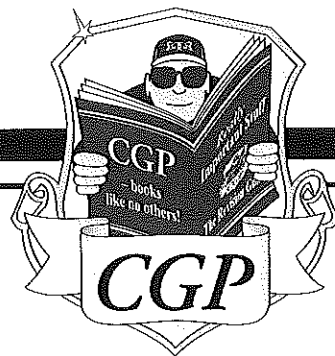


**CGP**

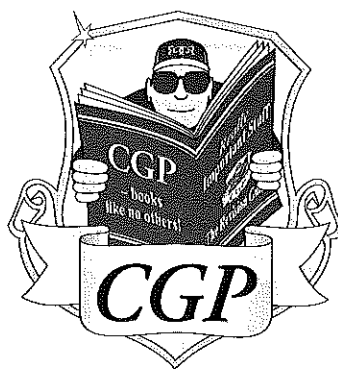


**GCSE OCR**

**Computer Science**

**For the Grade 9-1 Course**

**Practice Exam Papers  
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## Optimise your GCSE Computer Science exam prep with CGP...

Let's face it, OCR's Grade 9-1 Computer Science exams are tougher than a 1980s arcade game. Fortunately, our practice papers are just what you'll need to become a highly efficient exam-passing machine.

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So dust off your pseudocode — soon you'll be writing algorithms in your sleep.

### Published by CGP

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# What to Expect in The Exams

## Topics are Covered in Different Papers

For OCR GCSE Computer Science, you'll sit **two exam papers** at the **end** of your course.

Paper	Topics include...	Time	No. of marks	Overall % of GCSE
1	Computer systems, networks, software and real-world issues.	1 hr 30 mins	80	40%
2	Algorithms, programming, logic and data representation.	1 hr 30 mins	80	40%

The last 20% comes from your programming project.

## The exams will include some Extended Writing...

Paper 1 will include one or two **extended response** questions, where you'll have to write at length on a particular **topic** and consider its impact in different areas. Your answers will need to be well-written, clearly-structured and make **loads of good points**, not just waffle to fill the space. The only way to get these questions right is by carefully **planning** out your answer first.

Questions like this will be marked with a \*.

## ...and a healthy dose of Pseudocode/Flowcharts

- Many questions will present you with algorithms written in **pseudocode** or as **flowcharts**. To help you, OCR will always format these **in the same way** — there's info on this at the back of the OCR specification.
- Many questions, especially in paper 2, will ask you to **write your own algorithms or code** — generally you can give these either as **pseudocode** or a **flowchart**. Stick with whichever you find easier.
- There are **no specific rules** for how you should write **pseudocode**. It must be **clear enough** that a **competent programmer** could easily turn it into real code. Just keep it simple and aim for something similar to OCR.

All the algorithm answers in this booklet are just examples — there are loads of ways that you could answer each question.

# Working Out Your Grade

- Do a complete exam (Paper 1 and Paper 2).
- Use the answers and mark scheme in this booklet to mark each exam paper.
- Write down your mark for each paper in the table below — each paper is worth a maximum of 80 marks.
- Find your total for the whole exam (out of a maximum of 160 marks) by adding up your marks from both papers.
- Look the total up in this table to see what grade you got.

Total Mark	18-35	36-53	54-71	72-82	83-92	93-103	104-114	115-125	126-160
Grade	1	2	3	4	5	6	7	8	9

We can't be sure about the **exact grade boundaries** for the new grade 9-1 exams — but this table should be a pretty good guide.

***Stick your marks in here so you can see how you're doing***

	Paper 1	Paper 2	Total	Grade
SET A				
SET B				

## ***Important!***

Any grade you get on these papers is **no guarantee** of getting that in the real exam — but it will give you a rough idea of what grade you're **currently working at**.

# Answers

## Set A — Paper 1

1. a) E.g.
    - The CPU processes data and instructions. *[1 mark]*
    - The CPU fetches, decodes and executes program instructions. *[1 mark]*

*[1 mark available in total]*
  - b) Any **one** register with its purpose, e.g.
    - Memory Data Register (MDR) *[1 mark]* — holds data or instructions waiting to be processed or moved to RAM. *[1 mark]*
    - Program Counter (PC) *[1 mark]* — points to the next instruction to be executed. *[1 mark]*
    - Accumulator *[1 mark]* — stores the results of calculations carried out by the Arithmetic Logic Unit (ALU). *[1 mark]*

*[2 marks available in total]*
  - c) E.g.  
The computer will be able to execute more instructions per second. *[1 mark]* So his video games may appear to run more smoothly/have a higher frame rate *[1 mark]* and his photo editing software may run faster. *[1 mark]*

*[2 marks available in total]*
  - d) RAM stores data/instructions/software/files while they are in use by the system. *[1 mark]*
  - e) Virtual memory is the allocation of an area of secondary storage to be used like RAM. *[1 mark]* It is needed to allow the computer to open additional files/applications when RAM is full. *[1 mark]*
  - f) i) Embedded systems are computers that are built into a larger system. *[1 mark]*
  - ii) Any **three** examples, e.g.
    - dishwashers *[1 mark]*
    - televisions *[1 mark]*
    - washing machines *[1 mark]*
    - sat navs *[1 mark]*

*[3 marks available in total]*
2. a) A Wide Area Network connects computers/LANs that are in different geographical locations. *[1 mark]*
  - b) Any **one** piece of hardware with a suitable explanation, e.g.
    - Switch/Wireless Access Point (WAP) *[1 mark]* — directs data on the network. *[1 mark]*
    - Network Interface Card (NIC) *[1 mark]* — allows individual devices to connect to the network. *[1 mark]*
    - Ethernet cable *[1 mark]* — carries the data between devices on the network. *[1 mark]*

*[2 marks available in total]*
  - c) Client-server relationship:  
The client computer systems send requests to the server for data/services. The server processes and responds to requests from multiple clients. *[1 mark]*  
OR  
The server centrally stores data, e.g. documents, emails, passwords, etc. and manages how clients can access this data. *[1 mark]*  
Examples:
    - requesting a magazine article from the file server. *[1 mark]*
    - using a client machine to send an email via the email server to a freelance writer. *[1 mark]*

*[2 marks available — 1 for explanation of client-server relationship, 1 for a suitable example]*
  - d) Any **two** possible causes, e.g.
    - An additional nearby network could be using the same/an overlapping channel. *[1 mark]*
    - Objects or walls between her and the Wireless Access Point (WAP) could be obstructing the signal. *[1 mark]*
    - The computers suffering from poor signal could be a long distance from the Wireless Access Point (WAP). *[1 mark]*

*[2 marks available in total]*
3. a) E.g.  
Ethical issues:
    - Mr Whorton is placing the students' personal data in the hands of a third party, *[1 mark]* meaning he can't fully guarantee that it is safe, e.g. the cloud site might be hacked. *[1 mark]*
    - The data itself will be stored off-site, *[1 mark]* so unless the school keeps a local backup, the data could be lost if anything happens to the cloud storage company's servers. *[1 mark]*

Legal issues:

    - The Data Protection Act states that sensitive documents must be kept safe and secure. *[1 mark]* If he stores the data on a cloud storage service, Mr Whorton will have little control over its security. *[1 mark]*
    - The Data Protection Act states that data must not be kept for longer than necessary. *[1 mark]* Mr Whorton will have no control over whether the cloud storage company back up or copy the data, so he won't be able to ensure that it has been completely deleted when it is no longer needed. *[1 mark]*

*[4 marks available in total — ethical and legal issues must both be covered for full marks]*  
*Ethical and legal issues are both about what's right and wrong, but ethical means in the eyes of society and legal means in the eyes of the law.*
  - b) Any **two** differences, e.g.
    - Open source software is usually free, while proprietary software is usually paid for. *[1 mark]*
    - Open source software can be legally modified by anyone, while the modification of proprietary software is restricted. *[1 mark]*
    - Open source software can often contain bugs and security flaws, while proprietary software tend to be well-tested and reliable, with frequent patches and updates. *[1 mark]*
    - Open source software is usually only supported by online communities, whereas proprietary software will usually come with warranties, documentation and customer support. *[1 mark]*

*[2 marks available in total]*
  - c) The Computer Misuse Act 1990. *[1 mark]*
4. a) Secondary storage is a computer's non-volatile internal storage. *[1 mark]*
  - b) The laptop computer needs secondary storage to store data/programs/its operating system *[1 mark]* when it is not in use/when the power has been switched off. *[1 mark]*
  - c) Any **one** reason, e.g.
    - SSDs have no moving parts, *[1 mark]* making them more durable than HDDs, particularly in portable devices which will be frequently moved when in use. *[1 mark]*
    - SSDs have fast read-write speeds, *[1 mark]* so programs and files will load faster than if they were on a HDD. *[1 mark]*

*[2 marks available in total]*

- d) Any **one** storage technology with a suitable explanation, e.g.
- Memory card/SD card *[1 mark]*
    - They tend to have a high storage capacity, so they are suitable for storing large files. *[1 mark]*
    - They are very small, making them convenient for Margaret to bring to and from work. *[1 mark]*
  - Cloud storage *[1 mark]*
    - It would be convenient as Margaret would not need to physically transport anything. *[1 mark]*
    - Cloud storage doesn't require any additional hardware or specific ports. *[1 mark]*
    - Certain cloud storage services are free, and paid ones are usually cheap for the amount of storage they provide. *[1 mark]*
  - USB pen drive *[1 mark]*
    - USB pen drives are often relatively cheap and easy to obtain. *[1 mark]*
    - Most USB pen drives are small and portable, making them convenient for transferring data between devices. *[1 mark]*
    - It will be compatible with both machines — desktop computers and laptops always have USB ports. *[1 mark]*
- [3 marks available in total — 1 for a suitable storage technology and 2 for relevant explanations]*
5. a) i) Social engineering is a way of gaining illegal access to sensitive information/private networks by influencing people. *[1 mark]*
- ii) Any **two** examples, e.g.
- A phishing email is sent to the employees or customers of XiBank, *[1 mark]* pretending to be from an official source and tricking them into inputting their login details. *[1 mark]*
  - An employee or customer of XiBank receives a spoof phone call *[1 mark]* from someone pretending to be someone else within the company and asking them to disclose their login details. *[1 mark]*
  - A spoof version of the official XiBank website is created, *[1 mark]* where employees or customers can be tricked into entering their login details. *[1 mark]*
- [4 marks available in total]*
- b) i) A denial of service attack is where an attacker prevents access to a network or website by flooding it with useless traffic. *[1 mark]*
- ii) Any **one** effect, e.g.
- Customers are unable to withdraw their money. *[1 mark]*
  - Customers are unable to access their online account/the website runs very slowly. *[1 mark]*
  - Employees are unable to use the network/it becomes extremely slow. *[1 mark]*
- [1 mark available in total]*
- c) Any **three** measures, e.g.
- Establishing a good network policy for the company *[1 mark]*
  - Penetration testing *[1 mark]*
  - Ensuring that tools are in place to allow the use of network forensics *[1 mark]*
  - Requiring strong passwords from all users *[1 mark]*
  - Setting up user access levels on the network *[1 mark]*
  - Installing anti-malware software on all networked computers *[1 mark]*
  - Encrypting all sensitive data on the network *[1 mark]*
  - Educating employees in how to spot phishing scams *[1 mark]*
- [3 marks available in total]*
6. a) Any **two** functions, e.g.
- Communicating with hardware *[1 mark]*
  - Providing a User Interface (UI) *[1 mark]*
  - Providing a platform for applications to run on *[1 mark]*
  - Allowing multi-tasking *[1 mark]*
  - File and disk management *[1 mark]*
  - Managing user accounts/security. *[1 mark]*
- [2 marks available in total]*
- b) Utility software is used to help to maintain or configure a computer. *[1 mark]*
- Any **two** examples, e.g.
- disk defragmentation utilities *[1 mark]*
  - backup utilities *[1 mark]*
  - compression software *[1 mark]*
  - encryption software *[1 mark]*
  - disk restore utilities *[1 mark]*
  - anti-virus software *[1 mark]*
  - firewalls *[1 mark]*
  - automatic update utilities *[1 mark]*
- [3 marks available in total]*
- c) E.g. Multi-tasking allows more than one application to appear to the user to be running at the same time *[1 mark]* while in fact the Operating System is just efficiently managing memory and CPU processing time to simulate this. *[1 mark]*
- d) i) A full backup is a copy of every file on the system, *[1 mark]* while an incremental backup only copies files that were created or edited since the last backup. *[1 mark]*
- ii) They would first need to restore the full backup from the previous Monday, *[1 mark]* then the incremental backup made on the following Wednesday, *[1 mark]* and finally the incremental backup from the Friday. *[1 mark]*
7. Points you might include:
- Cultural implications
- People could become more isolated with the increased use of AI, rather than, for example, seeking face-to-face appointments with human medical professionals.
  - Companies may be able to save costs by employing fewer customer service staff and using AIs in their place.
  - AI assistants may not be able to provide the same quality of service as a human could — this could lead to a lower standard of customer service in general.
  - AIs could provide services such as personalised news and scheduling assistance, making daily life more convenient.
  - AI services could be adapted to include advertisements, further intruding on our day-to-day lives.
  - AI-tailored adverts are, in theory, relevant to the user, which could increase a user's interest in the adverts and make them more useful to them.
  - People may feel pressured into buying the latest AI technology to keep up with what may be considered 'basic needs', and they may struggle to afford this. This could further increase the digital divide.
- Technology
- Widespread use of AI will encourage the development of improvements to the technology, e.g. 'smarter' AI, faster service, better personalised service, etc.
  - Many AI technologies, such as speech recognition, work by collecting and analysing massive amounts of user data to become 'smarter', so as more people use AI services, more data will be collected and the 'smarter' it will become.
  - The current technology is still very limited, which may discourage people from investing time and money into its development.
  - The development of AI could lead to innovation in other areas of machine learning, such as weather systems, or to developments in hardware in fields like robotics.

### Ethical implications

- The AI systems may ask you to provide personal information in order to use the service, which may be made available to other parties without the user knowing (e.g. if the user agrees to an End User Licence Agreement without reading it carefully).
- As AIs develop to perform advanced tasks such as giving medical advice, they may reduce the need for people in these jobs, which may cause unemployment.
- If services such as medical advice become quicker and easier to access, it may help injured people or even save lives.
- Some people may be uncomfortable with the idea of 'creating intelligence', seeing it as ethically or religiously wrong (e.g. 'playing God').
- The human-like conversation may intimidate users who do not feel comfortable 'talking' to an AI that acts human.
- People may see the data collection required by AIs as an invasion of privacy — users may have their speech recorded by an AI assistant, or their movements tracked by their smart GPS, without necessarily being aware of it.
- The technology could be adapted to be used for illegal purposes, such as hacking.
- AI could read people's social media profiles to determine their social background, political/religious views, etc. Targeted messages could then be sent to these people to subtly influence their views, e.g. in a political election campaign.

### Environmental issues

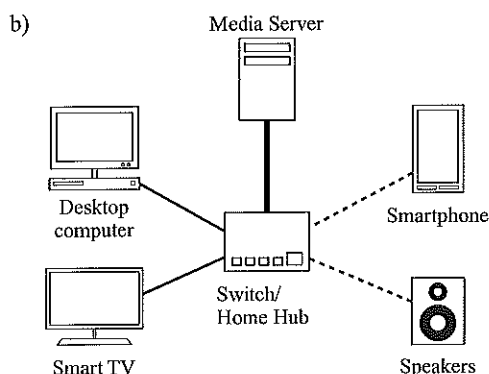
- Advances in AI technology may require more and more cutting-edge hardware, meaning that more precious metals will be used up.
- As more 'smart' devices are released, people will dispose of their old devices, causing the world's landfill sites to fill quickly. In the long term, this could pose an environmental risk at these sites.
- People could seek medical advice from AIs at home rather than driving to see a human professional, which could reduce emissions from cars and other vehicles.

How to mark your answer:

- Two or three brief points with very little explanation. **[1-2 marks]**
- Three to five detailed points covering at least two of: cultural implications, technology, ethical implications and environmental issues. **[3-5 marks]**
- Six or more detailed points that form a well-written, balanced discussion, covering all of: cultural implications, technology, ethical implications and environmental issues. **[6-8 marks]**

*I feel a sudden urge to clear my social calendar for a week, order lots of pizza and settle in to watch back-to-back Blade Runner, The Matrix, Westworld, WarGames, 2001, Tron, Tron Legacy, Ex Machina, Terminator 1, Terminator 2, maybe even Terminator 3... You'll have time to do the same after your GCSEs...*

8. a) Network topology refers to the layout of the network/where the various devices are all connected to create the network. **[1 mark]**



**[3 marks available — 1 for all devices connected to a central switch/hub, 1 for a distinction between wired and wireless device connections and 1 for the switch/hub connecting to the media server]**

*No marks for artistic ability (sadly), so don't get carried away with beautiful illustrations of each device. A labelled box will do.*

- c) A MAC address is a unique identifier for a device, which allows it to be found on a network. **[1 mark]**

d)

Operation	Protocol
Sending or retrieving files from a remote server or computer	POP (Post Office Protocol)
Downloading an email and deleting it from the sever	SMTP (Simple Mail Transfer Protocol)
Transferring emails between remote servers	HTTP (Hyper Text Transfer Protocol)
Accessing and retrieving web pages	FTP (File Transfer Protocol)

**[4 marks available — 1 for each correct connection]**

- e) A layer is a self-contained group of network protocols which have similar functions. **[1 mark]**

- f) Condition-controlled loop with filename as condition. **[1 mark]**

Requiring new user input if filename is in use. **[1 mark]**  
 Requiring new user input if filename is too long. **[1 mark]**  
 Saving file to server once filename is valid. **[1 mark]**  
 Displaying confirmation message after save. **[1 mark]**  
 Using final filename in confirmation message. **[1 mark]**

E.g.

```

filenameValid = false
filename = input("Enter a filename.")
do
    if filename exists on server then
        filename = input("Filename already in use.
                        Please enter a new filename.")
    elseif filename.length > 30 then
        filename = input("Filename too long.
                        Please enter a new filename.")
    else
        filenameValid = true
    endif
until filenameValid == true
save file to server as filename
print(filename + " has been successfully saved to the server.")
  
```

## Set A — Paper 2

1. a) Three [1 mark]
- b) Selection [1 mark]
- c) My name is Steve Wozniak and I am 66 years old.  
I am old enough to drive a car. [1 mark]
- d) i) A procedure is a set of instructions stored under one name,  
that can be called from the main program. [1 mark]
- ii) Functions always return a value, while procedures don't.  
[1 mark]
2. a) i) Iteration is when a segment of a program repeats/loops.  
[1 mark]
- ii) Iteration begins at line 03. [1 mark]
- b) It sets a new variable, 'nextQuestion' [1 mark] equal to  
the next line of 'r1\_Q.txt' (the next question and answers).  
[1 mark] It then separates the text into different fields/  
variables ('question', 'answer1', 'answer2', 'answer3' and  
'correctAnswer') so they can be accessed individually by the  
program. [1 mark]
- c) Comparing user answer to correct answer. [1 mark]  
Adding 1 to quizScore if correct. [1 mark]  
Outputting suitable "Correct" and "Incorrect" message for  
each question. [1 mark]  
Outputting total score at end. [1 mark]  
Closing file. [1 mark]  
E.g.  

```

01 quizfile = openRead("r1_Q.txt")
02 quizScore = 0
03 for n = 1 to 20
04     nextQuestion = quizfile.readLine()
05     split nextQuestion into separate fields
       question, answer1, answer2, answer3, correctAnsNum
06     print(question, answer1, answer2, answer3)
07     userAnswer = input("Enter 1, 2 or 3:")
08     if userAnswer == correctAnsNum then
09         print("Correct!")
10         quizScore = quizScore + 1
11     else
12         print("Wrong — bad luck!")
13     endif
14 next n
15 print("Your score is ", quizScore, " out of 20")
16 quizfile.close()

```
- d) Iteration for different columns (0 to 9). [1 mark]  
Iteration within this for different rows (0 to 5). [1 mark]  
Accessing Scores[x,y]. [1 mark]  
Adding up values for different columns. [1 mark]  
Calculating average. [1 mark]  
Outputting average. [1 mark]  
E.g.  

```

for y = 0 to 9
    total = 0, average = 0
    for x = 0 to 5
        total = total + Scores[x,y]
    next x
    average = total / 6
    print("Round ", y, " average score is:", average)
next y

```

3. a) 1 GB is equal to 1000 [allow 1024 as alternative answer] MB,  
and there are 8 bits in 1 byte. [1 mark]
- b) 156 [1 mark]  
Convert each '1' bit into denary using its place value:  
 $10011100 = 128 + 16 + 8 + 4 = 156$
- c) A in hexadecimal = 10 in binary,  
so  $A0 = 10 \times 16 = 160$  [1 mark]  
and  $A4 = 160 + 4 = 164$  [1 mark]
- d) Computers work using logic circuits, which use on/off  
or true/false states, [1 mark] so numbers need to be processed  
in a format that can represent on/off states, i.e. in binary  
as 1s and 0s. [1 mark]
- e)
 
$$\begin{array}{r}
 101110+ \\
 111000 \\
 \hline
 1100110 \\
 11 \\
 \hline
 \end{array}$$
 [2 marks available — lose 1 for each error made]
- f) 01001010 [1 mark]  
Remember, a 1 place left shift just means moving each digit one  
spot to the left, and sticking a 0 on the end.
4. a) Correctly defining function with two parameters. [1 mark]  
Calculating sum of parameters. [1 mark]  
Conditional statement based on total. [1 mark]  
Returning "Even" or "Odd" correctly. [1 mark]  
E.g.  

```

function diceEven(x, y)
    total = x + y
    if total MOD 2 == 0 then
        return "Even"
    else
        return "Odd"
    endif
endfunction

```
- b) Using user inputs as parameters in diceEven subroutine.  
[1 mark]  
Conditional statement to correctly award a point. [1 mark]  
E.g.  

```

first = input("Input first score")
second = input("Input second score")
if diceEven(first, second) == "Even" then
    score = score + 1
endif

```
5. a) Any two reasons, e.g.
  - High-level programming languages use commands that more  
closely resemble normal text, [1 mark] so they would be  
quicker and easier to work with. [1 mark]
  - Fewer lines of code are required to carry out the same tasks  
with high-level languages, [1 mark] so it would take less  
time to write the necessary code. [1 mark]
  - High-level languages are easier to read and debug [1 mark]  
so it will be easier to fix any errors in the code at the  
development stage. [1 mark]
  - Low-level languages tend to be less versatile between  
different machines and processors, [1 mark] so a high-level  
language might make it easier to make the application work  
on different mobile devices. [1 mark]
 [4 marks available in total]



Feature	Compiler	Interpreter
Translates the whole program to produce an executable file	✓	
Needed every time you want to run the program		✓
Halts the translation at the first line of error		✓
Runs the program at a slower speed		✓

[4 marks available — 1 for each correct row]

c) Any two features, e.g.

- Auto-complete [1 mark] — will save time while writing code by completing the typing of variables and functions. [1 mark]
- Debugger [1 mark] — will inform Gloria of the location of errors, and often suggest how to fix it. [1 mark]
- Explorer window [1 mark] — will help her to navigate through long programs. [1 mark]
- Breakpoints [1 mark] — will help Gloria to track errors in the middle of a program by pausing it at certain points. [1 mark]
- Auto-colour coding [1 mark] — will help her to distinguish between variables, functions, comments, etc. [1 mark]

[4 marks available in total]

6. a) A record is a collection of data entries/fields [1 mark], usually in a specific order.
- b) E.g. Records allow Frankie to store each customer's data in a fixed structure/collection of fields [1 mark] with different data types (arrays only allow a single data type) [1 mark]. This means that he can easily retrieve specific parts of the data, e.g. the User IDs of all the customers who have not paid. [1 mark]
- [2 marks available in total]

c) Boolean [1 mark]

d) 

002	Sam	King	M	No
-----	-----	------	---	----

 [1 mark]

7. a) The program calculates the number of months, weeks and days in a given number of years. [1 mark]
- b) Variable: Years [1 mark]  
Constant: Months/Weeks/Days [1 mark]
- c) Its value can change every time the program is run. [1 mark]
- d) E.g. a string/character/negative number. [1 mark]
8. a) Jakarta London Cairo Minsk Amsterdam Bangkok  
Not Amsterdam, continue:  
Jakarta London Cairo Minsk Amsterdam Bangkok  
Not Amsterdam, continue:  
Jakarta London Cairo Minsk Amsterdam Bangkok  
Not Amsterdam, continue:  
Jakarta London Cairo Minsk Amsterdam Bangkok  
Not Amsterdam, continue:  
Jakarta London Cairo Minsk Amsterdam Bangkok  
Amsterdam found.  
[4 marks available — 1 for starting by comparing Jakarta, 1 for moving to next entry, 1 for continuing to compare with subsequent entries, 1 for stopping once Amsterdam is found]

- b) Jakarta London Cairo Minsk Amsterdam Bangkok  
Jakarta London Cairo Minsk Amsterdam Bangkok  
Cairo Jakarta London Minsk Amsterdam Bangkok  
Cairo Jakarta London Minsk Amsterdam Bangkok  
Amsterdam Cairo Jakarta London Minsk Bangkok  
Amsterdam Bangkok Cairo Jakarta London Minsk  
[4 marks available — lose 1 mark for each incorrect stage (entries yet to be sorted are shown in grey, entry being compared is underlined)]

When doing an insertion sort, you can ignore all the entries that you haven't sorted yet, but you should make sure to keep writing them in at every stage.

- c) Correctly defined 1D array containing the seven continents. [1 mark]

Conditional statement to check input is of integer type. [1 mark]

[1 mark]

Conditional statement to check input is in correct range (0-6). [1 mark]

[1 mark]

Returning correct response from array. [1 mark]

Returning suitable responses for invalid inputs. [1 mark]

E.g.

function continent(number)

contArray = ["Africa", "Antarctica", "Asia", "Australia", "Europe", "North America", "South America"]

if number is not an integer then

return "Invalid Input Type"

elseif number < 0 OR number > 6 then

return "Invalid Number"

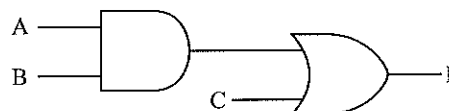
else

return contArray[number]

endif

endfunction

9. a)



[3 marks available — 1 for A and B as inputs of an AND gate, 1 for the output of the AND gate and C as inputs of an OR gate, and 1 for P as the output of the OR gate]

A	B	C	P
FALSE	FALSE	FALSE	FALSE
FALSE	FALSE	TRUE	TRUE
FALSE	TRUE	FALSE	FALSE
FALSE	TRUE	TRUE	TRUE
TRUE	FALSE	FALSE	FALSE
TRUE	FALSE	TRUE	TRUE
TRUE	TRUE	FALSE	TRUE
TRUE	TRUE	TRUE	TRUE

[6 marks available — 1 for each correct row]

It doesn't matter what order you put the rows in, as long as every combination of true/false is covered.

## Set B — Paper 1

1. a) E.g. Von Neumann architecture has data and instructions stored together in memory. *[1 mark]*
- b) E.g. A memory address is copied from the program counter to the MAR. *[1 mark]* The data/instruction at that address is copied to the MDR. *[1 mark]* The program counter is increased by 1 to point to the next instruction. *[1 mark]* The control unit decodes the instruction *[1 mark]* and the instruction is executed. *[1 mark]* The cycle restarts using the new instruction address in the program counter. *[1 mark]*  
*[4 marks available in total]*
- c) Any **two** differences, e.g.
  - RAM is volatile and ROM is non-volatile, *[1 mark]* meaning that data stored in RAM is lost when the power is turned off, while ROM retains its data. *[1 mark]*
  - RAM has a much greater memory capacity than ROM *[1 mark]* as RAM needs to hold the OS and all the applications being run, whereas ROM only holds data for some basic functions like startup. *[1 mark]*
  - RAM can be read from and written to *[1 mark]* while ROM is generally read-only. *[1 mark]*
  - RAM stores data that is currently in use *[1 mark]* whereas ROM stores the boot up instructions for the system. *[1 mark]*  
*[4 marks available in total]*
- d) Level 1 cache memory is quicker than Level 2 cache memory. *[1 mark]*
- e) The ALU performs logical operations and calculations *[1 mark]* and the accumulator stores the intermediate results of these operations. *[1 mark]*
- f) E.g.
  - Not all software supports multicore processing. *[1 mark]*
  - Certain tasks cannot be split evenly between cores. *[1 mark]*
  - Other factors affect a system's performance, such as:
    - clock speed *[1 mark]*
    - cache size/type *[1 mark]*
    - amount of RAM *[1 mark]*
    - amount of secondary storage *[1 mark]*
    - the specifications of the dedicated GPU *[1 mark]**[3 marks available in total]*
2. a) Any **two** characteristics, e.g.
  - price *[1 mark]*
  - reliability *[1 mark]*
  - read/write speed *[1 mark]*
  - durability *[1 mark]*
  - capacity *[1 mark]**[2 marks available in total]*  
*Wondering what the difference between reliability and durability is? Reliability is about how likely a product is to fail over time under general use, durability is more about how 'tough' the product is, e.g. to withstand knocks or cope with excessive usage.*
- b) E.g.
  - The university would not be able to access files kept in cloud storage if they lost their internet connection, *[1 mark]* while magnetic tape would always be accessible. *[1 mark]*
  - If Gail wants quick access to individual files, cloud storage would be faster than magnetic tape *[1 mark]* because tape uses sequential access, making it slow to find specific files. *[1 mark]*
  - A cloud storage system would likely charge a subscription, *[1 mark]* which would be more expensive, especially in the long term, than magnetic tape which is very cheap per GB. *[1 mark]*
  - Data kept in cloud storage is vulnerable to hacking, *[1 mark]* while this is not a problem for magnetic tape. *[1 mark]*
  - If there was a disaster such as a fire at the university, data stored in magnetic tape could be destroyed, *[1 mark]* while data stored in the cloud would be safe. *[1 mark]*

*[6 marks available in total — benefits and drawbacks of both options must be discussed for full marks]*

- c) E.g.
  - CDs would not be suitable as they can only hold around 700 MB of data. *[1 mark]*
  - USB pen drives would be suitable, as they are cheap/portable/fast and store a suitable amount of data. *[1 mark]*
  - External HDDs would not be suitable as obtaining 30 of them would be very expensive/excessive to store only 5 GB of data on each one. *[1 mark]*
3. a) A network interface controller allows a device to connect to a network. *[1 mark]*
- b) Router *[1 mark]*
- c) Any **one** advantage, e.g.
  - Wired networks are generally faster than wireless networks, *[1 mark]* as they have a greater bandwidth/can transfer more data per second. *[1 mark]*
  - Wired networks are more reliable than wireless networks *[1 mark]* because the signal quality is not affected by factors like interference/distance from the switch/WAP. *[1 mark]*
 Any **one** disadvantage, e.g.
  - Wired networks are less flexible/convenient than wireless networks. *[1 mark]* For example, employees would no longer be able to easily connect devices such as phones and tablets/be able to move between offices while staying connected to the network with a wireless device. *[1 mark]*
  - It would be expensive to change over to a wired network *[1 mark]*, as they would have to purchase new hardware, e.g. a wired switch and large amounts of ethernet cable/ it would take a long time for specialist IT staff to install the new cabling in all the offices. *[1 mark]*  
*[4 marks available in total]*
- d) Any **two** possible advantages, e.g.
  - Peer-to-peer networks have no centralised management *[1 mark]* whereas a client-server network would have a central server to deploy and manage security, backups, software, etc. *[1 mark]*
  - Peer-to-peer networks often create copies of files between devices, whereas client-server keeps a single, up-to-date file on the central server, *[1 mark]* which makes it easier to keep track of files as they are edited. *[1 mark]*
  - On peer-to-peer networks, machines may slow down when other machines access them, *[1 mark]* while servers are designed to handle lots of traffic without slowing down. *[1 mark]*
  - In a peer-to-peer network, when a user turns off their machine, the other network users lose access to any files on that machine, *[1 mark]* whereas servers are dedicated machines that are usually left on all the time. *[1 mark]*  
*[4 marks available in total]*
- e) E.g. the installed network forensic tools will have captured data packets entering the network during the attack. *[1 mark]* By analysing the captured data, the company can see how the network was attacked, identify weaknesses and resolve them to prevent similar attacks in the future. *[1 mark]*

Event	Order
The data is displayed on the recipient's computer.	6
Packets are sent across the network.	3
The data is split into equal-sized packets.	1
Routers direct individual packets across different paths.	4
Each packet is given an address, a number, and error checking (checksum) data.	2
Packets are reordered based on their number	5

*[3 marks available — award 1 mark for each 2 correct rows]*

b) Any **one** benefit, e.g.

- Splitting the data up allows the network to make efficient use of the many connections between the sender and recipient, e.g. the data can be split up between two paths so that each half is transferred quicker. **[1 mark]**
- Each packet is sent along its own optimum route to avoid network traffic, meaning all the packets reach the destination quicker than sending the data as a single file. **[1 mark]**
- If parts of the data get lost in transit, the recipient can request specific missing packets, which is much quicker than resending the whole file. **[1 mark]**

**[1 mark available in total]**

*Make sure you've properly got your head round why using small packets is quicker than sending whole files. It may seem confusing at first, but once it clicks it should be... well, less confusing.*

## 5. Points you might include:

Legal issues

- The person illegally downloading the software is breaking the law, risking criminal prosecution for a piece of software.
- Websites hosting the files/providing links to the files are at risk of prosecution (although sites that allow people to upload their own files are a legal grey area).
- The software creators could pursue a legal case against the person downloading the software illegally or the website hosting the links to the software, under the Copyright, Designs and Patents Act 1988.
- Because of the international nature of the Internet and varying worldwide copyright laws, it can be difficult to take legal action against people who pirate software.
- If strict copyright laws are introduced to prevent piracy, this could begin to affect jobs that rely on being able to use sections of copyrighted materials, such as journalism.

Ethical issues

- Software is often expensive to buy legally which many people cannot afford to do, so piracy could be seen as reducing the digital divide.
- The more software that is downloaded illegally, the more money people are effectively stealing from software companies, limiting their ability to produce more software/maintain current software/employ staff.
- Governments may be pressured into devoting time/staff/budget resources into blocking websites that are distributing software illegally, at the expense of other areas such as healthcare.
- If no action is taken against illegal downloads, this could endorse the attitude that it isn't a problem and encourage more people to commit the same crime.

Cultural implications

- Developers might be forced to add extra measures to their software to prevent/discourage piracy (e.g. digital rights management), which can make the software less convenient for people who are trying to use it legitimately.
- If a country has relaxed copyright laws, it could be taken advantage of by people in countries with strict copyright laws. This might lead to pressure between governments to change their copyright legislation.
- If the software company decided to pursue legal action, this could lead to bad press, putting the company in a negative light.
- Companies who do not pursue legal action could be seen as a target for criminals for future illegal downloads.
- Companies could be forced to reduce the price of their software, thus affecting the salary they pay their employees, which in turn could affect the employees' standard of living.
- Society in general could overlook the legal aspects of this activity and almost ignore the fact that they are committing a crime.

- If paid-for software becomes easy to obtain for free, then Creative Commons/Open Source software might become less popular, which could damage the online communities that support these types of projects.

Impact on stakeholders

- The person downloading the software could face prison, a fine or a ban from using the Internet.
- Governments could receive pressure from all parties to change the law in their favour, which could lead to unjust legislation.
- Software companies could go out of business, damaging the software development industry as a whole.
- Websites who host the links to illegally obtained software could be blocked by ISPs (Internet Service Providers), essentially stopping the access to the website – although this could receive bad press and be seen as censorship.

## How to mark your answer:

- Two or three brief points with very little explanation. **[1-2 marks]**
  - Three to five detailed points covering at least two of: legal issues, ethical issues, cultural implications and impact on stakeholders. **[3-5 marks]**
  - Six or more detailed points that form a well-written, balanced discussion, covering all of: legal issues, ethical issues, cultural implications and impact on stakeholders. **[6-8 marks]**
- Stakeholders are different groups of people that will be affected, so here they include software users, governments, software companies and companies that run hosting websites.*

- a) A Virtual Private Network (VPN) is a network that is entirely software-based, **[1 mark]** used to send data securely over a WAN/the Internet. **[1 mark]**
  - i) DNS servers translate a website's domain name into an IP address **[1 mark]** so that a web browser can access the web page/resource. **[1 mark]**
    - ii) Network layer **[1 mark]**
  - c) Any **two** differences, e.g.
    - On a star network, all devices are connected to a central switch/node, **[1 mark]** whereas on a mesh network, each device is connected to every other device, either directly or indirectly. **[1 mark]**
    - On a star network, if the central connection goes offline the entire network can fail, **[1 mark]** whereas a mesh network will reroute traffic via a different route, keeping the network online. **[1 mark]**
    - On a star network, cable usage is relatively low, **[1 mark]** whereas on a mesh network a lot of cabling is required, potentially increasing the cost of setting up the network. **[1 mark]****[4 marks available in total]**
  - d) IMAP **[1 mark]**
- a) Phishing **[1 mark]**
  - E.g.
      - Anti-virus software could scan all incoming emails and attachments, **[1 mark]** and automatically quarantine/delete any potential threats before they reach the user's inbox. **[1 mark]**
      - A firewall could block emails from unknown/suspicious senders. **[1 mark]**
      - Anti-virus software can provide an 'are you sure' warning before allowing the user to open any attachments from unknown senders. **[1 mark]****[2 marks available in total]**

c) Any **three** types of malware, e.g.

- Viruses [1 mark]
- Spyware [1 mark]
- Scareware [1 mark]
- Ransomware [1 mark]
- Worms [1 mark]
- Rootkits [1 mark]
- Trojans [1 mark]

[3 marks available in total]

8. a) Any **two** security measures, e.g.

- Data encryption [1 mark]
- User account control/access levels [1 mark]
- Password protection [1 mark]
- Pattern/PIN/fingerprint scanner/retina scanner [1 mark]
- Firewalls [1 mark]
- Automatic security updates [1 mark]

[2 marks available in total]

b) Drivers act as 'translators' between the OS and the hardware, [1 mark] so Joel needs the driver in order for the printer to understand the data it is being sent and be able to print it correctly. [1 mark]

c) i) Disk defragmentation utility [1 mark]

ii) E.g. The utility would collect together any parts of files that have been separated (fragmented) [1 mark] and reorganise them in an efficient way on the disk. [1 mark] This means that the read/write head in the HDD can access files with less movement, increasing the drive's performance. [1 mark]

[3 marks available in total]

d) Creating new file. [1 mark]

Combining individual reports into this file. [1 mark]

Compressing combined file. [1 mark]

Conditional (if) statement based on file size. [1 mark]

Uploading compiled report and deleting individual reports if condition is met. [1 mark]

Displaying error message and deleting compiled report if size too big. [1 mark]

E.g.

create new file called WeeklyReport

for k = 1 to 5

copy Report k to WeeklyReport

next k

compress WeeklyReport

if WeeklyReport < 5 MB then

upload WeeklyReport to cloud storage

for n = 1 to 5

delete Report n

next n

else

print("Error — file too big.")

delete WeeklyReport

endif

## Set B — Paper 2

1. a)

Data	Order of size
3 MB	3
6 nibbles	4
1.6 PB	1
500 TB	2
2 bytes	5

[3 marks available — award 3 marks for all rows correct, award 2 marks for only 3 rows correct, award 1 mark for 1-2 rows correct]

b) i) 01000001 [1 mark]

65 = 64 + 1, so 1s go in the corresponding bit positions.

ii) 6 in hexadecimal = 0110 in binary

— these become the first four digits.

5 in hexadecimal = 0101 in binary

— these become the second four digits. [1 mark]

So, put these together to get:

65 in hexadecimal = 01100101 in binary. [1 mark]

c) 1 0 0 1 1 1 1 1 +

```

1 1 1 1 1 1 0 1
1 1 0 0 1 1 1 0 0
1 1 1 1 1 1 1

```

[2 marks available — lose 1 for each error made]

d) An overflow error occurs when a computer system attempts to process a number that has too many bits for it to handle/ attempts to store more than 8 bits as a byte. [1 mark]

e) Any **one** character set, e.g.

• Extended ASCII [1 mark] — 8-bit character set/consists of 256 characters. [1 mark]

• Unicode® [1 mark] — uses either 16-bit or 32-bit binary codes/covers all major languages. [1 mark]

[2 marks available in total — 1 for a character set and 1 for a suitable feature of that character set]

2. a) Reducing the resolution will mean that fewer pixels are used to store the photograph, [1 mark] which will reduce the file size as less data needs to be stored. [1 mark]

b) Any **two** pieces of metadata, e.g.

• GPS data/where the photo was taken [1 mark]

• Timestamp/when the photo was taken [1 mark]

• What camera was used to take the photo [1 mark]

• The photograph's file format [1 mark]

• The image's dimensions/height/width/resolution [1 mark]

• The image's colour depth/colour model [1 mark]

[2 marks available in total]

c) i) E.g. The computer takes the analogue sound wave picked up by the microphone [1 mark] and uses sampling to convert it into a digital/binary format which can be stored in an audio file. [1 mark]

- ii) Accepting frequency and bit rate as variables. [1 mark]  
 Using a loop to record audio. [1 mark]  
 Using frequency and bit rate in sampling. [1 mark]  
 Checking on stop button and file size in every loop/as condition. [1 mark]  
 Displaying suitable alert message if file too large. [1 mark]  
 Naming and saving file. [1 mark]

E.g.

`stopButton = false`

`freq = input("Enter sample frequency")`

`bitRate = input("Enter bit rate")`

`do`

`input from microphone`

`take audio sample using freq and bitRate`

`save audio sample to tempFile`

`until stopButton == true OR tempFile size >= 1.5 GB`

`if tempFile size >= 1.5 GB then`

`print("Recording interrupted — file too large")`

`endif`

`filename = input("Enter a filename")`

`save tempFile as filename`

- d) Any **two** differences, e.g.

- Lossy compression greatly reduces the file size [1 mark] while the reduction with lossless compression is only small. [1 mark]
- Lossy compression can reduce the quality of the file [1 mark] while lossless files maintain the quality of the original. [1 mark]
- Lossless files can be decompressed back into the original file, [1 mark] whereas the original cannot be retrieved from a lossy file. [1 mark]

[4 marks available in total]

3. a) Iteration [1 mark]

- b) 03: Sets the variables to 0 at the start of each loop. [1 mark]  
 06: Adds the input sales value to the running total. [1 mark]  
 07: Keeps looping sales input until 0 is input. [1 mark]  
 08: Calculates the bonus as 0.1 times their total sales. [1 mark]

- c) Jesse has sold £200 and gets a £20 bonus.  
 Anabelle has sold £160 and gets a £16 bonus.  
 Roland has sold £30 and gets a £3 bonus.

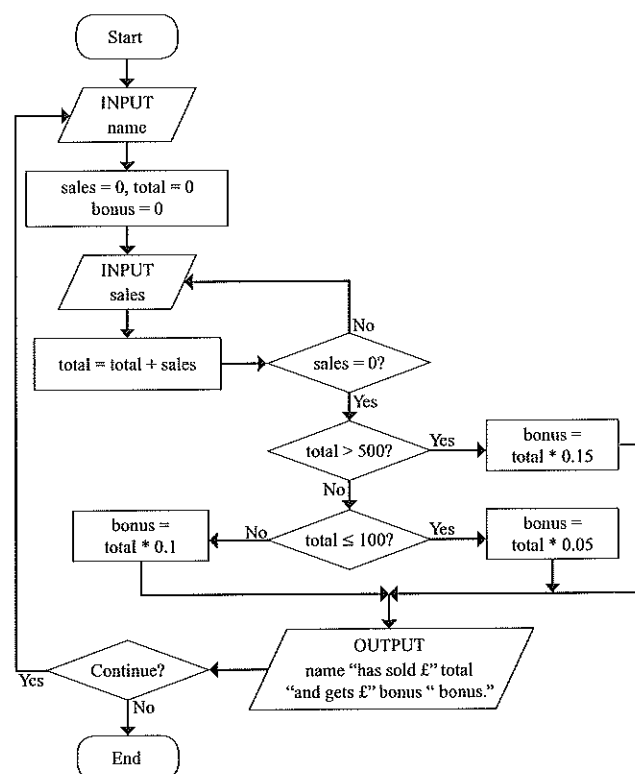
[3 marks available — 1 for correct format of each line, 1 for correct values of 'total' and 1 for correct values of 'bonus']

- d) Any **one** method, e.g.

- Use validation to check that the sales input is a positive number. [1 mark]
- Use sanitisation to ensure that inputs are in the correct format, e.g. remove £ signs, make Y/N uppercase. [1 mark]
- Presence check the inputs to ensure a value has been entered. [1 mark]

[1 mark available in total]

- e) Accepting inputs of 'name' and 'sales' variables. [1 mark]  
 Correctly calculating 'total' variable with a loop. [1 mark]  
 Decision branches for  $\text{total} > 500$  and  $\text{total} \leq 100$ . [1 mark]  
 Correct adjustment of bonus on each branch. [1 mark]  
 Appropriate output message. [1 mark]  
 Loop back to name input with 'Continue?' message. [1 mark]  
 E.g.



4. a) Array (1-dimensional) [1 mark]

1	Grape	Pear	Tomato	Fig	Mango	Kale	Apple	Cherry
2	Grape	Pear	Tomato	Fig	Mango	Kale	Apple	Cherry
3	Grape	Pear	Tomato	Fig	Mango	Kale	Apple	Cherry
4	Grape	Pear	Tomato	Fig	Mango	Kale	Apple	Cherry
5	Grape	Pear	Fig	Tomato	Kale	Mango	Apple	Cherry
6	Fig	Grape	Pear	Tomato	Apple	Cherry	Kale	Mango
7	Apple	Cherry	Fig	Grape	Kale	Mango	Pear	Tomato

[3 marks available — 1 for splitting initial list into halves until each list is one item long, 1 for merging and sorting single items into two-item lists, and 1 for repeating until full list is sorted]

- c) 

Apple	Cherry	Fig	Grape	Kale	Mango	Pear	Tomato
-------	--------	-----	-------	------	-------	------	--------

  
 $n = 8$ , so  $(n + 1)/2 = 9/2 = 4.5$ , which rounds to 5:  

Apple	Cherry	Fig	Grape	Kale	Mango	Pear	Tomato
-------	--------	-----	-------	------	-------	------	--------

  
 "Kale" is alphabetically after "Cherry",  
 so delete the second half of the list:  

Apple	Cherry	Fig	Grape
-------	--------	-----	-------

  
 Now  $n = 4$ , so  $(n + 1)/2 = 5/2 = 2.5$ , which rounds to 3:  

Apple	Cherry	Fig	Grape
-------	--------	-----	-------

  
 "Fig" is alphabetically after "Cherry",  
 so delete the second half of the list:  

Apple	Cherry
-------	--------

  
 Now  $n = 2$ , so  $(n + 1)/2 = 3/2 = 1.5$ , which rounds to 2:  

Apple	Cherry
-------	--------

"Cherry" has been found.

**[3 marks available — 1 for calculating  $(n + 1)/2$ ,  
 1 for comparing the item in this place with "Cherry"  
 and correctly deleting half of the list and 1 for repeating  
 this process until "Cherry" is found]**

d) E.g. Linear search **[1 mark]**

5. a) Error diagnostics will display the location of an error and may suggest possible fixes. **[1 mark]**

A run-time environment will allow Julian to execute and test his code within the IDE as he writes it. **[1 mark]**

b) Any **two** differences, e.g.

- Iterative testing is carried out throughout the development of a program, **[1 mark]** whereas final testing is carried out once, at the end of development, to check the software meets the initial requirements. **[1 mark]**
- Iterative testing allows for additional features to be added/ tested during the development of the software, **[1 mark]** whereas final testing only allows the initial requirements to be tested. **[1 mark]**
- Iterative testing can be time consuming, as the requirements may change, **[1 mark]** whereas final testing is potentially quicker since the requirements will stay the same throughout development. **[1 mark]**

**[4 marks available in total]**

- c) Logic error: the program will follow BODMAS and do the division before the subtraction, which is not what is intended. **[1 mark]**

Syntax error: the comparison operator '==' has been used instead of the assignment operator '='. **[1 mark]**

- d) Creating 'Daily\_Temps.txt'. **[1 mark]**

Accepting input of date and temperature on a loop. **[1 mark]**

Converting temperature to Celsius. **[1 mark]**

Correctly calling convertFC function. **[1 mark]**

Writing data to the file in a sensible format. **[1 mark]**

Ending loop and closing file when user is finished. **[1 mark]**

E.g.

```
file = openWrite("Daily_Temps.txt")
```

```
do
```

```
    date = input("Enter date")
```

```
    F = input("Enter temperature in F")
```

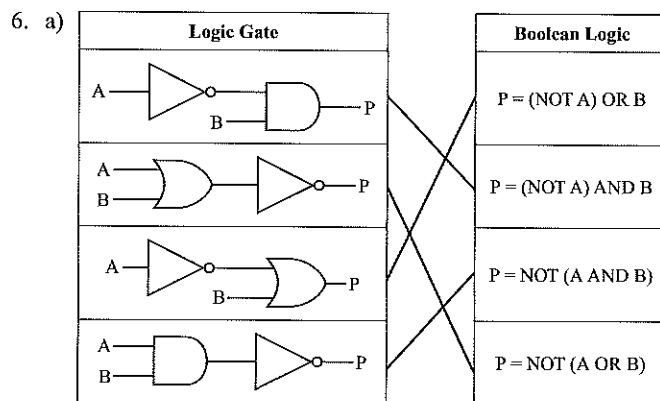
```
    C = ConvertFC(F)
```

```
    file.writeLine(date, " ", F, " Fahrenheit", " ", C, " Celsius")
```

```
    continue = input("Continue? (Y/N)")
```

```
until continue == "N"
```

```
file.close()
```



**[2 marks available — award 2 marks for all connections correct, award 1 mark for at least two connections correct]**

b)

A	B	P
FALSE	FALSE	TRUE
FALSE	TRUE	TRUE
TRUE	FALSE	TRUE
TRUE	TRUE	FALSE

**[3 marks available — award 3 marks for all rows correct, award 2 marks for at least two rows correct, award 1 mark for one row correct]**

- c) Accepting user inputs of library card and passcode. **[1 mark]**

Assigning Boolean value to librarycardValid. **[1 mark]**

Assigning Boolean value to passcodeValid based on user input. **[1 mark]**

Correct use of librarycardValid and passcodeValid in

determining the value of openDoor. **[1 mark]**

Correctly testing time of day in determining the value of openDoor. **[1 mark]**

E.g.

input library card

librarycardValid = check library card is registered on system

passcode = input("Please enter the passcode.")

passcodeValid = check passcode is correct

if librarycardValid AND passcodeValid AND time >= 7 AND

time <= 18 then

openDoor = true

else

openDoor = false

endif

7. a)

Feature	Line(s)
Boolean data	01, 06, 11
Casting	03
Iteration	05, 09 (or 05-09)
String data	03, 10, 12

**[4 marks available — 1 for each row]**

- b) The variable soilMoisture will be increased by less each loop, so it will take more loops to reach 50. **[1 mark]** Since the amount of water that the plants receive in each loop has not changed, this means that the plants will receive more water overall. **[1 mark]**



# CGP

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