PG ONLINE

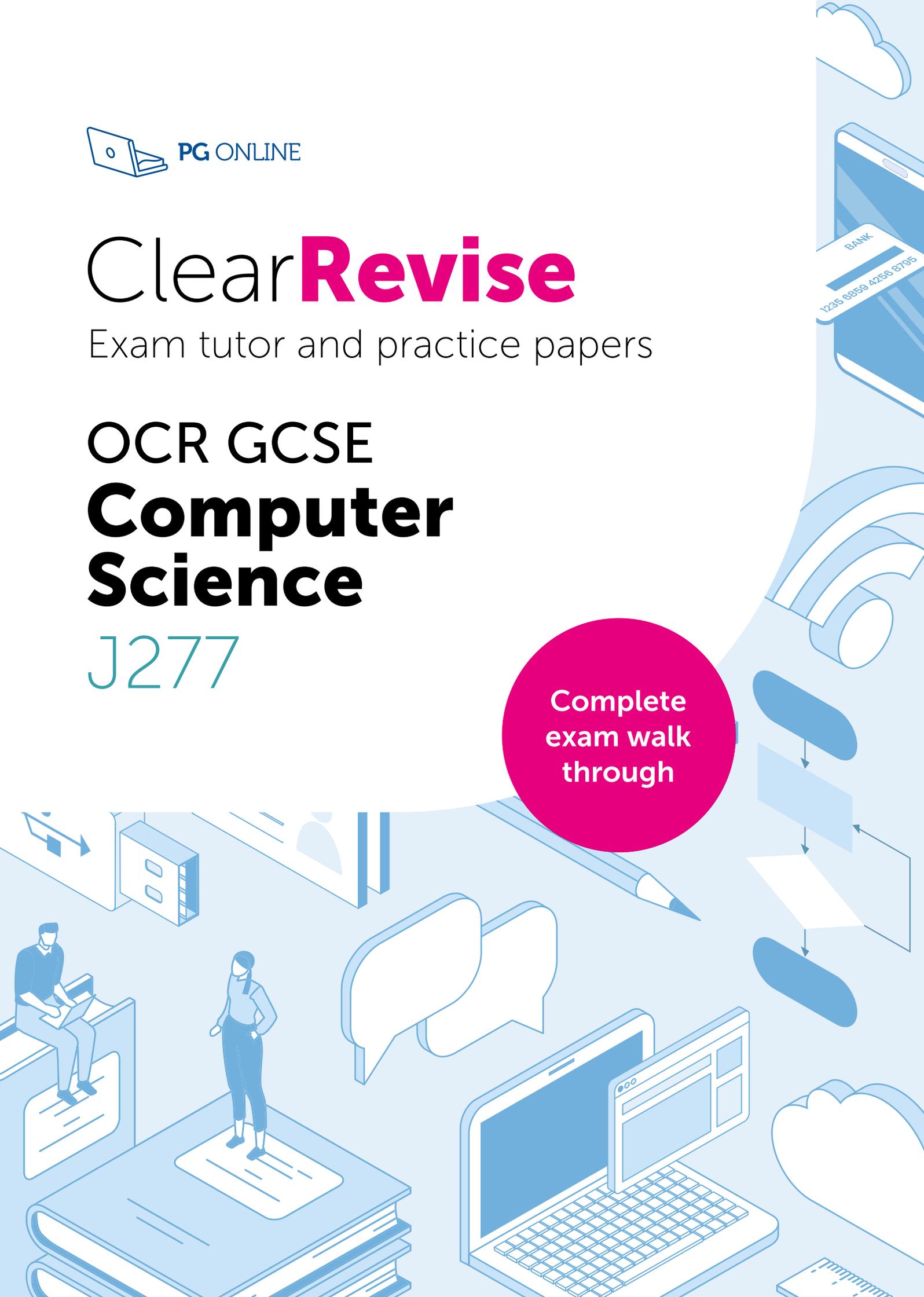# Clear**Revise**

Exam tutor and practice papers

OCR GCSE
Computer Science
J277

Complete exam walk through

Clear**Revise**™

OCR GCSE
Computer Science J277

Exam tutor and practice

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ACKNOWLEDGMENTS

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CONTENTS AND CHECKLIST

WHAT MAKES THIS GUIDE SPECIAL?

This guide is your personal exam tutor. It offers you a complete walk-through of the specification and related questions in a convenient format.

The best way to ace an exam is to practise... but that doesn't mean just endlessly doing past exam papers.

Imagine you were going to run a 100-metre race. If you really wanted to win it, you'd need a coach. They would analyse how you run and give you advice and lots of little improvements that you could make to win. Of course, you'd do some practice runs, but without coaching, you would have little idea how to improve.

Section 1

1

Left pages

Study questions with model answers

Start on the **left-hand pages**. Left-hand pages coach you through each topic area on the specification. We show you some questions and model answers that would get full marks. We also give you exam tips on exactly what the examiner is looking for from the question or question type.

2

Right pages

Apply your understanding to related topics

Now it is your turn! Once you have finished looking at the model answers on the left, **right-hand pages** provide you with a set of similar exam questions on the same topic. You should do really well in these as you've just seen model responses and tips on related questions.

Section 2
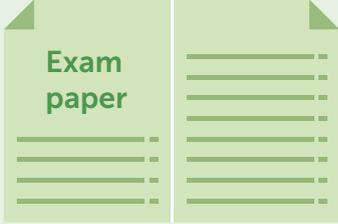
Exam paper

Complete a full set of practice exams

Now is your chance to have a go at real papers. You need to get 80 marks in 90 minutes, so allow yourself around 1 mark per minute, plus 10 minutes at the end for finding and correcting those silly mistakes we all tend to make.

There are two papers for this course - Paper 1 and Paper 2. When you take these papers, make sure you have a clear desk, turn off your phone and find somewhere quiet. Give yourself the same amount of time as a real exam. We suggest leaving at least a few hours, if not days, between sitting each paper so that you can give your brain a rest and recharge your batteries.

Once you've completed each paper, the answers are in the back of the book for you to mark yourself. Good luck!

3

[1]

✓

Learn from the mark schemes

Mark your work using the mark scheme provided at the bottom of each page.

By the end of Section A, you will have gone through lots of model answers and had a go at questions on every topic in the entire specification.

If you still feel that a topic needs more work, just use the smile icons ☺ or make a note on the page so that you can look up the topic later or ask your teacher for help.

THE SCIENCE OF REVISION

'Low stakes' examination practice

Practising past examination questions is a powerful way to revise and improve your understanding of the subject. Mark schemes and professional guidance provide valuable information too. Without the added pressure of the big day and the stressful atmosphere that an exam hall may create, studying all of this in a calm atmosphere where the results don't matter to anyone but yourself, creates the most effective environment for the retrieval of information.

Retrieval of information

Retrieval practice encourages students to come up with answers to questions.[1] The closer the question is to one you might see in a real examination, the better. Also, the closer the environment in which a student revises is to the 'examination environment', the better. Research shows that students who had a test 2–7 days away did 30% better using retrieval practice than students who simply read, or repeatedly reread material. Students who were expected to teach the content to someone else after their revision period did better still.[2] What was found to be most interesting in other studies is that students using retrieval methods and testing for revision were also more resilient to the introduction of stress.[3]

Feedback and note-taking

The tips and advice included with each model answer constructively focus purely on how to get more out of each question or type of question. Every topic shows model questions and answers, along with advice from experienced teachers and opportunities for students to try further similar questions. Answers and tips are displayed on the same page allowing for immediate feedback.[4] There is space for notes – use this if you need to. Making summarised points at the end of a revision session is the most effective way to use notes.[4]

Ebbinghaus' forgetting curve and spaced learning

Ebbinghaus' 140-year-old study examined the rate in which we forget things over time. The findings still hold true. However, the act of forgetting things and relearning them is what cements things into the brain.[5] Spacing out revision is more effective than cramming – we know that, but students should also know that the space between revisiting material should vary depending on how far away the examination is. A cyclical approach is required. An examination 12 months away necessitates revisiting covered material about once a month. A test in 30 days should have topics revisited every 3 days – intervals of roughly a tenth of the time available.[6]

Summary

Students: the more tests and past questions you do, in an environment as close to examination conditions as possible, the better you are likely to perform on the day. If you prefer to listen to music while you revise, tunes without lyrics will be far less detrimental to your memory and retention. Silence is most effective.[5] If you choose to study with friends, choose carefully – effort is contagious.[7]

1. Roediger III, H. L., & Karpicke, J.D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17(3), 249–255.

2. Nestojko, J., Bui, D., Kornell, N. & Bjork, E. (2014). Expecting to teach enhances learning and organisation of knowledge in free recall of text passages. *Memory and Cognition*, 42(7), 1038–1048.

3. Smith, A. M., Floerke, V. A., & Thomas, A. K. (2016) Retrieval practice protects memory against acute stress. *Science*, 354(6315), 1046–1048.

4. Kluger, A & DeNisi, A. (1996). The effects of feedback interventions on performance. Psychological bulletin, 119(2), 254–284.

5. Perham, N., & Currie, H. (2014). Does listening to preferred music improve comprehension performance? *Applied Cognitive Psychology*, 28(2), 279–284.

6. Cepeda, N. J., Vul, E., Rohrer, D., Wixted, J. T. & Pashler, H. (2008). Spacing effects in learning a temporal ridgeline of optimal retention. *Psychological Science*, 19(11), 1095–1102.

7. Busch, B. & Watson, E. (2019), *The Science of Learning*, 1st ed. Routledge.

HOW TO FIX MISTAKES IN YOUR EXAM

We all make mistakes, and the chances are that you'll make one or two in the exam.

If you realise that you've made a mistake in an answer, it's no problem.

Cross the answer out so that it is obvious that it's a mistake.

Example 1 – Put a line through the incorrect answer:

(c) Andy wants to get some photos printed in a shop.
Explain a suitable storage device or media he could use to transfer the files from home to the shop.

~~He should use a magnetic tape because it has a low cost per megabyte.~~

He should use a solid-state SD card because it is highly portable.   [2]

Example 2 – Put a line through each incorrect word.

(c) Andy wants to get some photos printed in a shop.
Explain a suitable storage device or media he could use to transfer the files from home to the shop.

He should use a ~~magnetic tape because~~ solid-state SD card because it is highly portable.

[2]

Example 3 – Put a cross through a section of writing.

(a) Discuss the impact of replacing checkouts with self-service tills.
Consider the impact on customers.

~~Shop assistants will be able to deal with many customers at a time. This will make them more efficient.~~

~~The job may also be more stimulating. However, fewer shop assistants will be required which will likely~~

~~result in people losing their jobs.~~

Customers who are shy or like to listen to music whilst shopping may prefer self-service tills where

human interaction is minimal. Some customers may find that they are able to process their items

But DON'T scrub out answers:

(c) Andy wants to get some photos printed in a shop.
Explain a suitable storage device or media he could use to transfer the files from home to the shop.

██

Exam tip

If you cross out an answer but don't write anything else, the examiner is allowed to mark it.

But they can't mark it if they can't read it because you scrubbed it out.

PAPER 1

COMPUTER SYSTEMS

(J277/01)

Information about Paper 1

Written exam: 1 hour and 30 minutes
50% of the GCSE
80 marks

All questions are mandatory.

This paper consists of multiple-choice questions,
short response questions and extended response questions.

! You **will** need:
A black pen (and some spares)

You **cannot** use:
A calculator

1.1.1 ARCHITECTURE OF THE CPU

② Left pages contain example questions with model answers. The answers will get full marks.

① Start on the left hand page.

1 (a) **Fig. 1** lists some functions of common CPU components. Tick (✓) **one** box in each row to show which function applies to each component.

Functions	ALU (Arithmetic Logic Unit)	CU (Control Unit)	Register
Performs subtraction	✓		
Stores a very small amount of data			✓
Performs binary shifts	✓		
Manages the execution of instructions		✓	

Fig.1

[3]

> **Exam tip**
>
> In **tick** questions, carefully check the number of boxes that must be ticked in each row.
>
> • For this question, if you tick more than one box in a row you will not get a mark for the row

(b) Many CPUs also contain cache.
Define what is meant by 'cache'.

Cache is a very fast form of memory that is used to store accessed instructions and data.

....

.... **[1]**

> **Exam tip**
>
> **Define** questions need just a short answer for the definition.

> **Do you remember?**
>
> CPUs follow the fetch-execute cycle.
>
> What are the three main stages of this cycle?
>
> 1. *Fetch the instruction from memory.*
> 2. *Decode the instruction.*
> 3. *Execute the decoded instruction.*

③ Look at the right–hand page have a go at some exam style questions on the same topic. The example here has four marks, so you should be able to finish it in four minutes.

2 (a) **Fig. 2** lists the uses for different registers in a CPU. Tick (✓) **one** box in each row to show if the use is true for the MAR, MDR or Program Counter.

Use	MAR (Memory Address Register)	MDR (Memory Data Register)	Program Counter
Contains the address of the next instruction that needs to be executed			
Stores the memory location currently being accessed			
Data is transferred to this register ready for use in the next clock cycle			

Fig.2

[3]

(b) One other register used in a CPU is the accumulator. Define what is meant by the 'accumulator'.

....

.... [1]

④ Mark yourself
Once you've finished the questions, mark them using the answers at the bottom of the page.

⑤ Are you confident?
Fill in one of the faces to show whether you feel you did well in the topic or if it needs more revision.

Total

/ 4

☹ 😐 ☺

Answers

2 (a)

Use	MAR (Memory Address Register)	MDR (Memory Data Register)	Program Counter
Contains the address of the next instruction that needs to be executed			✓
Stores the memory location currently being accessed	✓		
Data is transferred to this register ready for use in the next clock cycle		✓	

2 (b) It stores results from arithmetic calculations / bit shifts / logical operations[1]. Note: It also can store data that's been loaded from RAM.

1.1.2 # CPU PERFORMANCE

1 A business computer has one CPU which has a clock speed of 1 GHz.

(a) Explain the effect of changing the CPU to one which has a clock speed of 1.5 GHz.

Increasing the clock speed will result in programs running faster.

This is because more instructions are being processed each second. **[2]**

Exam tip

Explain questions need you to give a reason or a cause for something.

- The effect
- The reason

Exam tips will help coach you in how to answer the question. Read these tips as they will help you with the practice questions.

(b) State **one** other characteristic of a CPU that will affect its performance.

Cache size. **[1]**

Exam tip

State questions need just a short answer

The question asks for one characteristic, but you could have written "Number of cores" as an alternative correct answer.

Do you remember?

The question talks about GHz. This stands for Gigahertz.

What are all the unit prefixes you can think of?

Kilo = 1000

Mega = 1,000,000

Giga = 1,000,000,000

Tera = 1,000,000,000,000

Peta = 1,000,000,000,000,000

Most CPUs today use megahertz or gigahertz. Some embedded computers may use kHz.

Make notes
Use any blank space to make notes.

Do you remember?
These boxes may include some revision questions to help you think about the topic. Cover the answer and try the question.

Whilst this book covers the majority of points on the specification, there may be a few where we haven't asked a question. If this is the case, we'll remind you about any more points the exam board expects you to know.

2 An embedded computer has a clock speed of 500 kHz. When it is in power-saving mode, the clock speed reduces to 100 kHz.

(a) Explain the effect of changing the CPU clock speed from 500 kHz to 100 kHz.

....

....

....

.... **[2]**

(b) Other than the clock speed and cache size, state **one** other characteristic of a CPU that will affect its performance.

....

.... **[1]**

(c) Explain the effect of increasing the cache size of the CPU.

....

....

....

.... **[2]**

(d) State the number of cores that are available in a quad core computer.

....

.... **[1]**

Total

_____ / 6

☹ 😐 ☺

Answers

2 (a) The CPU will be slower / programs will run more slowly[1] as fewer instructions are being processed each second[1].

2 (b) The number of cores.[1]

2 (c) Programs will run faster[1] as accessing data/instructions from cache is faster than from the CPU / if more data is held in cache, the CPU won't need to access it from RAM which is slower[1].

2 (d) 4 cores.[1] Remember that 2 cores are dual core, 4 cores are quad core.

1.2.4 DATA STORAGE – NUMBERS

1 (a) Convert the binary number 11010010 to denary.

128 + 64 + 16 + 2 =

210 .... **[1]**

Exam tip

Convert questions need you to change how something appears. In this case you will need to do a calculation to work out the answer.

If there is more than one mark for a question like this then it will be for the working. Always show your working.

Exam tip

Carrying the 1 here shows your working for the second mark.

(b) Calculate the addition of the binary numbers:

1 0 1 1 0 0 1 0 +
0 0 0 1 0 1 0 1
1
1 1 0 0 0 1 1 1 .... **[2]**

Do you remember?

When doing conversions between binary and denary, you will probably find it helpful to write the headings for binary numbers:

128 64 32 16 8 4 2 1

In a binary number, the **most significant bit** is the leftmost bit (with the highest value). The **least significant bit** is the rightmost bit (with the lowest value).

Exam tip

Complete questions need you to provide all necessary parts to finish something. In this case it is similar to a calculation question.

(c) Complete a two-place shift to the left of the binary number 00110010.

11001000 .... **[1]**

(d) Explain the effect of performing a two-place shift to the left of the binary number 00110010.

It multiplies the number by 4. .... **[1]**

(e) Convert the binary number 11010010 to hexadecimal.

1 1 0 1 0 0 1 0 = 13 2 = D 2 hexadecimal .... **[2]**

Do you remember?

If two 8-bit binary numbers are added, it can result in a 9-bit number. If you need to store this as 8-bits there will be an error.

What is the name for this error?

Overflow error.

(f) Convert the denary number 83 to hexadecimal.

83 denary = 0 1 0 1 0 0 1 1 binary = 53 hexadecimal. .... **[2]**

2 (a) Convert the denary number 157 to binary.

....

....

.... **[1]**

(b) Calculate the addition of the 8-bit binary numbers:

1 0 1 0 1 0 0 0 +
1 1 0 1 0 1 0 1

.... **[2]**

(c) Explain what will happen if the answer for 2(b) is to be stored as an 8-bit number.

....

.... **[2]**

(d) Complete a right shift of the binary number 10011011.

....

.... **[1]**

(e) Explain the effect of performing a right shift of the binary number 10011011.

....

....

....

.... **[2]**

(f) Convert the denary number 198 to hexadecimal.

....

.... **[2]**

Total

/ 9

☹ 😐 ☺

Answers

*2 (a) 128x1 + 64x0 + 32x0 + 16x1 + 8x1 + 4x1 + 2x0 + 1x1 = **10011101**[1]*

2 (b) 101111101 1 mark for the overflow bit, 1 mark for the other bits.

2 (c) An overflow error[1] will occur as the answer requires nine bits[1].

2 (d) 01001101[1]

2 (e) The number will be halved.[1] There will be a loss of precision[1].

*2 (f) 198 denary = 1100 0110 in binary = **C**[1]**6**[1] **hexadecimal** OR 198 / 16 = 12 remainder 6 = **C**[1]**6**[1] **hexadecimal**.*

1.3.1 COMPUTER NETWORKS, CONNECTIONS AND PROTOCOLS

1 An office network is being created with four computers and a file server. Each computer will connect to the network using an Ethernet cable.

(a) Other than cabling, identify **two** items of network hardware that will be required to make a Local Area Network (LAN).

1 *Switch.* ....

2 *Network Interface Card (NIC).* .... **[1]**

Exam tip

Consider the context of the question carefully. A **wireless access point** wouldn't be the correct answer here as the question says it is a wired network (network with cables).

Exam tip

Identify questions need you to provide an answer from a number of possibilities or recognise and state a distinguishing factor or feature.

(b) The computers are connected using a star topology.
Draw a diagram to show how the computers, servers and network hardware are connected together.

Exam tip

Draw questions need you to produce a diagram. Your diagram must be labelled. Remember to make the diagram clear to read.
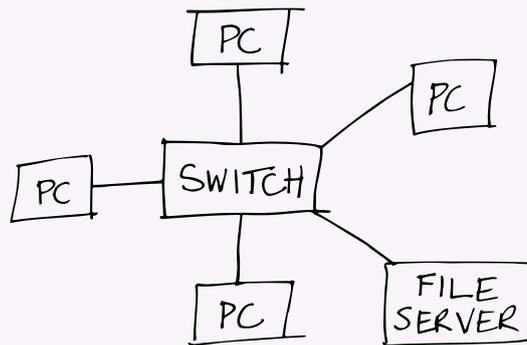
Exam tip

Make sure that your diagram matches any context you are given. Here, there must be four computers and a server.

[2]

(c) Explain the role of the client and server with reference to this diagram.

Clients *The PCs act as clients. They access services from the file server.* ....

Server *The file server is the server in this network. It provides the service of central file storage* ....

and retrieval. .... **[4]**

Do you remember?

This is a big topic. Check you understand the following before completing the questions.

- WAN (Wide Area Network)
- Factors affecting network performance
- Peer-to-peer networks
- The Internet, including DNS (Domain Name System), Hosting, The Cloud, Web servers and clients
- Mesh networks

2 A home network is used to connect two tablets and two laptops to the Internet.

(a) Other than a switch, identify **two** items of network hardware that will be required to make a Local Area Network (LAN) that connects to the Internet.

1 ....

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

(b) Freya has found that she is never able to access high-definition video streaming through the network. At certain times of day the network also becomes very slow.

Explain **one** factor that may be responsible for the poor performance of the network.

....

....

....

....

.... **[2]**

(c) The home network is set up as a star topology. An alternative topology that could be used for home devices to connect together is a mesh topology.

Explain **one** advantage of the use of a mesh topology.

....

....

....

.... **[2]**

Total

/ 6

😞 😐 🙂

Answers

2 (a) Any two from: Wireless access point[1], Router [1], Network Interface Card (NIC)[1].

2 (b) Increasing the number of devices connected[1] will result in the network slowing for all users[1]. This is because the bandwidth is shared by each user[1]. This is why the network slows at some points in the day.
OR The bandwidth from the router to the Internet is not very large[1] which means there isn't sufficient bandwidth for high definition video to be streamed[1].

2 (c) The network is more reliable[1] as no central switch is required[1] because devices connect directly to each other with multiple connections[1]. OR It is easier to add new devices to the network[1] as they only need to connect to a nearby device (rather than a central switch)[1].

1.4.2   IDENTIFYING AND PREVENTING VULNERABILITIES

1   Modern smartphones contain large amounts of personal information.

(a)   Explain, with reference to security, **two** ways that users can protect their smartphone.

1   *The user can use biometric security, or set a password which will prevent anyone who isn't*

recognised or who doesn't know the password from using the phone.

2   **The data stored on the smartphone can be encrypted. This means that if anyone** *accesses the*

secondary storage, they won't be able to understand the data. **[4]**

(b)   A smartphone's developer wants to make sure that their phone is secure before they sell it to customers. Describe how penetration testing will help the developer limit the vulnerabilities in the phone's security.

Smartphone developers will pay a company to perform penetration tests on a sample phone.

They may perform a black box test where no information is known about the device. Or they may

carry out a white box test where they are given information about the device. The penetration testing

simulates a cyberattack on the device. If any weaknesses are found, these can be reported with the test

results to the smartphone developers so that they can be fixed and the smartphone can be

made more secure. **[4]**

(c)   Explain **two** methods of physical security that a smartphone developer may use to prevent theft of their intellectual property.

1   *Locks will be used on doors and windows to stop intruders from gaining access to sample phones*

or computers.

2   *An alarm will be used which will detect anyone who breaks into the building and also alert the police.*

[4]

Do you remember?

What other physical security methods are available?

- *CCTV*
- *Security guards*
- *Fingerprint door entry scanners*
- *ID cards*

Do you remember?

Check you understand the following other methods of preventing vulnerabilities before completing the questions.

- Anti-malware software
- Firewalls
- User access levels

2 A school has a network with 200 computers and three school servers. They have installed anti-malware software on each computer.

(a) Describe how anti-malware software works to prevent malware attacks.

....

....

....

.... **[2]**

(b) Describe how user access levels can be used by the school to help prevent data theft of confidential files.

....

....

....

....

....

.... **[3]**

(c) Other than anti-malware software and user access levels, give **one** other method that can limit the threat of an attack of the school's computer systems or network.

.... **[1]**

Total

____ / 6

☹ 😐 ☺

Answers

2 (a) The software contains a database of virus/malware definitions[1]. It then checks any file that has been downloaded against these to see if there is a match[1]. It can also do a full scan of the system to see if there are any matches[1]. If a match is found, the file will be quarantined/deleted[1].

2 (b) Each user will be given certain privileges which allow them to access different parts of the system[1]. For example, a student can log on, but they won't be given access to a database that stores student medical information[1]. A teacher, however, will have a user access level that allows access to this information[1]. When a user logs in, they provide their username which determines which privileges they will have[1].
Other examples may be given such as where certain parts of the file server, that contain confidential files, can only be accessed by teachers or headteachers.

2 (c) Firewalls[1], Passwords[1], Encryption[1], Physical security[1] or any specific physical security method such as locks on a server room door., Penetration testing of the network/servers[1].

1.6.1 ETHICAL, LEGAL, CULTURAL AND ENVIRONMENTAL IMPACT

1* Supermarkets have replaced many checkouts with self-service tills.

Discuss the impact of replacing checkouts with self-service tills.

In your answer, you might consider the impact on:

- Customers
- Cultural issues
- Legal issues
- Privacy issues

Exam tip

The ***** next to a question number means the quality of your written communication will be assessed. Remember to use the correct spelling, punctuation and grammar.

Exam tip

Discuss questions are normally long answer questions. When completing these questions, use the following advice:

- Highlight key parts of the question first.
- You may like to plan out key points before you start writing.
- You need to give a balanced review with a range of arguments. So in this case, discuss both the positive and negative impacts.

Customers who are shy or like to listen to music whilst shopping may prefer self-service tills where human interaction is minimal. Some customers may find that they are able to process their items faster than a checkout cashier. However, there are negative cultural issues to self-service tills. Older or more isolated customers may feel that they are even more lonely if they are not able to talk to another person during their shop. Some customers may enjoy the ability to process their own order.

There are privacy issues for both types of checkout. Customers may not want another person to see that they are purchasing certain medical or hygiene products. They may be happier with using a self-service checkout for these purchases. However, most self-service checkouts require a payment card or loyalty card to use them. This makes them more likely to be tracking and storing all user purchases.

If a user's purchases are tracked and can be linked to their payment card or loyalty card, then this becomes personal information. The supermarket will need to make sure that they conform to the Data Protection Act 2018. For instance, they will need to keep the data secure and allow customers to see any personal data held about themselves if they make a subject access request.

[8]

▨ **Customer positive impact**	▨ **Privacy positive impact**
▨ **Customer negative impact**	▨ **Privacy negative impact**
▨ **Cultural positive impact**	▨ **Accurate and detailed legal issue**
▨ **Cultural negative impact**	▨ **Examples relevant to the context**

Read these boxes before you have a go at question 2.

2 Towns in the UK have large numbers of CCTV cameras to monitor high streets and public outdoor spaces.

Discuss the impact of a large network of CCTV cameras.

In your answer, you might consider the impact on:

- Pedestrians and shop owners
- Ethical issues
- Privacy issues
- Legal issues

....

....

....

....

....

....

....

....

....

....

....

....

....

....

....

[8]

Total

/ 8

☹ 😐 ☺

Continue on a separate sheet if necessary   *See the next page for how to mark your answer*

Do you remember?

You need to know about the following legislation:

- The Data Protection Act 2018
- The Computer Misuse Act 1990
- The Copyright, Designs and Patents Act 1988
- Software licences – both open source and proprietary

Exam tip

For **discuss** questions make sure you show the following:

- Accurate and detailed knowledge
- Apply this to the context given
- Both sides of the discussion are considered – include both positives/negatives or advantages/disadvantages
- Examples are relevant to an explanation or the context
- Each bullet point in the question needs to be discussed

Answers

How to mark your answer	Possible factors and evidence you could use in your answer. You can use different ideas to these.
Your answer should include similar points to those made on the right.	**Pedestrians** • May feel safer knowing the area is being monitored • Crime rates may be reduced • May feel oppressed that 'Big Brother' is always watching them
Give your answer **6-8 marks** if it has the following features: • Shows a **thorough knowledge** of the topic • Is **accurate and detailed** • Applies to the **context** of CCTV on the high-street • Any examples are **relevant** to the context or what you are explaining • Both **positives and negatives** are given • **All** the areas of impact given in the question are covered • The answer is **clear and logically structured**	**Shop owners** • Less chance of theft • Safer for staff to work there • Reduced insurance costs • Increased security and peace of mind **Ethical issues** • People may have negative feelings about constantly being watched which need to be balanced against safety and security needs • The cost of buying, installing and monitoring cameras means there may be fewer police on the street
Give your answer **3-5 marks** if it has the following features: • Shows a **reasonable knowledge** of the topic • Is **generally** accurate • Applies to the context with **one or two exceptions** • Any examples are **generally** relevant to the context or what you are explaining • **Most** of the areas of impact are covered • The answer has **some** structure	• Pedestrians may not want to have real time tracking with facial recognition… • …. but such technologies can help prevent crime or identify criminals **Privacy** • People may lose their right to privacy in public spaces if too many cameras are installed **Legal** • The footage and recordings must comply with the Data Protection Act 2018
Give your answer **1-2 marks i**f it has the following features: • **Basic** knowledge of the topic • A **basic** answer with some inaccuracies • A **limited attempt** to apply the answer to the context • The answer is **unstructured**	• The recordings must be stored securely and encrypted • They must be deleted after a certain period of time • The public need to have a right to see footage of themselves if they make a subject access request • Signage must be in place to say an area is making use of CCTV so that the public are aware
Give your answer **0 marks** if you didn't attempt the question or it did not contain any points relevant to the question.	• The CCTV system must have a clearly defined purpose and a legitimate aim – such as national security, the prevention of crime or public safety

PAPER 2

COMPUTATIONAL THINKING, ALGORITHMS AND PROGRAMMING

(J277/02)

Information about Paper 2

Written exam: 1 hour and 30 minutes
80 marks
50% of the GCSE

All questions are mandatory.

This paper consists of multiple-choice questions,
short response questions and extended response questions.

! You **will** need:
A black pen (and some spares)

You **cannot** use:
A calculator

2.1.2 DESIGNING, CREATING AND REFINING ALGORITHMS

1 Look at the following flowchart which shows an algorithm for calculating the speed of runners in a 100-metre race.
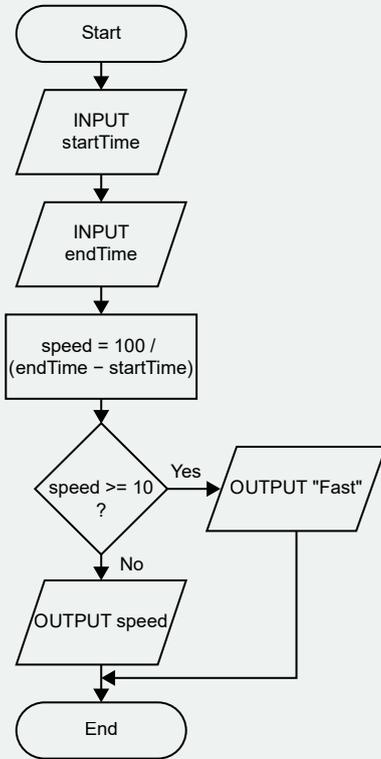
Exam tip

Make sure you use the correct symbols if you need to draw a flowchart.

Flowchart symbols

Line	Input/Output
Process	Decision
Sub program	Terminal
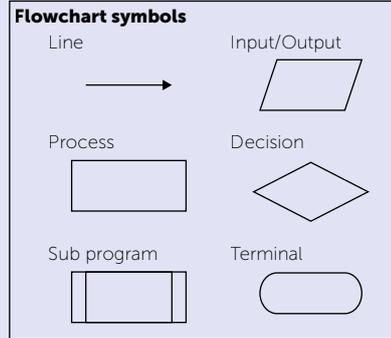
Exam tip

Some questions will ask you to write code. You can write this using a high-level programming language such as Python, VB or C#. Alternatively, you can use OCR Exam Reference Language.

All code questions will be written in Exam Reference Language.

(a) Identify **one** process in the algorithm.

The calculation: speed = 100 / (endTime − startTime) .... **[1]**

(b) **Complete** the following table to show the values of the speed variable and outputs of the algorithm for the given inputs.

startTime	endTime	speed	Output
5	105	*1*	*1*
30	80	*2*	*2*
100	110	*10*	*Fast*

[3]

Exam tip

Complete questions need you to provide all necessary parts to finish something. In this case, you are finishing a table, but it could also be used to complete a diagram or flowchart.

Exam tip

Answers that require you to complete a table may give one mark for each correct box, or, as in this example, one mark per row.

Do you remember?

This is a large topic. Make sure you also remember the following:

- Pseudocode
- A high-level language
- How to identify common errors including syntax and logic errors
- Trace tables

2 Look at the following algorithm:

```
1 startTime = int(input("Enter start time: "))
2 endTime = int(input("Enter end time: ")
3 speed = (100 / endTime) – startTime
4 IF speed >= 10 THEN
5    print("Fast")
6 ELSE
7    print(str(speed))
```

(a) Define what is meant by 'syntax error'.

.... **[1]**

(b) Identify **one** syntax error that occurs in the code.

....

.... **[1]**

(c) State the output from the program for the following inputs:

Start time: 2

End time: 10

Output:... **[1]**

(d) Identify **one** logic error in the code and write a line of code to fix the error.

You must use either:

• OCR Exam Reference Language, or

• A high-level programming language that you have studied.

Logic error ....

....

Fixed line of code ....

.... **[2]**

Total

/ 5

☹ 😐 ☺

Answers

2 (a) An error that breaks the rules of the language[1].

2 (b) Line 2 has a missing end bracket at the end of the line[1].

2 (c) 8[1] (100 / 10) – 2 = 10 – 2 = 8

2 (d) Logic error: Line 3 the brackets have been put in the wrong place[1].

2 (d) Fixed line of code: `speed = 100 / (endTime – startTime)`[1]

2.2.1 PROGRAMMING FUNDAMENTALS

1 The following algorithm is used to calculate the area of a circle.

```
const PI = 3.14
radius = float(input("Enter radius"))
area = PI * radius^2
print(str(area))
```

(a) Explain **one** use of a constant in the code.

PI is a constant in this code. The value of PI in Mathematics doesn't change, so it is suitable to store this

as a constant so that it won't be changed when the program is running. **[2]**

(b) Identify **two** variables in the program.

1 *Radius.*

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

(c) State the basic programming construct used to control the flow of this program.

Sequence. **[1]**

2 A machine packs flour into bags. Each bag contains 500 grams. The following algorithm is used to determine how many bags can be packed and how much flour will be left over. If less than 250 grams of flour is left after packing the bags, it will be discarded.

(a) Complete the pseudocode for this program.

```
const BAG_WEIGHT = 500
flourWeight = int(input("Enter the amount of flour in the machine: "))

bagsRequired = flourWeight ___DIV___ BAG_WEIGHT

leftOverFlour = flourWeight ___MOD___ BAG_WEIGHT
print(str(bagsRequired))

if leftOverFlour ___<___ 250 then
    print("Throw away the flour")
else
    print("Use the remaining flour in a smaller bag")
endif
```

Exam tip

DIV is integer division – this means the whole number after division. Some languages use **//** for this.

MOD means modulus. This means the remainder. Some languages use **%** for this.

(b) Other than a sequence, state the basic programming construct used to control the flow of this program.

Selection. **[1]**

Do you remember?

Before you complete the questions, make sure you remember the following:

- Iteration – this can be count-controlled with a FOR loop or condition-controlled with a WHILE loop
- == means equal to
- != means not equal to
- = means assignment

3 The following algorithm calculates the average of two numbers and rounds it down to the nearest whole number.

```
numberOne = int(input("Enter first number"))
numberTwo = int(input("Enter second number"))
average = (numberOne + numberTwo) DIV 2
print(str(average))
```

(a) Identify **one** variable in the program.

.... **[1]**

(b) State the output from the algorithm if the numbers input are 5 and 10.

....

.... **[1]**

(c) Explain why **average** will never store a decimal number.

....

....

....

.... **[2]**

(d) The program makes use of the basic programming construct of a sequence. Give **one** other basic programming construct.

.... **[1]**

(e) Explain the difference between the **=** operator used in the program and the **==** operator.

....

....

....

.... **[2]**

Answers

3 (a) numberOne[1], numberTwo[1], average[1]

3 (b) 7[1] [The calculation is (5 + 10) // 2 = 7. The // means integer division, so it is rounded down.]

3 (c) The // operator means integer division[1]. This will always result in removing the decimal component / rounding down[1].

3 (d) Selection[1], iteration[1].

3 (e) = is used for assignment[1] whilst == is used for comparison[1].

PRACTICE PAPERS

Information about the practice papers

Before attempting the papers, go through the previous section of the book and revise any sections that you weren't confident about. Use the face icons at the end of each topic to reflect on your level of understanding and make your own judgement of what needs more revision.

Now to the papers.

You should do each of these papers under exam conditions.

Aim to make the desk you sit at look as similar to that in the exam room. Turn off your mobile phone, music and remove all other distractions.

Let everyone in the house know that you can't be disturbed for 90 minutes whilst you do the paper.

Don't do both papers in one sitting. We advise leaving at least a day between attempting each paper.

! You **will** need:
   A black pen (and some spares)

   You **cannot** use:
   A calculator

GCSE (9–1) Computer Science

J277/01 Computer systems

PRACTICE PAPER 1

DO NOT USE
- A calculator.

INSTRUCTIONS
- Write in black ink
- Write your answer to each question in the space provided.
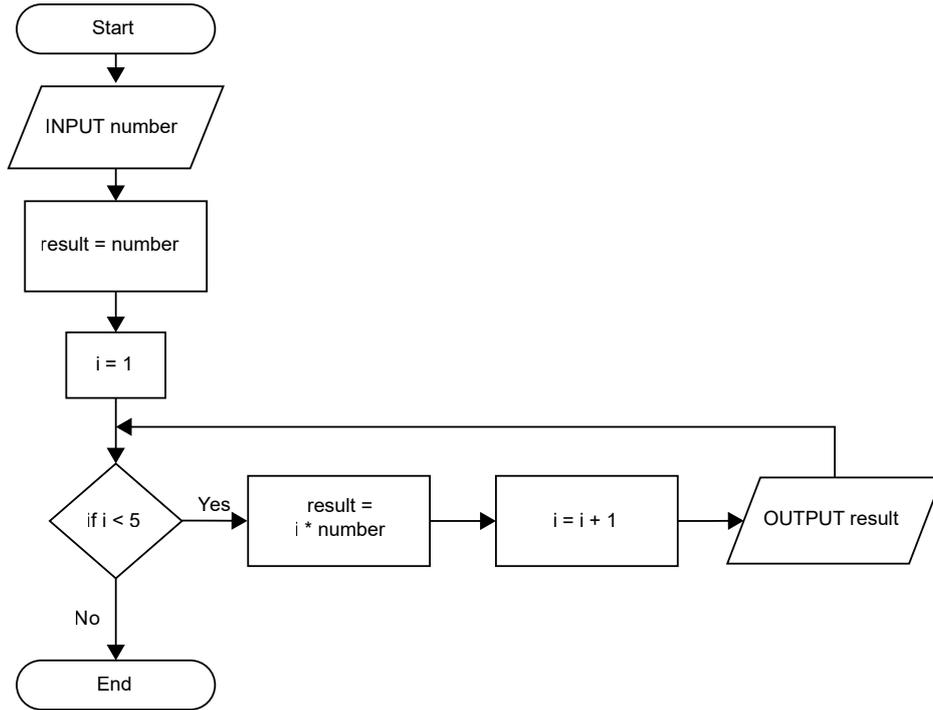- Answer all the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets [ ].
- Quality of written communication will be assessed in this paper in questions marked with an asterisk (*).
- This paper has 10 pages.

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

Final mark .... / 80 = ...%

2 A board game requires two dice to be thrown. The program to implement this works as follows:

- Each dice will roll a number between 1 and 6

- The numbers rolled are added together to get a score for the throw

- If both numbers are the same, the score is doubled

- The score is output

(a) Complete the pseudocode below for the program.

```
dice1 = random(1,6)
dice2 = random(1,6)

score = ..................................................................…

if ................................. == ................................. then

    score = ...............................................................…
endif

print(.........................................................................)
```

[5]

(b) A second program for the board game needs to perform the following tasks:

- The user is asked to enter a number between 1 and 6

- The computer then rolls a random number between 1 and 6

- If the computer's roll matches the user's number, then a value of 10 is added to the user's score

- The program repeats the first three bullet points five times before outputting the total score

Write an algorithm for this program.

....

....

....

....

....

....

....

....

....

....

....

....

.... **[5]**

3 The following shows a flowchart for an algorithm.

(a) Complete the following trace table for the algorithm with an input of 2. The first row has been completed for you.

number	i < 5	result	i	output
2		2	1	

[5]

(b) Other than **number**, identify **two** variables used in this algorithm.

1 ....

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

(c) The value stored in the variable **number** is not changed at any point in the algorithm. Explain why **number** must be a variable and not a constant.

....

....

....

.... **[2]**

PRACTICE PAPERS ANSWERS

Paper 1

Question	Answer	Marks	Topic number
1			
1 (a)	Clock speed[1], number of cores[1].	2	1.1.2
1 (b)	Cache stores recently used instructions/data[1]. It is faster to access than RAM[1]. The more cache that is available, the more instructions/data that can be stored in it[1]. This results in more opportunities to use faster cache rather than RAM[1].	2	
1 (c)	The Program Counter holds the memory address of the next instruction to be executed[1]. *Remember, it is incremented (increased by 1) after each instruction is executed.*	1	1.1.1
1 (d)	MAR / Memory Address Register[1], MDR / Memory Data Register[1], Accumulator[1]. *Accept other common registers on the CPU.*	2	
2			
2 (a)	<table><tr><th>Use</th><th>RAM</th><th>ROM</th></tr><tr><td>Stores the software for the apps that the user can select to use different streaming services.</td><td></td><td>✓</td></tr><tr><td>Data will still be stored even if the device is turned off.</td><td></td><td>✓</td></tr><tr><td>Stores the current video that is being played.</td><td>✓</td><td></td></tr></table>	3	1.2.1
2 (b)	Microwave oven[1], washing machine[1], MP3 player[1], digital watch[1], dishwasher[1], Blu-ray player[1], digital radio[1], manufacturing robot[1], satnav[1] *or any other embedded system.*	1	1.1.3
2 (c)	Program instructions typically stored in ROM/flash memory[1], limited memory[1], lower power / slower CPU[1], high reliability of hardware/programs[1].	2	
2 (d)	It is faster than alternatives[1] which means it will cope with recording/playback of high-definition programs/ultra-high-definition programs[1]. It is more portable/takes up less physical space[1] so can more easily fit inside the television[1]. It is more durable[1] so can still work if dropped/jolted[1]. It is more reliable due to no moving parts[1] so recorded programs are less likely to be lost[1]. It can have large capacities/can store many programs[1] so saves needing to change disks[1]. *Only accept capacity if compared with removable optical disks/DVD/Blu-ray. Magnetic hard disks have large capacities. Do not accept cheaper as solid-state storage is normally the most expensive per GB.*	4	1.2.2
2 (e)	Optical[1], magnetic[1].	1	
3			
3 (a)	101101111 *First 5 digits[1], last 4 digits[1]*	2	1.2.4
3 (b)	There will be an overflow error[1] because the answer is 9 bits, but the register is only 8 bits[1].	2	
3 (c)	10111011 *First 4 digits[1], last 4 digits[1]*	2	
3 (d)	5D *1 mark for each digit*	2	
3 (e)	10111010[1]	1	
3 (f)	The number is doubled [1].	1	
4			
4 (a)	Image file size = colour depth x image height (px) x image width (px) Image file size = 16 bits per pixel x 1000 px x 1000 px[1] Image file size = 16 000 000 bits / 8 bits per byte = 2 000 000 bytes Image file size = 2 000 000 bits / 1 000 000 bytes per megabyte[1] Image file size = **2 MB** OR **2 megabytes**[1]	3	1.2.4 1.2.3
4 (b)	Image height[1], image width[1], image colour depth[1], location the image was taken[1], camera settings[1], ISO[1], shutter speed[1]. *Accept other data that is commonly stored as metadata.*	2	1.2.4
4 (c)	The quality of the image will improve[1].	1	
4 (d)	Compression encodes a file in such a way as to reduce its file size[1].	1	1.2.5
4 (e)	Lossy compression will reduce the file size more than lossless compression[1]. This is because some less important data will not be stored[1].	2	
5			
5 (a)	*Five PCs[1] that each connect to a central switch or hub with one line each between switch/hub and PC[1].* *Correct labels.[1]*	3	1.3.1
5 (b)	Router.[1]	1	
5 (c)	Benefit: Each computer has a dedicated cable[1] which won't experience interference from other computers (interference happens on a wireless network)[1]. The bandwidth of a cable is likely to be higher than wireless[1] which means that websites will load faster / uploads and downloads will be faster[1]. Drawback: Cabling will need to be purchased for each computer[1] which may increase the cost of setting up the network[1]. Care will need to be taken as to where the cables are laid[1] so that they don't create a trip hazard[1].	4	1.3.2

SPECIFICATION AND QUESTION MAP

1.1	Computer systems	Paper 1
1.1	Systems architecture	Question number (part)
1.1.1	Architecture of the CPU	1(c,d)
1.1.2	CPU performance	1(a,b)
1.1.3	Embedded systems	2(a,b)
1.2	Memory and storage	
1.2.1	Primary storage (Memory)	2(a)
1.2.2	Secondary storage	2(d,e)
1.2.3	Units	4(a)
1.2.4	Data storage	3(a–f), 4(a–c)
1.2.5	Compression	4(d,3)
1.3	Computer networks, connections and protocols	
1.3.1	Networks and topologies	5(a,b,d,e)
1.3.2	Wired and wireless networks, protocols and layers	5(c,f)
1.4	Network security	
1.4.1	Threats to computer systems and networks	6(a,b)
1.4.2	Identifying and preventing vulnerabilities	6(c)
1.5	Systems software	
1.5.1	Operating systems	7(a–c)
1.5.2	Utility software	7(d)
1.6	Ethical, legal, cultural and environmental impacts of digital technology	
1.6.1	Ethical, legal, cultural and environmental impact	6(d), 8

2.1	Computational thinking, algorithms and programming	Paper 2
2.1	Algorithms	Question number (part)
2.1.1	Computational thinking	1(a,b), 8(b)
2.1.2	Designing, creating and refining algorithms	2(a,b) 3(a–c), 6(a), 9(c)
2.1.3	Searching and sorting algorithms	5(a–e)
2.2	Programming fundamentals	
2.2.1	Programming fundamentals	2(a,b) 6(a), 7(d), 8(a,c)
2.2.2	Data types	5(d), 7(b)
2.2.3	Additional programming techniques	4, 8(a,c), 9(b)
2.3	Producing robust programs	
2.3.1	Defensive design	7(a), 9(a)
2.3.2	Testing	6(b,c) 7(c)

COMMAND WORDS

The **command words** below will be used consistently in all assessment material and resources.

Command word	What you need to do
Add	Join something to something else so as to increase the size, number, or amount.
Analyse	Break down in order to bring out the essential elements or structure. Identify parts and relationships, and interpret information to reach conclusions.
Annotate	Add brief notes to a diagram or graph.
Calculate	Obtain a numerical answer showing the relevant stages in the working.
Compare	Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.
Complete	Provide all the necessary or appropriate parts.
Convert	Change the form, character, or function of something.
Define	Give the precise meaning of a word, phrase, concept or physical quantity.
Describe	Give a detailed account or picture of a situation, event, pattern or process.
Design	Produce a plan, simulation or model.
Discuss	Offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence.
Draw	Produce (a picture or diagram) by making lines and marks on paper with a pencil, pen, etc.
Evaluate	Assess the implications and limitations. Make judgements about the ideas, works, solutions or methods in relation to selected criteria.
Explain	Give a detailed account including reasons or causes.
Give	Present information which determines the importance of an event or issue, or to show causation.
How	In what way or manner; by what means.
Identify	Provide an answer from a number of possibilities. Recognise and state briefly a distinguishing factor or feature.
Justify	Give valid reasons or evidence to support an answer or conclusion.
Label	Add title, labels or brief explanation(s) to a diagram or graph.
List	Give a sequence of brief answers with no explanation.
Order	Put the responses into a logical sequence.
Outline	Give a brief account or summary.
Refine	Make more efficient, improve, modify or edit.
Show	Give steps in a derivation or calculation.
Solve	Obtain the answer(s) using algebraic and/or numerical and/or graphical methods.
State	Give a specific name, value or other brief answer without explanation or calculation.
Tick	Mark (an item) with a tick or select (a box) on a form, questionnaire, etc., to indicate that something has been chosen.
What	Asking for information specifying something.
Write/Rewrite	Mark (letters, words, or other symbols) on a surface, typically paper, with a pen, pencil, or similar implement/write (something) again so as to alter or improve it.

EXAMINATION TIPS

With your examination practice, use a boundary approximation using the following table. Be aware that boundaries are usually a few percentage points either side of this.

Grade	9	8	7	6	5	4	3	2	1
Boundary	90%	80%	70%	60%	50%	40%	30%	20%	10%

1. Be aware of command words at the back of the specification. If 'describe' or 'explain' questions are given you need to expand your answers. To help you justify your responses, aim to include words such as BECAUSE... or SO... in every answer because this forces you to justify your point, so you get additional marks. See how well it works!

2. Explain questions such as 'explain why this is the most appropriate...' do not require just a list of benefits. Instead you should identify the benefits and then expand each one, applying them to the scenario or context.

3. Full answers should be given to questions – not just key words. Make your answers match the context of the question.

4. Algorithm questions require an actual algorithm not a repetition of the question.

5. If a question explicitly asks for an algorithm to be written in pseudocode, then it will not gain marks if it is written as a flowchart. Equally, a question that asks for an algorithm to be written as a flowchart will not gain marks if answered with pseudocode.

6. If you have difficulties with algorithm questions, remember that you will gain marks (where appropriate) for input and output statements.

7. The statement `INPUT = variableName` will not gain marks in pseudocode as the variable name needs to be on the left of the assignment operator, e.g. `variableName = INPUT`.
   `INPUT variableName` is an acceptable alternative.

8. String concatenation is not enough for an output for example. `print(hello + name)` – the string must be in quotes, e.g. `print("hello " + name)`

9. Generic answers are not sufficient. For example, if a question asks for a description of the function of a router, an answer 'it connects devices together' is not sufficient. Instead answers should describe how routers are used to receive packets from computers, read the destination address of each and then forward each packet to its destination. Faster, bigger and cheaper are not very useful responses unless you justify your point.

10. The pseudocode you write does not need to match any precise syntax as long as it can 'be reasonably inferred by a competent programmer'.

11. Arrays will always start at zero, not 1.

12. Remember that a nested loop completes fully for each iteration of the outer loop.

13. In pseudocode, `input("enter name")` will not gain marks as the result needs to be assigned to a variable to store it – e.g. `name = input("enter name")`. Equally, two values cannot be input at the same time as a variable will only store one value. Instead, use `a = INPUT("Enter a")` then `b = INPUT("Enter b")`. `INPUT a, b` would be an acceptable alternative.

14. A common error in IF statements is `if name != "Sam" or "sam" then`.
    This should be: `if name != "Sam" or name != "sam" then`

15. Be careful with quotes around strings, e.g. `choice = A` (which assigns a variable) is very different to `choice = "A"` (which assigns a string).

   Good luck!

NOTES, DOODLES AND EXAM DATES

Doodles

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Target grades

Paper 1:

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Paper 2:

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Overall grade:

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Practice results

Practice paper results

Paper 1:

....

Paper 2:

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Overall grade:

....

Exam dates

Paper 1:

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Paper 2:

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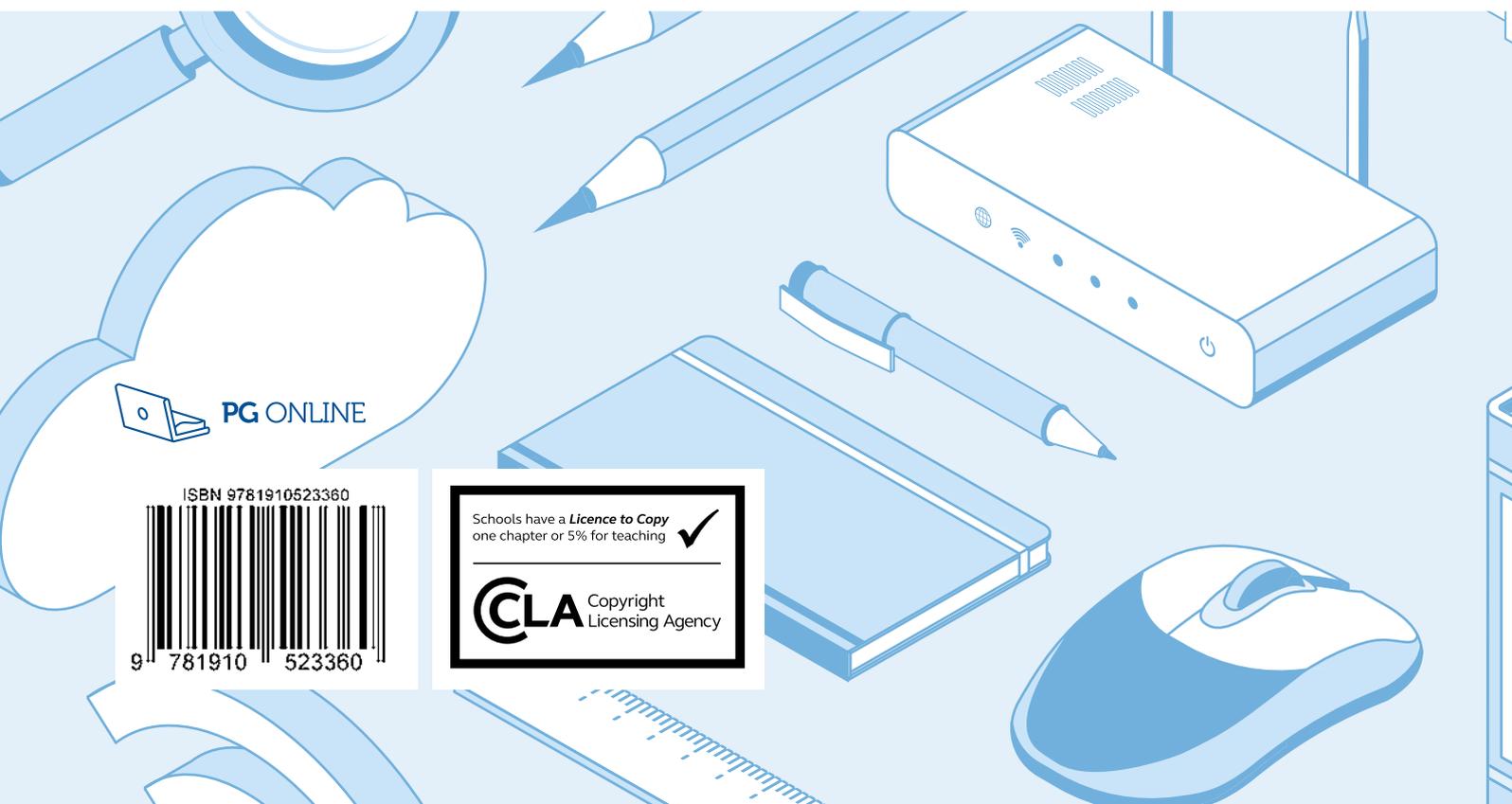- Answers to all questions
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Lastly, there are two complete exam papers written in the same style as the OCR exam papers to try. They follow exactly the same format and length as the real exam, providing a realistic experience and a great opportunity to show how much you've progressed.

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