player gets the correct answer, 1 is added to their score
- at the end of the game their score is displayed.

(a) Charlie has been told that the game will need to be tested before giving it to the players.

(i) Explain why programs should be tested before use.

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..... **[2]**

(ii) Complete the table by naming and describing **one** type of test that should be used on Charlie's program before releasing it.

Test type	Description

[2]

(iii) Complete the table by identifying **and** describing **two** features of an IDE that can be used when testing a program.

Feature	Description

[4]

(b) Validating inputs can reduce errors when a program is being run.

Identify **two** methods of validation **and** explain how they can be used on this game.

Validation method 1 .....

Use .....

.....

.....

.....

Validation method 2 .....

Use .....

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.....

.....

[6]

(c) Write an algorithm to play this game. The rules are repeated from the start of the question here:

- the player is asked 3 addition questions
- each question asks the player to add together two random whole numbers between 1 and 10 inclusive
- if the player gets the correct answer, 1 is added to their score
- at the end of the game their score is displayed.

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..... **[6]**

SECTION B

We advise you to spend at least 40 minutes on this section.

Some questions require you to respond using either the OCR Exam Reference Language or a high-level programming language you have studied. These are clearly shown.

6 OCR Security Services is a company that installs intruder alarm systems in commercial buildings.

The systems use a computer that is connected to the door sensors and window sensors.

The following data is stored in the system:

Data stored	Variable identifier	Example data
The user's name	`UserName`	Admin123
A telephone number to call when the alarm is activated	`EmergencyPhoneNumber`	+449999999999
Whether a door sensor is activated	`DoorSensorActive`	True
Whether a window sensor is activated	`WindowSensorActive`	True
A timer that counts, to the nearest second, how long a door sensor has been activated	`DoorActiveTime`	100
A timer that counts, to the nearest second, how long a window sensor has been activated	`WindowActiveTime`	100
Whether the system is armed	`SystemArmed`	True
Whether the system is in test mode	`TestModeActive`	True

(a) Below is a table showing some variables within the program.

Tick (✓) **one** box in each row to identify the most appropriate data type for each variable.

Variable	Boolean	Char	String	Integer	Real
`UserName`					
`EmergencyPhoneNumber`					
`DoorSensorActive`					
`DoorActiveTime`					

[4]

(b) The alarm has an algorithm that decides whether to sound the alarm by checking the data that is stored in the following three variables.

- `SystemArmed`
- `DoorSensorActive`
- `WindowSensorActive`

The alarm will only sound when the alarm has been activated **and** one or both of the door and window sensors are activated. When the system needs to sound the alarm it calls the pre-written procedure `SoundAlarm()`

Write a program that checks the data in the variables and calls `SoundAlarm()` when appropriate.

You must use **either**:
- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied.

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..... **[4]**

(c) The alarm system can also have motion sensors. Each type of sensor has a code. The code for each sensor is given in the table:

Code	Sensor
MS	Motion sensor
DS	Door sensor
WS	Window sensor

A program is written to reset the sensors. The program:

- asks the user to enter the code for the sensor they want to reset
- calls the prewritten function `CheckSensorCode()` to check whether the code entered is a valid code
- the sensor number is read as input if the code is valid and the function `ResetSensor()` is called for the sensor

```
01  sensorType = input("Enter code of the type of sensor to reset")
02  if(CheckSensorCode(sensorType)) then
03      sensorNumber = input("Please input the number of the sensor
                              to reset")
04      sensorID = sensorType + sensorNumber
05      ResetSensor(sensorID)
06  endif
```

(i) Give the line number where there is concatenation.

..... **[1]**

(ii) Give the identifier of a variable used in the program.

..... **[1]**

(iii) Identify the data type of the data returned by the function `CheckSensorCode()`

..... **[1]**

(iv) Give the line number that contains a function call.

..... **[1]**

(v) Identify **two** programming constructs that have been used in the program.

1 .....

2 .....

[2]

(d) The alarm system has a log that stores a record each time a sensor is triggered. This is called an event. The record format is given in the table:

Fieldname	Description
`Date`	The date the event happened
`SensorID`	The sensor that was activated
`SensorType`	The type of sensor that was activated – Door, Motion or Window
`Length`	The number of seconds the sensor was triggered (to the nearest second)

The log is stored in a database table called `events`. The current contents of `events` is shown:

Date	**SensorID**	**SensorType**	**Length**
05/02/2023	WS2	Window	38
05/02/2023	MS1	Motion	2
06/02/2023	DS3	Door	1
06/02/2023	MS2	Motion	3
06/02/2023	MS1	Motion	2
07/02/2023	WS1	Window	24
07/02/2023	DS1	Door	1

Write an SQL statement to display the sensor IDs of the door sensors that have been triggered for more than 20 seconds.

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..... **[3]**

(e) A program written in a high-level language is used to access the data from the database. This program has a procedure, `SaveLogs()`, that stores the data to an external text file.

The procedure `SaveLogs()`:
- takes the string of data to be stored to the text file as a parameter
- takes the filename of the text file as a parameter
- stores the string of data to the text file.

Write the procedure `SaveLogs()`

You must use **either**:
- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied.

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..... **[6]**

(f) OCR Security Services need to identify the total number of seconds the sensors have been activated on a specific date.

The data from the database table `events` is imported into the program written in a high-level programming language.

The program stores the data in a two-dimensional (2D) string array with the identifier `arrayEvents`

The data to be stored is shown in the table.

Date	SensorID	SensorType	Length
05/02/2023	WS2	Window	38
05/02/2023	MS1	Motion	2
06/02/2023	DS3	Door	1
06/02/2023	MS2	Motion	3
06/02/2023	MS1	Motion	2
07/02/2023	WS1	Window	24
07/02/2023	DS1	Door	1

In this table, the value of `events[1, 1]` contains `"MS1"`.

(i) An array can only store data of one data type. Any non-string data must be converted to a string before storing in the array.

Identify the process that converts integer data to string data.

..... **[1]**

(ii) Write a program that:

- asks the user to input a date
- totals the number of seconds sensors have been activated on the date input
- outputs the calculated total in an appropriate message including the date, for example:

```
Sensors were activated for 40 seconds on 05/02/2023
```

You must use **either**:

- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied.

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..... **[6]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

OCR
Oxford Cambridge and RSA

Wednesday 15 May 2024 – Afternoon

GCSE (9–1) Computer Science

J277/01 Computer Systems

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

1

(a) The following table has either the binary or denary value of 3 numbers.

Complete the table by converting the 8-bit binary number into denary and the denary number into 8-bit binary.

8-bit Binary	Denary
11110000	
	105
00011110	

[3]

(b) Complete the table by writing the answer to each statement.

Statement	Answer
The smallest denary number that can be represented by a 4-bit binary number	
The largest denary number that can be represented by a 6-bit binary number	
The maximum number of different colours that can be represented with a colour depth of 7-bits	
The minimum number of bits needed to represent 150 different characters in a character set	

[4]

(c) Show the result of a left binary shift of 4 places on the binary number 00001111.

..... **[1]**

(d) Describe how to convert a 2-digit hexadecimal number into denary.

Use an example in your answer.

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..... **[3]**

(e) Add these two 8-bit binary numbers using binary addition.

Show your working out.

```
  0 1 1 0 1 0 1 1
+ 0 0 0 0 1 1 1 1
-----------------
```

[2]

2 An airport has computers that are connected together on a Local Area Network (LAN).

(a) Each computer has an IP address and a MAC address.

(i) Give **one valid** example of an IPv4 address and **one valid** example of an IPv6 address.

IPv4 .....

.....

IPv6 .....

.....

[2]

(ii) Describe the format of a MAC address.

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.....

..... **[2]**

(b) The airport currently has wired connections in their Local Area Network.

(i) Describe **two** benefits to the airport of using wired connections in their network.

1 .....

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2 .....

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[4]

(ii) Explain the reasons why the airport should also allow the network to be accessed using a wireless connection.

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..... **[3]**

(c) One office in the airport has five computers connected to one switch. There are two printers in the office that can be accessed by all computers.

The computers are connected using a star topology.

(i) Draw a diagram to show how the five computers, switch and two printers are connected in a star topology.

[3]

(ii) Give **one** benefit and **one** drawback of the office using a star topology instead of a mesh topology.

Benefit .....

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Drawback .....

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[2]

(iii) Describe the role of the switch in the star topology.

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..... **[3]**

3 A computer has an operating system and utility software.

(a) The table contains operating system functions and a task that each function performs.

Complete the table by writing the two missing function names and a task performed by the two given functions.

Function	Task
	Moves data from secondary storage to RAM
Peripheral management	
	Allows the user to create, name and delete folders
User interface	

[4]

(b) Complete the description of utility system software using the words provided in the box. Not all words are used.

access	amount	apart	compression	consecutive
defragmentation	deleted	encryption	key	lock
quantity	separate	speed	understood	

..... software changes data using a ..... . If the changed data is intercepted, it cannot be ..... . This software does not stop the data from being intercepted.

..... software analyses the data on a disk to find files that have been split and stored in separate locations. The split files are moved to be ..... in storage and the free space is moved together. This does not provide more storage space on the disk, instead it makes the ..... of the data faster because the read head does not have to move as far to access the next part of the file.

[6]

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4* A computer programmer has developed a computer game that they want to release for users to download over the internet. The programmer needs to decide whether to release the game as open source or proprietary software.

Discuss the features, benefits and drawbacks of each type of licence for this program and make a recommendation to the programmer.

You should include the following in your answer:
- features of each licence
- legal and ethical issues of each licence
- benefits and drawbacks of each licence. **[8]**

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5 A musician uses a computer to make and record music.

(a)

(i) Tick (✓) **one** box to identify the correct description of sound sampling.

- ☐ The frequency of the wave is measured a set number of times each second.
- ☐ The amplitude of the wave is measured at set intervals.
- ☐ The digital sound wave is measured a set number of times each second.
- ☐ The analogue sound wave's resolution is measured at set intervals.

[1]

(ii) Explain how changing the bit depth will affect the sound file.

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..... **[2]**

(b) The musician has run out of storage space on their secondary storage device and needs to buy a replacement.

(i) Identify whether the musician should buy a magnetic secondary storage device or a solid state secondary storage device for their computer.

Justify your choice.

Type .....

Justification .....

.....

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[4]

(ii) Identify **one other** type of secondary storage.

..... **[1]**

(iii) Tick (✓) **one** box to identify the smallest secondary storage capacity.

- ☐ 2.1 GB
- ☐ 300 MB
- ☐ 200 000 KB
- ☐ 0.0021 TB

[1]

(iv) The musician's recordings have an average (mean) file size of 3 MB. The musician has 1000 recordings.

Calculate an estimate of the storage space in GB that the 1000 files will require, assuming they are each 3 MB in size. Show your working out.

Working space:

Answer: ..... GB **[2]**

6 A computer has a Central Processing Unit (CPU).

(a) Describe what happens during the fetch-execute cycle.

.....

.....

.....

..... **[2]**

(b) Complete the table by writing the name of **two** registers used in the fetch-execute cycle **and** the purpose of each register.

Register	Purpose

[4]

(c) Give **three** characteristics of a CPU that can affect its performance.

1 .....

2 .....

3 .....

[3]

7 A car has a 'Follow Me' system that uses a cruise control feature to allow the car to follow the car in front of it. It will keep the same speed and distance without the driver's intervention. The cruise control system is an example of an embedded system.

(a) Explain the reasons why the 'Follow Me' system is an example of an embedded system.

.....

.....

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.....

..... **[3]**

(b) The car's system has Read Only Memory (ROM) and Random Access Memory (RAM).

(i) State **two** items that will be stored in the ROM for the 'Follow Me' system.

1 .....

2 .....
[2]

(ii) The RAM will store currently running data and instructions.

State **three** items of data that will be stored in the RAM for the 'Follow Me' system.

1 .....

2 .....

3 .....
[3]

(iii) Explain why the 'Follow Me' system does not need virtual memory.

.....

.....

.....

..... **[2]**

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.

OCR
Oxford Cambridge and RSA

Tuesday 21 May 2024 – Afternoon

GCSE (9–1) Computer Science

J277/02 Computational thinking, algorithms and programming

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.
- We advise you to spend approximately 50 minutes on Section A and approximately 40 minutes on Section B.

SECTION A

We advise you to spend approximately 50 minutes on Section A.

1 Tick (✓) **one** box in each row to identify the programming construct where each keyword is used.

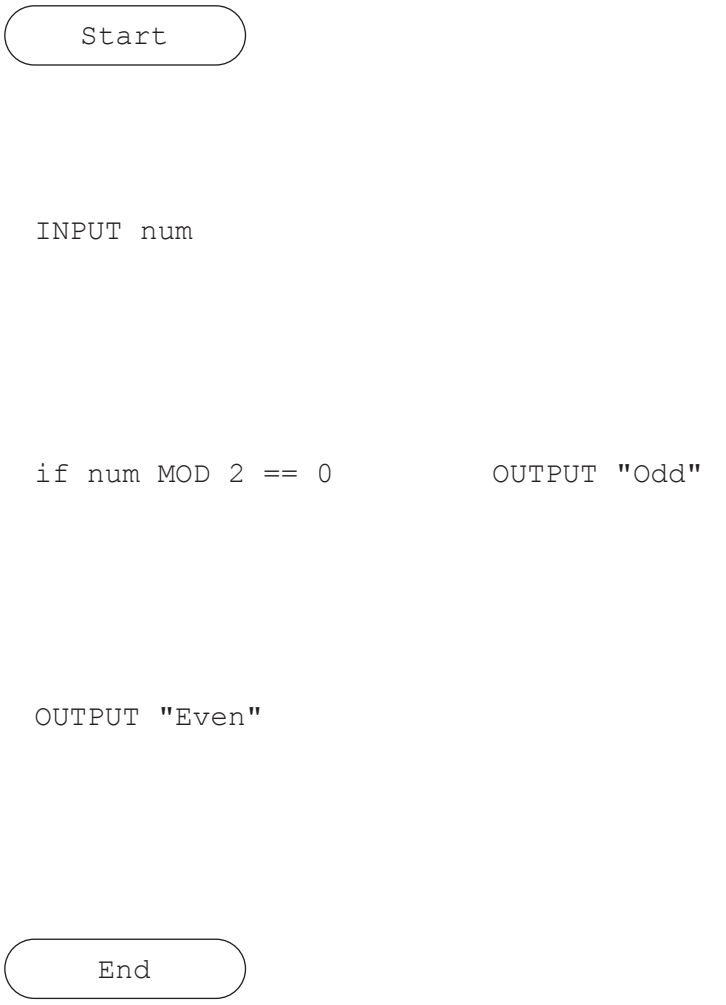
Keyword	Programming construct	
	Selection	**Iteration**
`if`		
`for`		
`while`		

[3]

2 An algorithm decides if a number is odd or even.
An odd number divided by 2 will give the remainder 1.

The flowchart statements have been written for the algorithm, but the flowchart is incomplete.

Complete the flowchart.



[4]

3

(a) State what is meant by the term syntax error. Give **one** example of a syntax error in a program.

Definition .....

.....

Example .....

.....

[2]

(b) A student writes an algorithm to input two numbers and add them together to create a total.

If the total is between 10 and 20 inclusive, `"success"` is output.

If the total is not between 10 and 20 inclusive, `"warning"` is output.

```
01 num1 = input("Enter a number")
02 num2 = input("Enter a number")
03 total = num1 + num1
04 if total >= 10 then
05     print("success")
06 else
07     print("warning")
08 endif
```

The algorithm does not work correctly.

Identify the line number of the **two** logic errors in the algorithm and refine the code to correct each logic error.

Line number .....

Correction .....

.....

Line number .....

Correction .....

.....

[4]

(c)

(i) Show how a binary search will be used to find the number 10 in the following data set:

1 2 5 6 7 10 20

.....

.....

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.....

.....

..... **[3]**

(ii) State **one** pre-requisite for a binary search algorithm.

.....

..... **[1]**

(iii) Tick (✓) **one** box to identify the name of the sorting algorithm that splits data into individual items before recombining in order.

☐ Bubble sort

☐ Insertion sort

☐ Merge sort

[1]

4 A program allows users to search for and watch videos. Users give a rating to the videos they watch.

(a) Identify **one** input and **one** output for the program.

Input .....

Output .....

[2]

(b) Describe **one** method of defensive design that can be used when creating the program.

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..... **[2]**

5

(a) Complete the truth table for **P = (A AND B) OR C**

A	B	C	P
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

[4]

(b) Draw a logic circuit for **P = NOT A AND (B OR C)**

[3]

6 The variable `message` is assigned a value.

```
message = "abcd1234"
```

(a) Complete the table to show the output when each statement executes.

The first output has been completed for you.

Statement	Output
`print(message.length)`	`8`
`print(message.upper)`	
`print(message.left(4))`	
`print(int(message.right(4))*2)`	

[3]

(b) Write an algorithm in pseudocode to:

- store `"Hello"` in the variable `word1`
- store `"Everyone"` in the variable `word2`
- concatenate `word1` and `word2` to store `"HelloEveryone"` in the variable `message`

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..... **[3]**

7 Programs can be written in high-level languages or low-level languages.

(a) Give **two** reasons why some programs are written in a low-level language.

1 .....

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2 .....

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[2]

(b) Describe the benefits of using a compiler instead of an interpreter when writing a program.

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..... **[3]**

8 An algorithm stores the position of a character on a straight line as an integer. A user can move the character left or right.

The following algorithm:
- generates one random number between 1 and 512 (inclusive) to store as the position
- prompts the user to input a direction to move (left or right)
- takes a direction as input until a valid direction is input.

```
p = random(1, 512)
print("The position is ", p)
a = ""
while a != "left" and a != "right"
     a = input("Enter direction, left or right")
endwhile
```

(a) Describe **two** ways to improve the maintainability of the algorithm.

1 .....

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.....

2 .....

.....

.....

[4]

(b) If the character moves left, 5 is subtracted from the position.
If the character moves right, 5 is added to the position.

The position of the character can only be between 1 and 512 inclusive.

The function `moveCharacter()`:

- takes the direction (left or right) and current position as parameters
- changes `position` based on `direction`
- sets `position` to 1 if the new position is less than 1
- sets `position` to 512 if the new position is greater than 512
- returns the new position.

Complete the function `moveCharacter()`

```
function moveCharacter(direction, position)
```

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```
endfunction
```

[6]

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SECTION B

We advise you to spend approximately 40 minutes on Section B.

Some questions require you to respond using either the OCR Exam Reference Language or a high-level programming language you have studied. These are clearly shown.

9 Students take part in a sports day. The students are put into teams.

Students gain points depending on their result and the year group they are in. The points are added to the team score.

The team with the most points at the end of the sports day wins.

(a) Data about the teams and students is stored in a sports day program.

(i) Identify the most appropriate data type for each variable used by the program.

Each data type must be different.

Variable	Example	Data type
`teamName`	`"Super-Team"`	
`studentYearGroup`	`11`	
`javelinThrow`	`18.2`	

[3]

(ii) The student names for a team are stored in an array with the identifier `theTeam`

An example of the data in this array is shown:

Index	0	1	2	3	4	5
Data	Ali	Eve	Ling	Nina	Sarah	Tom

theTeam

A linear search function is used to find whether a student is in the team. The function:

- takes a student name as a parameter
- returns `True` if the student name is in the array
- returns `False` if the student name is **not** in the array.

Complete the design of an algorithm for the linear search function.

```
function linearSearch(studentName)

    for count = 0 to ..........

        if theTeam[..........] == .......... then

            return ..........

        endif

    next count

    return False

endfunction
```

[4]

(b) This algorithm calculates the number of points a student gets for the distance they throw in the javelin:

```
01   javelinThrow = input("Enter distance")
02   yearGroup = input("Enter year group")
03   if javelinThrow >= 20.0 then
04       score = 3
05   elseif javelinThrow >= 10.0 then
06       score = 2
07   else
08       score = 1
09   endif
10   if yearGroup != 11 then
11       score = score * 2
12   endif
13   print("The score is", score)
```

Complete the trace table for the algorithm when a student in year 10 throws a distance of 14.3

You may not need to use all the rows in the table.

Line number	`javelinThrow`	`yearGroup`	`score`	Output

[4]

(c) The height a student jumps in the high jump needs to be input and validated.
The height is entered in centimetres (cm) and must be between 40.0 and 180.0 inclusive.

(i) Write an algorithm to:
- take the height jumped as input
- output `"VALID"` or `"NOT VALID"` depending on the height input.

You must use **either**:
- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied.

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..... **[4]**

(ii) The algorithm is tested using a range of tests.

Complete the table to identify an example of test data for each type of test.

Test data (height jumped in cm)	Type of test	Expected output
	Normal	`"VALID"`
	Boundary	`"VALID"`
	Erroneous	`"NOT VALID"`

[3]

(d) The individual results for each student in each event are stored in a database.

The database table `TblResult` stores the times of students in the 100 m race. Some of the data is shown:

StudentID	YearGroup	TeamName	Time
11GC1	11	Valiants	20.3
10VE1	10	Super-Team	19.7
10SM1	10	Super-Team	19.2
11JP2	11	Champions	19.65

Complete the SQL statement to show the Student ID and team name of all students who are in year group 11

```
SELECT StudentID, .....

FROM .....

.....
```

[4]

(e) Abstraction and decomposition have been used in the design of the sports day program.

(i) Identify **one** way that abstraction has been used in the design of this program.

.....

..... **[1]**

(ii) Identify **one** way that decomposition has been used in the design of this program.

.....

..... **[1]**

(f) An algorithm works out which team has won (has the highest score).

Write an algorithm to:
- prompt the user to enter a team name and score, or to enter "stop" to stop entering new teams
- repeatedly take team names and scores as input until the user enters "stop"
- calculate which team has the highest score
- output the team name and score of the winning team in an appropriate message.

You must use **either**:
- OCR Exam Reference Language, **or**
- A high-level programming language that you have studied

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[6]

END OF QUESTION PAPER

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EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.