

GCSE (9-1)

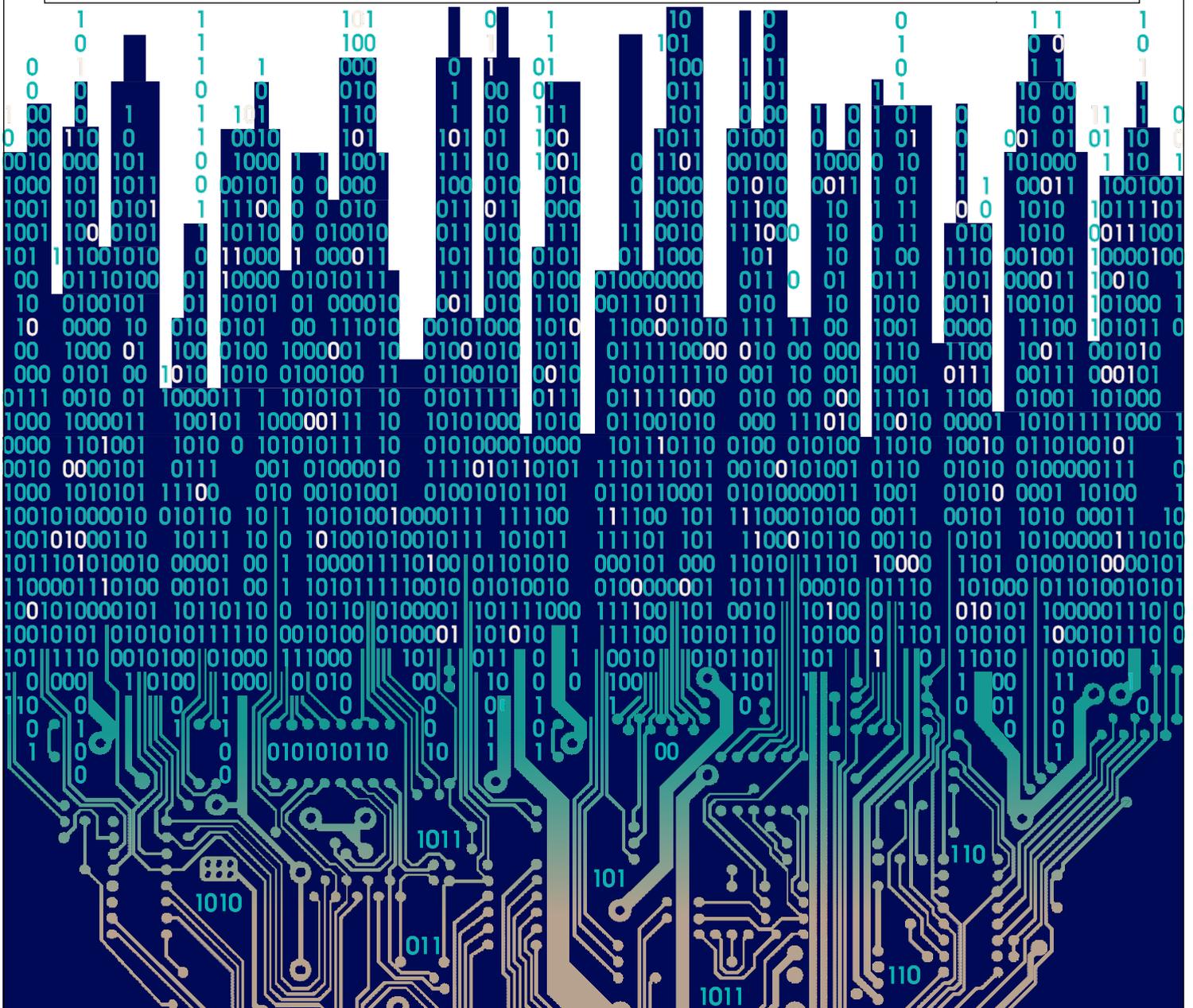
# Computer Science

Specimen Set 1 Paper 1

*Exemplars*

*First teaching September 2020*

*First certification 2022*



[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

## Contents

Contents.....	2
About this booklet .....	4
Layout of the booklet.....	4
How to use this booklet.....	5
Question 1.....	6
Introduction .....	6
Question 1a.....	6
Question 1b.....	9
Question 1c.....	11
Question 1d.....	13
Question 2.....	15
Introduction .....	15
Question 2a(i).....	15
Question 2a(ii).....	17
Question 2a(iii).....	18
Question 2a(iv).....	20
Question 2a(v).....	22
Question 2b.....	24
Question 2c.....	26
Question 2d.....	28
Question 2e.....	30
Question 2f.....	34
Question 2g.....	38
Question 3.....	40
Introduction .....	40
Question 3a.....	40
Question 3b.....	42
Question 3c(i).....	44
Question 3c(ii).....	46
Question 3c(iii).....	47
Question 3c(iv).....	49
Question 3c(v).....	50

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)


---

Question 3d.....	52
Question 3e.....	54
Question 3f.....	58
Question 3g.....	61
Question 4.....	64
Introduction .....	64
Question 4a.....	64
Question 4b.....	66
Question 4c.....	68
Question 4d.....	70
Question 4e(i) .....	72
Question 4e(ii).....	74
Question 4f(i) .....	76
Question 4f(ii) .....	78
Question 4g.....	80
Question 5.....	87
Introduction .....	87
Question 5a.....	87
Question 5b.....	89
Question 5c.....	91
Question 5d.....	93
Question 5e.....	96
Creating a question.....	101
Basic rules .....	101
Example 1: Representation of sound.....	101
Flowchart .....	102
Exam technique .....	102
Requirements of the command word taxonomy .....	102
Format of questions.....	102
General.....	103

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

## About this booklet

Refer to Appendix 1: Command word taxonomy in the [GCSE Computer science 2020 specification](#) to find out more information about the range of command words used on Paper 1.

Some marked responses have additional information. This might include clarification of the marks, advice on interpreting the mark scheme, an identification of a misconception, or exam technique advice. Not every marked response will have this additional information.

The number of marked responses varies across questions. For multiple-choice questions, there may be one response only. For the majority of questions, there are three marked responses. For higher-tariff questions, there are four or more marked responses.

## Layout of the booklet

Each of the five questions in the paper has a section devoted to it.

- There is an introduction which identifies the topic and subtopics from the specification.

For each subpart of a question there is:

- A description of what the subpart assesses
- A pointer to the relevant section in the textbook
- A pointer to the relevant section in the interactive scheme of work
- A description of the command word and its requirements
- An image of the question from the paper, including the number of marks available
- The mark scheme for that subpart only

These are followed by a number of student response sections, which include:

- An image of the actual student response
- The number of marks allocated
- An explanation for the marks allocated
- Any additional information relevant for that response

A section is included to help teachers understand how to write a two-mark explain question. This is one of the question types that requires a linked response.

There is also a section that includes advice on exam technique, some of which is relevant only to this paper.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

### How to use this booklet

Teachers may like to use these resources by

1. Working through them to understand how our assessment team will mark responses
2. Using them to create their own questions and mark schemes

If teachers want to use these resources with students, they may want to:

1. Give students the exemplar responses to mark themselves
2. Challenge groups of students to create annotations on the responses where the response matches the marks given
3. Challenge students to amend and improve responses to gain more marks
4. Set students to creating their own similar questions

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

## Question 1

### Introduction

Question 1 covers topic 5 of the specification, issues and impacts. Issues related to the environment, ethics and legalities, and cybersecurity are found in this topic.

### Question 1a

Question 1a assesses students' ability to identify and name some of the ways to protect intellectual property.

More information can be found here:

- Textbook – Topic 5.2 Ethical and legal issues
- Scheme of Work – Block 8, P11

The command word is 'state'. It requires short answers, often only one or two words per mark.

<p><b>1 Issues and impact</b></p> <p>(a) State <b>two</b> methods of protecting intellectual property. <span style="float: right;">(2)</span></p> <p>1.....</p> <p>.....</p> <p>2.....</p> <p>.....</p>
---

### Mark Scheme

Question Number	Answer	Additional Guidance	Mark
<b>1(a)</b>	Any <b>two</b> from: <ul style="list-style-type: none"> <li>• Copyright</li> <li>• Patents</li> <li>• Trademarks</li> <li>• Licensing</li> <li>• Non-disclosure agreement</li> <li>• Limit access to sensitive information</li> <li>• Awareness training for employees</li> </ul>		<b>2</b>

Response A

<b>1</b>	<b>Issues and impact</b>	
	(a) State <b>two</b> methods of protecting intellectual property.	(2)
1	Copyright	
2	Patent	2/2

*Marks and explanation*

Both responses are clearly in the mark scheme. (2 marks)

*Additional information*

This is a 'state' command word, so only short answers are expected.

Response B

<b>1</b>	<b>Issues and impact</b>	
	(a) State <b>two</b> methods of protecting intellectual property.	(2)
1	Intellectual property can be protected as long as the company network is, as people can claim around	DO NOT WRITE IN THIS AREA
2	Copyrighting companies that use your intellectual property.	
		1/2

*Marks and explanation*

The first response connects protecting intellectual property to protecting networks. (0 marks)

The second item mentions copyrighting. (1 mark)

*Additional information*

The specification section, Issues and impact, should guide students to the context of the question.

Students should remember not to write over the areas in grey.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

Response C

**1 Issues and impact**

(a) State **two** methods of protecting intellectual property.

(2)

1. ~~Module protection~~ Audit trails - audit software

2. Modular testing.

0/2

*Marks and explanation*

Audit trails and modular testing are ways to ensure more robust software, not ways to protect intellectual property. (0 marks)

*Additional information*

The student has confused two different topics from the specification. The question is based on Topic 5, the response is from Topic 3.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 1b

Question 1b asks student to identify an ethical issue associated with the use of artificial intelligence. This is a multiple-choice question. One mark means one tick.

More information can be found here:

- Textbook – Section 5.2 Ethical and legal issues
- Scheme of Work – Block 10 , P20

The command word is ‘identify’. It requires selection of one or more pieces information.

<p>(b) Identify the ethical issue associated with the use of artificial intelligence. <span style="float: right;">(1)</span></p> <p><input type="checkbox"/> <b>A</b> Acceptable use policies</p> <p><input type="checkbox"/> <b>B</b> Algorithmic bias</p> <p><input type="checkbox"/> <b>C</b> Logic errors</p> <p><input type="checkbox"/> <b>D</b> Unpatched software</p>
---

### Mark Scheme

Question Number	Answer	Additional Guidance	Mark
<b>1(b)</b>	<p>B Algorithmic bias</p> <p><i>A is not correct because AUPs are not an ethical issue associated with the use of artificial intelligence</i></p> <p><i>C is not correct because logic errors are not an ethical issue associated with the use of artificial intelligence</i></p> <p><i>D is not correct because unpatched software is not an ethical issue associated with the use of artificial intelligence</i></p>		<b>1</b>

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

Response A

(b) Identify the ethical issue associated with the use of artificial intelligence. (1)

- A Acceptable use policies
- B Algorithmic bias
- C Logic errors
- D Unpatched software

**0/1**

*Marks and explanation*

The tick is in the wrong box for a multiple-choice response. (0 marks)

*Additional information*

Response A has helpfully underlined the keywords in the question, but has not identified the other associated term from the options list.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 1c

- Question 1c assesses students' ability to remember ways of reducing the environmental impact of digital technology.

More information can be found here:

- Textbook – Section 5.1 Environmental issues
- Scheme of Work – Block 8, P7 and P8

The command word 'state'. Notice that 'one' and 'users' are emboldened. That's a clue to help students identify the context and depth of the required response. It requires short answers.

<p>(c) State <b>one</b> way <b>users</b> could reduce the environmental impact of digital technology. (1)</p> <hr/> <hr/>
---

### Mark Scheme

Question Number	Answer	Additional Guidance	Mark
<b>1(c)</b>	Any <b>one</b> from: <ul style="list-style-type: none"> <li>• Reduce use</li> <li>• Responsible Disposal (to prevent leaking chemicals)</li> <li>• Recycling</li> <li>• Reuse</li> <li>• Replace devices less frequently</li> <li>• Use power-saving options (such as black screen)</li> </ul>		<b>1</b>

### Response A

<p>(c) State <b>one</b> way <b>users</b> could reduce the environmental impact of digital technology. (1)</p> <p>Recycle by taking the technology apart and recycle correctly</p>
---

1/1

### Marks and explanation

The response includes unrequired expansion, as recycle would have sufficed. (1 mark)

### Additional information

An expansion is always helpful to ensure the examiner has a clear understanding of your response.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

## Response B

(c) State **one** way **users** could reduce the environmental impact of digital technology. (1)

Use the devices they have  
for a longer time i.e. not  
buy new versions  
every year.

1/1

*Marks and explanation*

The response fits the mark scheme. (1 mark)

## Response C

(c) State **one** way **users** could reduce the environmental impact of digital technology. (1)

Use renewable energy sources

0/1

*Marks and explanation*

That is a good way to reduce environmental impact, but is not under most user's direct control. The response does not associate renewable energies with charging the phone. (0 marks)

*Additional information*

A good hint for this type of question is to look at the bold words. Notice that 'users' is bold. Be sure to answer the question in the context of a user, not an organisation or company.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

Question 1d

- Question 1d assesses students' ability to explain a threat to networks. This falls into the cybersecurity subtopic.
- 

More information can be found here:

- Textbook – 5.3 Cybersecurity
- Scheme of Work – Block 5, P25, P27

The command word is 'explain'. It requires that a linked explanation be given. That is a statement and an expansion. Try using the word 'because' in the response to ensure the expansion is provided.

(d) Explain **one** reason why an employee who is logged on to the company network should not click on a link in an email from an unknown source. (2)

---



---



---

Mark Scheme

Question Number	Answer	Additional Guidance	Mark
<b>1(d)</b>	An explanation to include <b>two</b> from: It increases the risk to data / reduces cybersecurity (1) because the sender could be using social engineering techniques / the link could lead to a malicious website / could download malware (1)		<b>2</b>

Response A

(d) Explain **one** reason why an employee who is logged on to the company network should not click on a link in an email from an unknown source. (2)

It could contain malware that can access all there data

2/2

*Marks and explanation*

The response identifies that the link could contain malware. (1 mark)

It gives an expansion of that mark to state the consequence of clicking. (1 mark)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Additional information

An explain question should include a statement and a linked expansion.

### Response B

(d) Explain **one** reason why an employee who is logged on to the company network should not click on a link in an email from an unknown source. (2)

The link could download a  
virus

1/2

### Marks and explanation

The response identifies that clicking could download a virus. (1 mark). However, there is no expansion provided. (0 marks)

### Additional information

Try using the word 'because' in the response to ensure the expansion is provided.

### Response C

(d) Explain **one** reason why an employee who is logged on to the company network should not click on a link in an email from an unknown source. (2)

Because they don't know who it is from.

0/2

## Question 2

### Introduction

Question 2 covers topic 3, computers. The subtopics of hardware, software, and programming languages are found in this topic.

### Question 2a(i)

**Question 2a(i) assesses students' ability to recall the steps of the fetch, decode, and execute cycle.**

More information can be found here:

- Textbook – Topic 3.1 Hardware
- Scheme of Work – Block 3, P13, P14, P15

The command word is 'complete'. Questions using this command word might include diagrams, as here, or tables. It's always a good idea to use subject-specific annotations and symbols.

**2 Computers**

(a) The CPU carries out a process.

(i) Complete the diagram. (2)

### Mark Scheme

Question Number	Answer	Additional Guidance	Mark
<b>2(a)i</b>			<b>2</b>

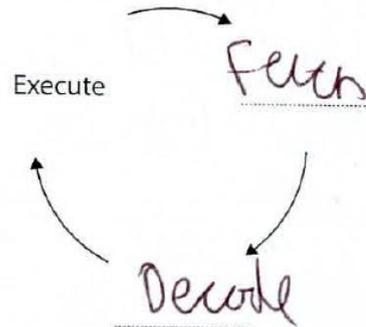
Response A

**2 Computers**

(a) The CPU carries out a process.

(i) Complete the diagram.

(2)



2/2

*Marks and explanation*

Fetch and decode are provided in the correct locations. (2 marks)

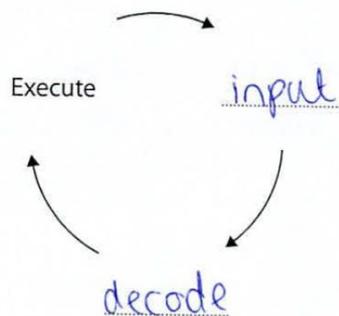
Response B

**2 Computers**

(a) The CPU carries out a process.

(i) Complete the diagram.

(2)



1/2

*Marks and explanation*

Decode appears in the correct place. If it had been in the other blank, it would not have earned a mark. (1 mark)

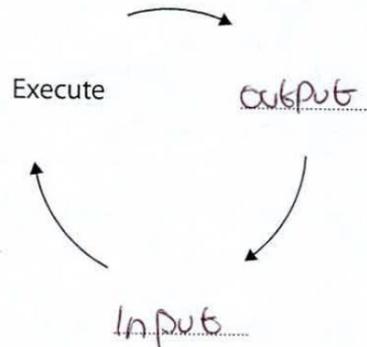
Response C

**2 Computers**

(a) The CPU carries out a process.

(i) Complete the diagram.

(2)



0/2

*Marks and explanation*

The student has confused the fetch, decode, and execute cycle with the input, process, output sequence. (0 marks)

*Additional information*

The input, process, output sequence is in Topic 1: Computational Thinking. The questions are organised by topic to help students identify the context of the question.

**Question 2a(ii)**

Question 2a(ii) assesses students' ability to recall the components inside the microprocessor.

More information can be found here:

- Textbook – Topic 3.1 Hardware
- Scheme of Work – Block 3, P13, P14, P15

The command word is 'identify'. This command word is used with multiple-choice questions.

**Mark scheme**

Question Number	Answer	Additional Guidance	Mark
<b>2(a)ii</b>	C Data bus  <i>A is not correct because binary shift is not a hardware component. B is not correct because the control unit does not carry instructions from memory to the CPU D is not correct because registers do not carry instructions from memory to the CPU</i>		<b>1</b>

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response A

(ii) Identify the hardware component that carries instructions from memory to the CPU. (1)

**A** Binary shift  
 **B** Control unit  
 **C** Data bus  
 **D** Register

1/1

#### Marks and explanation

The tick is in the correct box. (1 mark)

#### Additional information

The student has used a good exam technique of crossing out one of the distractors. Obviously, the student knows it is not the correct answer.

### Question 2a(iii)

Question 2a(iii) assesses students' ability to recall the components inside the microprocessor.

(iii) State the component of the CPU that carries out additions and comparisons. (1)

.....

.....

The command word is 'state'. This command word requires short answers, sometimes only one word.

More information can be found here:

- Textbook – Topic 3.1 Hardware
- Scheme of Work – Block 3, P13, P14, P15

Command word

#### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>2(a)iii</b>	Arithmetic logic unit / ALU		<b>1</b>

**Response A**

(iii) State the component of the CPU that carries out additions and comparisons. (1)

~~Random access memory~~  
Arithmetic Logic Unit

1/1

*Marks and explanation*

The correct response has been provided. (1 mark)

*Additional information*

The student has thoroughly crossed out an incorrect response, so the examiner will ignore it.

**Response B**

(iii) State the component of the CPU that carries out additions and comparisons. (1)

~~logic unit~~ Arithmetic Logic Unit

1/1

*Marks and explanation*

Arithmetic logic unit is specified in the mark scheme (1 mark)

**Response C**

(iii) State the component of the CPU that carries out additions and comparisons. (1)

~~the~~ logic unit

0/1

*Marks and explanation*

Only part of the required response is given. (0 marks)

*Additional information*

The full name of the component must be provided for the mark. However, in this case, the abbreviation ALU would also have been accepted.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 2a(iv)

Question 2a(iv) assesses students' ability to recall information about clock speed.

(iv) State the reason why a higher clock speed is desirable. (1)

---



---

More information can be found here:

- Textbook – Topic 3.1 Hardware
- Scheme of Work – Block 3, P13, P14, P15

The command word is 'state'. This command word requires short answers. In this case, more than one word is required, but the response shouldn't require more than the indicated answer lines.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
2(a)iv	More instructions can be carried out each second		1

### Response A

(iv) State the reason why a higher clock speed is desirable. (1)

high clock speed is desirable because  
it is at the rate of instructions  
are carried out.

1/1

### Marks and explanation

The reference to the rate of instructions carried out is sufficient for the mark. (1 mark)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

(iv) State the reason why a higher clock speed is desirable. (1)

A Higher clock speed means tasks are completed quicker, making it more favourable.

0/1

#### Marks and explanation

The response has identified that 'tasks' are completed quicker. It requires reference to 'instructions'. (0 marks)

#### Additional information

Students can answer this question simply by recalling the definition of clock speed.

### Response C

(iv) State the reason why a higher clock speed is desirable.

A higher clock speed means more<sup>(1)</sup> computations a second and therefore it will be faster.

(v) State the name of a bus that is unidirectional.

0/1

#### Marks and explanation

There is no reference to 'instructions'. Not all instructions are computations. (0 marks)

#### Additional information

Students should be careful to be as precise with their terminology as possible.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 2a(v)

Question 2a(v) assesses students' ability to recall the components inside the microprocessor.

(v) State the name of a bus that is unidirectional.	(1)
---	-----

More information can be found here:

- Textbook – Topic 3.1 Hardware
- Scheme of Work – Block 3, P13, P14, P15

The command word is 'state'. This command word requires short answers, sometimes only one word.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>2(a)v</b>	Address (bus)		<b>1</b>

### Response A

2. (v) State the name of a bus that is unidirectional. Address bus	(1)
<span style="border: 2px solid red; border-radius: 50%; padding: 5px; font-weight: bold; color: red;">1/1</span>	

### Marks and explanation

Although the student has indicated doubt with the answer, it is correct. (1 mark)

### Additional information

The question mark could be a way to identify questions that the student will revisit if there is time at the end of the exam.

### Response B

(v) State the name of a bus that is unidirectional. all buses	(1)
<span style="border: 2px solid red; border-radius: 50%; padding: 5px; font-weight: bold; color: red;">0/1</span>	

### Marks and explanation

All the buses are not unidirectional. (0 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

*Additional information*

Reading the question carefully should have highlighted that the name of 'a bus' is required.

Response C

(v) State the name of a bus that is unidirectional. (1)

BUS network Topograp Bus Network Topology

0/1

*Marks and explanation*

The response indicates that the student is confused between network topologies and machine architecture. (0 marks)

*Additional information*

The area of the specification that this question belongs to is indicated in at the top of the main question. This topic is Computers.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

**Question 2b**

Question 2b assesses students' ability to recall information about magnetic storage media and devices.

(b) Describe how data is stored on magnetic media. <span style="float: right;">(2)</span>

More information can be found here:

- Textbook – Topic 3.1 Hardware
- Scheme of Work – Block 3, P16, p17

The command word is 'describe'. The responses should give an account of something. In this case, there is a 'how' in the question. This indicates that the description is of a process, rather than just characteristics.

**Mark scheme**

Question Number	Answer	Additional Guidance	Mark
<b>2(b)</b>	Any <b>two</b> from: There is a magnetic/chemical coating on surface of the media (1) The magnetic state/polarity of the chemical can be changed (1) to represent a 0 or 1 (1)		<b>2</b>

**Response A**

(b) Describe how data is stored on magnetic media. <span style="float: right;">(2)</span>
The surface of magnetic tape has a coating on it.
The coating is magnetised or not to represent 0 or 1.

2/2

*Marks and explanation*

All three marks from the mark scheme are here, chemical coating, changes state, to be 0 or 1. (2 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

(b) Describe how data is stored on magnetic media. (2)

The discs spin and read-write heads move across the discs. Data is encoded as opposing magnetic polarities on the surface of the disc by electromagnets in the read-write heads.

1/2

#### Marks and explanation

The response describes the use of magnetic polarities. (1 mark)

There is no indication of polarity relating to 0/1 for the additional mark. (0 mark)

#### Additional information

The mark scheme is looking for the ideas of a magnetic coating, changing state, to represent 0s and 1s.

### Response C

(b) Describe how data is stored on magnetic media. (2)

Used in floppy disks, hard disks and tapes, cheap and high capacity.

0/2

#### Marks and explanation

This response gives examples of magnetic media and reasons for choosing them, rather than a description of how data is stored. (0 marks)

#### Additional information

The identified items in the response are more appropriate to the context of IT, rather than computer science.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 2c

Question 2c assesses students' ability to recall information about optical storage media and devices.

(c) State the type of secondary storage that uses a laser to read the disk.

(1)

More information can be found here:

- Textbook – Topic 3.1 Hardware
- Scheme of Work – Block 3, P16, P17

The command word is 'state'. In this case, a one-word response is all that is required.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
2(c)	Optical		1

### Response A

(c) State the type of secondary storage that uses a laser to read the disk.

(1)

Optical storage

1/1

### Marks and explanation

Optical is the required response. Storage is ignored. (1 mark)

### Response B

(c) State the type of secondary storage that uses a laser to read the disk.

(1)

Blu-ray disc

0/1

### Marks and explanation

Blu-ray is a trademark, not a type of secondary storage. Subject-specific language is required. (0 marks)

### Additional information

A single word response of 'optical' would meet the requirements of the question. It is not a good idea to use a trademarked name in any response.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

Response C

(c) State the type of secondary storage that uses a laser to read the disk.

~~Optical CD~~

(1)

0/1

*Marks and explanation*

A CD is an example of an optical drive, not a type of generic type of secondary storage. (0 marks)

*Additional information*

The first response, which is correct, has been crossed out and replaced, so cannot be awarded. (0 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 2d

Question 2d assesses students' ability to recall a definition from the specification, specifically section 3.3 Programming languages.

(d) Some program code requires translation.

Define the term 'translation'.

(1)

More information can be found here:

- Textbook – Topic 3.3 Programming languages
- Scheme of Work – Block 7, P10

The command word is 'define'. The meaning of the term is required. Students should remember to use subject-specific terminology.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>2(d)</b>	Converting (human readable) code to binary/machine code		<b>1</b>

### Response A

(d) Some program code requires translation.

Define the term 'translation'.

(1)

when high level language is changed  
into machine code.

**1/1**

### Marks and explanation

The response covers the points required in the mark scheme. (1 mark)

### Additional information

The mark scheme is looking for the understanding that a high-level, human readable annotation is changed into binary machine code which a computer can execute.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

(d) Some program code requires translation.

Define the term 'translation'.

(1)

~~Changing the translating the code into another language~~ programming language.

0/1

#### Marks and explanation

This response lacks enough detail to understand what the student means by programming language. An example might have helped. (0 marks)

#### Additional information

This is a common misconception that translation changes between programming languages. Remember, the result of translation is binary or machine code. Subject-specific terminology is always required.

### Response C

(d) Some program code requires translation.

Define the term 'translation'.

(1)

Chaning the code into a ~~differe~~ into something else

0/1

#### Marks and explanation

This is a very vague response. It's the 'something else' that the mark scheme is looking for.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

## Question 2e

Question 2e assesses students' ability to recall the difference between a compiler and an interpreter.

<p>(e) Describe <b>two</b> ways a compiler differs from an interpreter. <span style="float: right;">(4)</span></p> <p>1 .....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>2 .....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
--

More information can be found here:

- Textbook – Topic 3.3 Programming languages
- Scheme of Work – Block 7, P10

The command word is 'describe' followed by 'differs from'. This type of question is really asking for a comparison or contrast. Both items from the question, compiler and interpreter, must be addressed using the same concept. Think of it as a contrast.

## Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>2(e)</b>	<p><b>Two</b> linked descriptions from:</p> <ul style="list-style-type: none"> <li>• A compiler carries out translation once prior to execution (1) whereas an interpreter carries out translation every time the program executes (1)</li> <li>• A compiler produces a stand-alone executable file (1) whereas an interpreter is required each time the code is run (1)</li> <li>• A compiler reports errors after translation is complete (1) whereas an interpreter reports errors as they occur (1)</li> </ul>	Both items in the question must be addressed in each response	<b>4</b>

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response A

(e) Describe **two** ways a compiler differs from an interpreter.

(4)

1 A compiler only needs to translate the code once.

However, an interpreter has to translate it every time the program runs.

2 The interpreter stops and reports errors when it finds them. However, a compiler doesn't stop when it finds an error.

3/4

#### Marks and explanation

The first response matches the first bullet in the mark scheme. (2 marks)

The first part, of the second response, matches the third bullet in the mark scheme. (1 mark)

However, the part targeting the compiler doesn't explain what a compiler does when it finds an error. (0 mark)

#### Additional information

In a linked description, both parts must be addressed in the same context. Try using 'where as', 'however', or 'on the other hand', in the response to make sure both sides are covered.

## Response B

(e) Describe **two** ways a compiler differs from an interpreter. (4)

1. A compiler produces object code which doesn't need the source to run.
2. The interpreter shows the errors one at a time when it finds them.

2/4

*Marks and explanation*

The output of the compiler doesn't need the source code to run. (1 mark)

An interpreter does show the errors one at a time when it finds them. (1 mark)

*Additional information*

This response has earned the first mark of each available two marks. It is missing the comparison.

## Response C

(e) Describe **two** ways a compiler differs from an interpreter. (4)

1. ~~compilers~~ interpreters go through each line of code individually. Compilers go through the code ~~in~~ ~~together~~ once.
2. ~~interpreters~~ can find errors ~~more~~ ~~accurately~~ whereas compilers cannot. When interpreters ~~do~~ spot an error they stop whereas compilers carry on and find all errors ~~altogether~~.

1/4

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

*Marks and explanation*

The first response is lacking detail. It does not describe a single difference between compilers and interpreters. (0 marks)

The second response identifies that interpreters stop when they spot an error (1 mark). The use of 'all together' is not enough for the second mark.

*Additional information*

In a 'Describe the difference' question, the same idea should be contrasted across both items in the question. Try using 'whereas' to make sure both items in the question are covered.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 2f

Question 2f assesses students' ability to relate information about how an operating system works.

<p>(f) Describe <b>two</b> ways an operating system manages processes. <span style="float: right;">(4)</span></p> <p>1 .....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>2 .....</p> <p>.....</p> <p>.....</p> <p>.....</p>
---

More information can be found here:

- Textbook – Topic 3.2 Software
- Scheme of Work – Block 4, P21

The command word is 'describe'. This use of describe is looking for a linked description where the first mark is for a statement and the second is an expansion of that statement. A four-mark describe means to give two separate two-mark descriptions.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>2(f)</b>	<p><b>Two</b> linked descriptions from:</p> <ul style="list-style-type: none"> <li>• Uses paging / allocates addresses/sections [of RAM] (1) to share memory between processes (1)</li> <li>• Extends main memory (1) by using part of secondary storage (1) (as virtual memory)</li> <li>• The memory of inactive processes (1) is stored in virtual memory and swapped back when the process becomes active (1)</li> <li>• Uses scheduling algorithm (1) to share processing time between competing processes (1)</li> </ul>		<b>4</b>

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response A

(f) Describe **two** ways an operating system manages processes. (4)

1. Gives you more memory by using part of the hard disk for virtual memory

2. It manages the CPU usage allowing programs CPU time

3/4

#### *Marks and explanation*

Gives you more memory taken as extending memory. (1 mark)

Using a hard disk as virtual memory. (1 mark)

Giving programs CPU time is the idea of sharing processor time. (1 mark)

#### *Additional information*

For a 'Describe' the parts of the response should be related.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

(f) Describe **two** ways an operating system manages processes. (4)

1. It prioritises the tasks and allocates time to each process

2. It checks that all ~~requests~~ requests for memory are valid and allocates it accordingly

2/4

#### Marks and explanation

It prioritises the tasks is not quite enough for the first mark. (0 mark)

Allocating time to each process is the idea of sharing CPU time. (1 mark)

The idea of allocating memory fits the mark scheme. (1 mark)

#### Additional information

It is possible to earn a mark for providing either part of a linked description. For the second mark, it must relate to the first.

## Response C

(f) Describe **two** ways an operating system manages processes.

(4)

1 The operating system manages users, logons and passwords and these are used to allocate permissions for entry to data.

2 The operating system ~~the~~ shares out processor time between them so that in turn they can have their program instructions processed

1/4

**Marks and explanation**

The first part of the response is about managing users, not processes as required by the question. (0 marks).

The second part of the response gains a mark for the idea of sharing processor time, as in bullet 2, second part. (1 mark)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

**Question 2g**

Question 2g assesses students' understanding of how an embedded system works.

(g) Describe how an embedded system that uses a sensor could control car windscreen wipers.	(2)

More information can be found here:

- Textbook – Topic 3.1 Hardware
- Scheme of Work – Block 7, P1, P2

The command word is 'describe'. This is followed by 'how', which indicates a process.

**Mark scheme**

Question Number	Answer	Additional Guidance	Mark
<b>2(g)</b>	A description to include <b>two</b> from: If set pressure levels / moisture levels are reached (1) a switch could be turned on/off / windscreen wipers could be turned on/off / (wiper) motor speed altered (1).		<b>2</b>

**Response A**

(g) Describe how an embedded system that uses a sensor could control car windscreen wipers.	(2)
The sensor would detect when water is on the windscreen it would then turn the windscreen wipers to turn on.	

2/2

*Marks and explanation*

The idea that the sensor is connected to the windscreen and detects rain earns a mark. (1 mark)

The idea that the windscreen wiper is turned on is just enough for the other mark. (1 mark)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Additional information

The mark scheme is looking for the connection between the sensor being on the windscreen and the ability to detect rain for the first mark. The second mark is for activating an actuator, a motor, or the wipers.

### Response B

(g) Describe how an embedded system that uses a sensor could control car windscreen wipers. (2)

The sensors could detect rain and activate the windscreen wipers.

**1/2**

### Marks and explanation

Sensors' is not enough for the first mark. They need to be clearly placed in the context of the windscreen. (0 marks)

The resultant of turning on the wipers is identified. (1 mark)

### Additional information

Students are advised to always provide as specific a response as possible. If there is a context in the question, use it in the response.

### Response C

(g) Describe how an embedded system that uses a sensor could control car windscreen wipers. (2)

If the sensor is activated on the windscreen then the signal gets sent to the windscreen wiper which wipe everything off.

**0/2**

### Marks and explanation

The response is a description of the context in the question. It lacks any understanding of the processes behind the tie between the sensor and the wiper.

## Question 3

### Introduction

Question 3 covers topic 1 of the specification, computational thinking. The subtopics found here are decomposition and abstraction, algorithms, and truth tables.

### Question 3a

**Question 3a assesses students' understanding of decomposition.**

**3 Computational thinking**

(a) Define the term 'decomposition'. (1)

---



---

More information can be found here:

- Textbook – Topic 1.1 Good programming practice: tools and strategies
- Scheme of Work – Block 1, CT2

The command word is 'define'. The meaning of the term is required. Students should remember to use subject-specific terminology.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>3(a)</b>	Breaking down a problem/solution/system/algorithm		<b>1</b>

### Response A

**3 Computational thinking**

(a) Define the term 'decomposition'. (1)

where problems are broken down  
 into sub programs

1/1

#### Marks and explanation

The concept of breaking down problems is in the mark scheme. (1 mark)

#### Additional information

The response includes a good tie to subprograms in code.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

**3 Computational thinking**

(a) Define the term 'decomposition'. (1)

Breaking a problem down into more smaller and manageable parts,  
which are then easier to solve

1/1

#### *Marks and explanation*

The information for the mark is provided, along with expansion. (1 mark)

#### *Additional information*

Expansions are not required, but very often provide the details to really secure the mark.

### Response C

**3 Computational thinking**

(a) Define the term 'decomposition'. (1)

Breaking things down

0/1

#### *Marks and explanation*

The response lacks any type of connection to computer science or problem solving. 'Things' does not imply problems. (0 marks)

#### *Additional information*

The definition must not be general, vague, or casual. Use subject-specific terminology.

### Question 3b

**Question 3b assesses students' understanding of linear search.**

<p>(b) State the worst case for a linear search algorithm.</p> <p style="text-align: right;">(1)</p> <hr style="border-top: 1px dotted black;"/> <hr style="border-top: 1px dotted black;"/>
--

More information can be found here:

- Textbook – Topic 1.12 Sorting and searching
- Scheme of Work – Block 4, CT22, CT23

The command word is 'state'. This command word requires short answers, but should not need more than the lines available.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>3(b)</b>	The target item is not in the list / is at end of the list		<b>1</b>

### Response A

<p>(b) State the worst case for a linear search algorithm.</p> <p style="text-align: right;">(1)</p> <p style="font-family: cursive;">If the item is the last thing on the list</p> <hr style="border-top: 1px dotted black;"/> <div style="text-align: right; border: 2px solid red; border-radius: 50%; padding: 5px; width: fit-content; margin-left: auto;">1/1</div>
---

#### Marks and explanation

The item being the last one in the list matches the mark scheme. (1 mark)

### Response B

<p>(b) State the worst case for a linear search algorithm.</p> <p style="text-align: right;">(1)</p> <p style="font-family: cursive;">If the last number is the number you looking for</p> <hr style="border-top: 1px dotted black;"/> <div style="text-align: right; border: 2px solid red; border-radius: 50%; padding: 5px; width: fit-content; margin-left: auto;">1/1</div>
--

#### Marks and explanation

The last number' is assumed to be 'at the end of the list'. Just enough for the mark. (1 mark)

#### Additional information

Statements should be unambiguous and clear. The last number could just be the last number checked, not necessarily the last number in the list.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

## Response C

(b) State the worst case for a linear search algorithm.	(1)
<i>Answer: A lot of numbers</i>	<b>0/1</b>

*Marks and explanation*

The number of items in a list may affect the time it takes to find a target, but it's the design of the algorithm that is the context of this question. (0 marks)

*Additional information*

Again, responses should be as specific as possible.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 3c(i)

**Question 3c(i) assesses students' understanding of a bubble sort.**

(c) A bubble sort is carried out on this list to put it in ascending order.

8 3 2 4 0 3 9

The value '8' starts in position 0.

(i) State the number of passes required to complete the sort. (1)

More information can be found here:

- Textbook – Topic 1.2 Sorting and searching
- Scheme of Work – Block 2, CT9

The command word is 'state'. This only requires a single number.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
3(c)i	5		1

### Response A

(c) A bubble sort is carried out on this list to put it in ascending order. 8 3 2 4

8 3 2 4 0 3 9 3 8 2 4

The value '8' starts in position 0. 3

(i) State the number of passes required to complete the sort. (1)

5

**1/1**

### Marks and explanation

Five is the correct response. (1 mark)

### Additional information

One good way to practice for these type questions is to execute the searches and sorts on paper, slowly, counting each pass, each comparison, and each swap.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

### Response B

(c) A bubble sort is carried out on this list to put it in ascending order.

8 3 2 4 0 3 9

The value '8' starts in position 0.

(i) State the number of passes required to complete the sort.

(1)

4

0/1

#### *Marks and explanation*

The response probably indicates that the last pass of the bubble sort was not made. (0 marks)

#### *Additional information*

Remember, a final pass must be made without swaps for the list to be sorted.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 3c(ii)

**Question 3c(ii) assesses students' understanding of a bubble sort.**

(ii) State the number of swaps made on the final pass.	(1)
--	-----

More information can be found here:

- Textbook – Topic 1.2 Sorting and searching
- Scheme of Work – Block 2, CT9

The command word is 'state'. This only requires a single number.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
3(c)ii	0		1

### Response A

(ii) State the number of swaps made on the final pass.	(1)
--	-----

0

1/1

#### *Marks and explanation*

Zero is the correct response. (1 mark)

#### *Additional information*

It's possible to know this answer without actually remembering how to do the bubble sort.

### Response B

(ii) State the number of swaps made on the final pass.	(1)
--	-----

1

0/1

#### *Marks and explanation*

One is the number of swaps made on the penultimate pass. (0 marks)

#### *Additional information*

There is always one final pass without swaps to ensure the list is sorted.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 3c(iii)

**Question 3c(iii) assesses students' understanding of the components that make up algorithms.**

(iii) State the component of an algorithm used to store whether a swap has been made during a pass.

(1)

More information can be found here:

- Textbook – Topic 1.3 Data types
- Scheme of Work – Block 1, CT1, CT2, CT3

The command word is 'state'. A single word response is adequate.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
3(c)iii	Variable	Accept words that describe a use of variable in this case, e.g. flag	1

### Response A

(iii) State the component of an algorithm used to store whether a swap has been made during a pass.

(1)

variable  
Boolean True/False

### Marks and explanation

Variable is the correct response. (1 mark)

1/1

### Additional information

An incorrect response has been clearly marked out, so the provided alternative is awarded.

### Response B

(iii) State the component of an algorithm used to store whether a swap has been made during a pass.

(1)

terminator

0/1

### Marks and explanation

A terminator is a flowchart symbol used for start and stop. (0 mark)

### Additional information

The response has confused representing algorithms in flowcharts with the logic of how an algorithm works.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

Response C

(iii) State the component of an algorithm used to store whether a swap has been made during a pass. (1)

*Array*

0/1

*Marks and explanation*

An array is a data structure. (0 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 3c(iv)

**Question 3c(iv) assesses students' understanding of a bubble sort.**

(iv) State the position of the item that will be compared with the value in position 0.

(1)

More information can be found here:

- Textbook – Topic 1.2 Sorting and searching
- Scheme of Work – Block 2, CT9

The command word is 'state'. This only requires a single number.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
3(c)iv	1		1

### Response A

(iv) State the position of the item that will be compared with the value in position 0.

(1)

~~44~~ 1

1/1

#### Marks and explanation

One is the correct response. (1 mark)

#### Additional information

There is a clue in the question itself, as it says that 'B' is in position zero.

### Response B

(iv) State the position of the item that will be compared with the value in position 0.

(1)

3

0/1

#### Marks and explanation

The digit 3 is the contents of the item at position 1, not the position. (0 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 3c(v)

**Question 3c(v) assesses students' understanding of programming constructs used in algorithms.**

<p>(v) Define the term 'iteration'.</p>	(1)

More information can be found here:

- Textbook – Topic 1.6 One-dimensional data structures
- Scheme of Work – Block 3, CT14; Block 7, CT1

The command word is 'define'. The meaning of the term is required. Students should remember to use subject-specific terminology.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>3(c)v</b>	Looping over every item in a data structure		<b>1</b>

### Response A

<p>(v) Define the term 'iteration'.</p>	(1)
<p>A kind of loop that goes through every item in a list for example a 'for' loop.</p>	
<div style="border: 2px solid red; border-radius: 50%; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">1/1</div>	

#### *Marks and explanation*

The response indicates the idea of visiting every item in a data structure, i.e. a list. (1 mark)

#### *Additional information*

### Response B

<p>(v) Define the term 'iteration'.</p>	(1)
<p>A for loop</p>	
<div style="border: 2px solid red; border-radius: 50%; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 0 auto;">0/1</div>	

#### *Marks and explanation*

A 'for loop' is used to implement iteration, but is not the definition of iteration. (0 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

**Response C**

(v) Define the term 'iteration.'	(1)
<del>A loop</del> A loop	
	0/1

**Marks and explanation**

Although iteration is conceptually a loop, it has a subject-specific meaning. (0 marks)

**Additional information**

Always be more specific. Iteration is a special kind of loop that looks at every item in a data structure and the number of times through the loop is known before it starts.

### Question 3d

**Question 3d assesses students' understanding of subprograms.**

(d) Explain <b>one</b> benefit of using subprograms. <span style="float: right;">(2)</span>

More information can be found here:

- Textbook – Topic 1.7 Subprograms
- Scheme of Work – Block 3, CT17; Block 7, CT2; Block 10, CT23

The command word is 'explain'. It requires that a linked explanation be given. That is a statement and an expansion. Try using the word 'because' in the response to ensure the expansion is provided.

#### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>3(d)</b>	An explanation to include <b>two</b> from: <ul style="list-style-type: none"> <li>• The subprogram may be used more than once in a program (1) so that writing, debugging, testing will save time (1)</li> <li>• The subprogram performs one specific/contained task (1) so it can be moved away from the main program code (1)</li> <li>• Subprograms for common tasks can be stored in libraries and reused in other programs (1) so that they don't have to be re-written (1)</li> </ul>		<b>2</b>

#### Response A

(d) Explain <b>one</b> benefit of using subprograms. <span style="float: right;">(2)</span>

Less time is spent debugging repeated blocks of code because a subprogram can be called many times from a program.

2/2

#### Marks and explanation

Less time debugging earns a mark. Calling the subprogram many times earns the other mark. (2 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

(d) Explain **one** benefit of using subprograms. (2)

It's easy to read and can  
be called upon again  
easily.

1/2

#### Marks and explanation

The mark is for 'called upon again'. (1 mark).

Ease of reading might be considered a benefit, but an 'Explain' requires a reason/expansion, not two benefits. (0 marks)

#### Additional information

Try to write responses that are as specific as possible. If they include words like easier, cheaper, or quicker, think if you can explain them in a different more subject-specific way.

### Response C

(d) Explain **one** benefit of using subprograms. (2)

Only have to check the section  
of code once per errors

1/2

#### Marks and explanation

There is a mark here for the idea that it is more efficient to debug subprograms than multiple sections of code. (1 mark)

The additional mark would be for another linked statement. (0 marks)

#### Additional information

The command word 'Explain' always requires a statement for one mark, followed by a reason or expansion for the second mark.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

### Question 3e

**Question 3e assesses students' understanding of truth tables.**

(e) Complete this truth table. (3)

A	B	C	(A AND B)	(NOT C)	(A AND B) OR (NOT C)
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

More information can be found here:

- Textbook – Topic 1.8 Working with algorithms
- Scheme of Work – Block 2, CT10

The command word is 'complete'. In this case, each cell in the table should be filled with the appropriate response.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Mark scheme

Question Number	Answer	Additional Guidance	Mark																																																						
3(e)	<p>One mark for each correct column</p> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>(A AND B)</th> <th>(NOT C)</th> <th>(A AND B) OR (NOT C)</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr> </tbody> </table>	A	B	C	(A AND B)	(NOT C)	(A AND B) OR (NOT C)	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0	1	1	0	1	1	0	0	0	1	0	0	0	1	1	1	0	1	0	0	0	1	1	0	1	1	1	1	1	1	1	0	1	Allow follow through	3
A	B	C	(A AND B)	(NOT C)	(A AND B) OR (NOT C)																																																				
0	0	0	0	1	1																																																				
0	0	1	0	0	0																																																				
0	1	0	0	1	1																																																				
0	1	1	0	0	0																																																				
1	0	0	0	1	1																																																				
1	0	1	0	0	0																																																				
1	1	0	1	1	1																																																				
1	1	1	1	0	1																																																				

### Response A

(e) Complete this truth table. (3)

A	B	C	(A AND B)	(NOT C)	(A AND B) OR (NOT C)
0	0	0	F	T	T
0	0	1	F	F	F
0	1	0	F	T	T
0	1	1	F	F	F
1	0	0	F	T	T
1	0	1	F	F	F
1	1	0	T	T	T
1	1	1	T	F	T

3/3

#### Marks and explanation

The use of T/F is awarded, assuming that F is 0 and T is 1. (3 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

(e) Complete this truth table.

(3)

A	B	C	(A AND B)	(NOT C)	(A AND B) OR (NOT C)
0	0	0	0	0	0
0	0	1	0	1	<del>0</del> 1
0	1	0	0	0	0
0	1	1	0	1	1
1	0	0	0	0	0
1	0	1	0	1	1
1	1	0	1	0	1
1	1	1	1	1	1

2/3

#### Marks and explanation

The response has a mark for the first column which is correct for AND. (1 mark)

The NOT is incorrect, so no mark (0 marks)

The OR, however, is correct for the inputs in the previous two columns. (1 mark)

#### Additional information

The additional guidance indicates that follow-through errors are awarded.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response C

(e) Complete this truth table.

(3)

A	B	C	(A AND B)	(NOT C)	(A AND B) OR (NOT C)
0	0	0		✓	
0	0	1			
0	1	0		✓	
0	1	1			
1	0	0		✓	
1	0	1			
1	1	0	✓	✓	
1	1	1			

1/3

#### Marks and explanation

The examiner has interpreted that blanks in the cells means False and that ticks mean True. Therefore, the first column earns no marks. (0 marks)

The second column does earn a mark. (1 mark)

The third column earns no marks. (0 marks)

#### Additional information

If the question uses 1s and 0s, then the responses should be 1s and 0s. Ticks and blanks are not well-defined subject-specific symbols.

### Question 3f

**Question 3f assesses students' understanding of the arithmetic operations used in algorithms**

(f) The identifier `plants` is used for an array of values.

`len(plants) // 2` is used to find the index position of the middle item in `plants`

Explain **one** reason why integer division, rather than division, is used to do this. (2)

.....

.....

.....

More information can be found here:

- Textbook – Topic 1.2 Algorithms and programs
- Scheme of Work – Block 1, CT1

The command word is 'explain'. The 'explain' command word always requires a statement and a linked expansion.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>3(f)</b>	An explanation to include <b>two</b> from: An integer is returned with <code>//</code> (1) because <ul style="list-style-type: none"> <li>• <code>len(plants)</code> could be an odd number (1)</li> <li>• the value for position has to be an integer / not a decimal (1)</li> </ul> e.g. If the length of the array is an odd number, normal division will return a real number (1) (which is not acceptable because) index values are integers (1)		<b>2</b>

### Response A

(f) The identifier `plants` is used for an array of values.

`len(plants) // 2` is used to find the index position of the middle item in `plants`

Explain **one** reason why integer division, rather than division, is used to do this. (2)

Because the result of the division must not be a real number, which would be the case if division was used for an array with an odd number of values.

2/2

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Marks and explanation

This response is turned around, but it identifies that the list having an odd number of items is the problem, so earns one mark. The second mark is for noting that the index cannot be a real number. (1 mark)

### Additional information

Remember, using the format of statement, with 'because' is a good way to make sure both marks are earned.

### Response B

(f) The identifier `plants` is used for an array of values.  
`len(plants) // 2` is used to find the index position of the middle item in `plants`  
Explain **one** reason why integer division, rather than division, is used to do this.

Since the values are discrete, you can't have half an index. (2)

2/2

### Marks and explanation

Discrete values is taken to mean integers for one mark. (1 mark)

The idea that the indices cannot be decimal is enough for the other mark. (1 mark)

### Additional information

An alternative, more clear response would be, integer division returns integers, because indices cannot be decimal numbers.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

## Response C

(f) The identifier `plants` is used for an array of values.  
`len(plants) // 2` is used to find the index position of the middle item in `plants`  
Explain **one** reason why integer division, rather than division, is used to do this. (2)

*integer division will give a whole number answer giving a rough answer to the index position*

**1/2**

### Marks and explanation

Integer division gives a whole number is awarded a mark. (1 mark)

A rough answer is just not enough for the remaining mark as there's no reference to the effect of decimal numbers. (0 mark)

### Additional information

The 'Explain' command word always requires a statement and a linked expansion.

### Question 3g

**Question 3g assesses students' ability to use abstraction.**

(g) Here are four images of creatures that will be used in a computer game.

(Source: images from © PAL)

Before coding the game, a programmer applies abstraction.

One feature of creatures is their colour.

State **two other** features of the creatures that the programmer could include when creating a general model for a creature.

(2)

---

1

---

2

---

More information can be found here:

- Textbook – Topic 1.1 Good programming practice: tools and strategies
- Scheme of Work – Block 3, CT15; Block 10, CT23

The command word is 'state'. A short answer is required. It doesn't have to be only a single word, but should not require more than the space given.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>3(g)</b>	Any <b>two</b> from: <ul style="list-style-type: none"> <li>• Number of legs</li> <li>• Number of antennae</li> <li>• Length / width / size</li> <li>• Number of wings</li> <li>• Size of head</li> <li>• Shape of body</li> <li>• Number of eyes</li> <li>• Size of mouth</li> <li>• Habitat</li> </ul>	Accept any appropriate feature. Award two marks from the same bullet point for the identification of two different features e.g. number of legs (1), legs jointed/unjointed (1)	<b>2</b>

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response A

Before coding the game, a programmer applies abstraction.

One feature of creatures is their colour.

State **two other** features of the creatures that the programmer could include when creating a general model for a creature.

(2)

1. ~~How many~~ How many legs

2. If it can fly.

**2/2**

#### Marks and explanation

Number of legs matches mark scheme. (1 mark) 'Flying' is not in the mark scheme, but additional guidance allows any appropriate feature to be awarded. (1 mark)

#### Additional information

Because all possible responses cannot be determined, the additional guidance allows marks to be awarded for any appropriate feature.

### Response B

Before coding the game, a programmer applies abstraction.

One feature of creatures is their colour.

State **two other** features of the creatures that the programmer could include when creating a general model for a creature.

(2)

1. ~~are~~ legs.

2. length.

**1/2**

#### Marks and explanation

All of these creatures have legs, so the distinguishing feature is the number of legs. (0 marks) The length is in the mark scheme. (1 mark)

#### Additional information

Be precise with responses. For 'State' questions, the responses can be more than one word.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

### Response C

State **two other** features of the creatures that the programmer could include when creating a general model for a creature.

(2)

1 Time of day

2 The type of weather

0/2

#### *Marks and explanation*

These may be of interest when creating other aspects of a game, but the question specifically asks about the model for the creatures. (0 marks)

#### *Additional information*

Be sure to always read the question carefully to identify the context of the required response.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

## Question 4

### Introduction

Question 4 covers topic 1 of the specification, data. The subtopics found here are binary, data representation, and data storage and compression

### Question 4a

Question 4a assesses students' understanding of manipulating binary patterns.

#### 4 Data

(a) Identify the result of a single logical shift left on the 8-bit binary pattern 0101 0101.

(1)

- A** Addition
- B** Division
- C** Multiplication
- D** Subtraction

More information can be found here:

- Textbook – Topic 2.1 Binary
- Scheme of Work – Block 2, P8, P9

The command word is 'identify'. This command word is used with multiple-choice questions.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>4(a)</b>	<p>C Multiplication</p> <p><i>A is not correct because addition does not result from a single logical shift left</i></p> <p><i>B is not correct because division does not result from a single logical shift left</i></p> <p><i>D is not correct because subtraction does not result from a single logical shift left</i></p>		<b>1</b>

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

**Response A**

**4 Data**

(a) Identify the result of a single logical shift left on the 8-bit binary pattern 0101 0101.

A Addition

B Division

C Multiplication

D Subtraction

Handwritten notes:  $\frac{4}{84}$ ,  $01010101$ ,  $00101010$ ,  $0416 \cdot 4 \cdot (1)$

**0/1**

**Marks and explanation**

The correct response has been crossed out, as in the directions at the top of the paper. (0 marks)

**Question 4b**

**Question 4b assesses students' understanding of manipulating binary patterns.**

(b) Convert the denary number -33 to 8-bit binary using two's complement. (2)

.....

.....

.....

More information can be found here:

- Textbook – Topic 2.1 Binary
- Scheme of Work – Block 1, P3

The command word is 'convert'. This command word requires applying a process to change the representation of an artefact. For these type questions, it's a good idea to show the working out.

**Mark scheme**

Question Number	Answer	Additional Guidance	Mark
4(b)	1 mark for each nibble 1101 1111		<b>2</b>

**Response A**

(b) Convert the denary number -33 to 8-bit binary using two's complement. (2)

~~100~~    128    64    32    16    8    4    2    1

0    0    1    0    0    0    0    1

1    1    0    1    1    1    1    0

1    1    0    1    1    1    1    1

2/2

*Marks and explanation*

This response has shown the step of flipping the bits and adding a binary one to the result.

The final bit pattern is clearly indicated, with both nibbles correct. (2 marks)

*Additional information*

It's always a good idea to show working with any of these conversion type questions. It helps show the examiner how much you understand.

**Response B**

(b) Convert the denary number -33 to 8-bit binary using two's complement. (2)

---

$33 = 0010\ 0001$

---

$-33 = 1101\ 1110$

---

1/2

*Marks and explanation*

The top nibble is correct. (1 mark)

The lower nibble is incorrect. (0 marks)

**Response C**

(b) Convert the denary number -33 to 8-bit binary using two's complement. (2)

128	64	32	16	8	4	2	1
0	0	1	0	0	0	0	1

---



---



---

0/2

*Marks and explanation*

The response has converted the denary number 33 to 8-bit binary. This is the first step, but earns no mark. (0 marks)

### Question 4c

**Question 4c assesses students' understanding of manipulating binary patterns.**

(c) Complete the table to show the result of  $1001\ 0110 + 0101\ 0001$  (2)

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

More information can be found here:

- Textbook – Topic 2.1 Binary
- Scheme of Work – Block 1, P4

The command word is 'complete'. In this case, each cell in the table should be filled with the appropriate response.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>4(c)</b>	1 mark for each nibble 1110 0111		<b>2</b>

### Response A

(c) Complete the table to show the result of  $1001\ 0110 + 0101\ 0001$  (2)

1	0	0	1	0	1	1	0
0	1	0	1	0	0	0	1
1	1	1	<del>0</del>	0	1	1	1

2/2

### Marks and explanation

This response receives both marks (2 marks). It also shows how one cell has been clearly crossed out.

*Additional information*

When crossing out, make sure the response to mark is clear. Examiners can't choose between two responses.

**Response B**

(c) Complete the table to show the result of  $1001\ 0110 + 0101\ 0001$  (2)

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

1/2

*Marks and explanation*

The lower nibble matches the mark scheme. (1 mark)

The top does not illustrate the carry. (0 mark)

**Response C**

(c) Complete the table to show the result of  $1001\ 0110 + 0101\ 0001$  (2)

	<sup>0</sup>	<sup>0</sup>	<sup>1</sup>					
	128	64	32	16	8	4	2	1
140	1	0	0	1	0	1	1	0
81	0	1	0	1	0	0	0	1
221	1	1	0	1	1	0	1	1

0/2

*Marks and explanation*

Neither the upper nor the lower nibble is correct. (0 marks)

*Additional information*

It's not always clear how a student has arrived at an incorrect response. In this case, the conversion of the top pattern to 140 is incorrect. Therefore, the incorrect result has been converted back to binary.

### Question 4d

**Question 4d assesses students' understanding of manipulating binary patterns.**

(d) Convert the hexadecimal number 2A to 8-bit binary. (2)

---



---



---



---

More information can be found here:

- Textbook – Topic 2.1 Binary
- Scheme of Work – Block 2, P10

The command word is 'convert'. This command word requires applying a process to change the representation of an artefact. For these type questions, it's a good idea to show the working out.

#### Mark scheme

Question Number	Answer	Additional Guidance	Mark
4(d)	1 mark for each nibble 0010 1010		<b>2</b>

#### Response A

(d) Convert the hexadecimal number 2A to 8-bit binary. A 10  
B (2)

2 | A  
 0010 | 1010  
00101010
2/2

#### Marks and explanation

The top nibble is correct. (1 mark)

The lower nibble is correct. (1 mark)

#### Additional information

This response has also shown the working out. This is helpful in demonstrating understanding.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

(d) Convert the hexadecimal number 2A to 8-bit binary. (2)

2 = 0000 0010

A = 0010 0000

2A = 0010 0010

1/2

#### Marks and explanation

The lower nibble has been converted correctly. (1 mark).

The upper nibble is not correct. (0 marks)

### Response C

(d) Convert the hexadecimal number 2A to 8-bit binary. (2)

2      A

00000010      00001010

00000010

00001100

0/2

#### Marks and explanation

The 2 has been converted to binary. The A, 10 decimal, has been converted to binary.

Unfortunately, they were added rather than being concatenated. (0 mark)

#### Additional information

The working out on this response would be useful for the teacher and student to see the misconception. The final response is clearly identified with the squiggly underline.

## Question 4e(i)

Question 4e(i) assesses students' understanding of bitmap images.

<p>(e) Images can be represented as bitmaps.</p> <p>(i) Define the term 'pixel'.</p>	(1)
--	-----

More information can be found here:

- Textbook – Topic 2.2 Data representation
- Scheme of Work – Block 9, P13, P14

The command word is 'define'. The meaning of the term is required. Students should remember to use subject-specific terminology.

## Mark scheme

Question Number	Answer	Additional Guidance	Mark
4(e)i	The smallest single point of colour in an image / picture element / the smallest element of a bit-mapped image		<b>1</b>

## Response A

<p>(e) Images can be represented as bitmaps.</p> <p>(i) Define the term 'pixel'.</p> <p>An individual element that holds a colour</p>	(1)
---	-----

1/1

*Marks and explanation*

The response has both ideas of a picture element holding a colour. (1 mark)

## Response B

<p>(e) Images can be represented as bitmaps.</p> <p>(i) Define the term 'pixel'.</p> <p>A tiny square of a image is a pixel.</p>	(1)
--	-----

0/1

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

*Marks and explanation*

A tiny square of an image is not enough to indicate that it is a picture element nor that it holds a colour. (0 marks)

*Additional information*

Remember, always use subject-specific vocabulary. Be precise in the response.

Response C

(e) Images can be represented as bitmaps.

(i) Define the term 'pixel'.

(1)

The number of bits in one colour detail of the  
colour

0/1

*Marks and explanation*

Pixels are associated with colour, but the response lacks the explanation of that connection.

**Question 4e(ii)**

**Question 4e(ii) assesses students' understanding of bitmap images.**

(ii) Describe **one** way that changing the number of bits allocated to the colour depth determines how an image is represented. (2)

.....

.....

.....

More information can be found here:

- Textbook – Topic 2.2 Data representation
- Scheme of Work – Block 9, P13, P14

The command word is 'describe'. This use of describe requires a linked description where the first mark is for a statement and the second is an expansion of that statement.

**Mark scheme**

Question Number	Answer	Additional Guidance	Mark
<b>4(e)ii</b>	A description to include <b>two</b> from: Increasing the number of bits used for each pixel (1) allows more colours to be represented in each pixel (1) OR increasing the number of bits allows more pixels to be used (1) providing a greater level of resolution (1) OR Decreasing the number of bits used for each pixel (1) allows fewer colours to be represented in each pixel (1) OR Decreasing the number of bits allows fewer pixels to be used (1) providing a reduced level of resolution (1)		<b>2</b>

**Response A**

(ii) Describe **one** way that changing the number of bits allocated to the colour depth determines how an image is represented. (2)

.....

using more bits for each pixel means the image can have more colours

.....

2/2

*Marks and explanation*

Increasing the number of bits is identified. (1 mark)

The effect of the increase is the linked part of the description. (1 mark)

*Additional information*

This response shows the technique of making a statement and then providing a linked part.

**Response B**

(ii) Describe **one** way that changing the number of bits allocated to the colour depth determines how an image is represented. (2)

If the number of bits increases  
 the colour depth of the image increases  
 and a wider range of colours is shown.

1/2

*Marks and explanation*

Understanding that a wider range of colours is available earns a mark. (1 mark)

The additional mark would be for linking it to being the colours of pixels. (0 mark)

*Additional information*

A 'Describe' requires a linked description. Make a statement for one mark and expand it for the additional mark.

**Response C**

(ii) Describe **one** way that changing the number of bits allocated to the colour depth determines how an image is represented. (2)

~~This gives the colour~~  
 This allows a greater number of mean  
 colours to be used.

1/2

*Marks and explanation*

A greater number of colours earns a mark. (1 mark).

The response is missing the second part of the linked description.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 4f(i)

**Question 4f(i) assesses students' understanding of representing analogue sound in binary.**

(f) Analogue sound must be converted into a digital representation.

(i) State the name for the height of a sound wave.

(1)

More information can be found here:

- Textbook – Topic 2.2 Data representation
- Scheme of Work – Block 9, P15

The command word is 'state'. State requires short answers. In this case one word is sufficient.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
4(f)i	Amplitude		1

### Response A

(f) Analogue sound must be converted into a digital representation.

(i) State the name for the height of a sound wave.

(1)

Amplitude

1/1

### Marks and explanation

Amplitude is the required response. (1 mark)

### Response B

(f) Analogue sound must be converted into a digital representation.

(i) State the name for the height of a sound wave.

(1)

Sound Sampling

0/1

### Marks and explanation

Although this response is not accurate, it is within the context of the specification point. (0 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

### Response C

(f) Analogue sound must be converted into a digital representation.	
(i) State the name for the height of a sound wave.	(1)
Sample frequency	0/1

#### *Marks and explanation*

The sample frequency is not awarded. However, it is within the correct specification topic. (0 mark)

#### *Additional information*

The words at the front of the lines ensure both requirements are addressed. There is a great deal of subject-specific vocabulary that can be learned using recall techniques such as flashcards.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

**Question 4f(ii)**

**Question 4f(ii) assesses students' understanding of representing analogue sound in binary.**

(ii) State **one** benefit and **one** drawback of increasing the bit depth of audio. (2)

Benefit.....

.....

Drawback.....

.....

More information can be found here:

- Textbook – Topic 2.2 Data representation
- Scheme of Work – Block 9, P15

The command word is 'state'. State requires short answers. For two marks, it's two short answers.

**Mark scheme**

Question Number	Answer	Additional Guidance	Mark
<b>4(f)ii</b>	One mark for the benefit: <ul style="list-style-type: none"> <li>• Increases the accuracy of the representation (1)</li> </ul> One mark for a drawback from: <ul style="list-style-type: none"> <li>• Increases the amount of storage required (1)</li> <li>• Increases the time it takes to download the audio file (1)</li> </ul>	Do not accept increases the quality	<b>2</b>

**Response A**

(ii) State **one** benefit and **one** drawback of increasing the bit depth of audio. (2)

Benefit *Allows more data to be stored*

*and a higher range of sound to be accurately presented.*

Drawback *The file size will be larger.*

2/2

*Marks and explanation*

The response identifies that the accuracy of the representation is better. (1 mark)

The file size will be larger. (1 mark)

*Additional information*

This is a good use of subject-specific vocabulary, where it talks about the accuracy of the representation in relation to the original.

**Response B**

(ii) State **one** benefit and **one** drawback of increasing the bit depth of audio.

(2)

Benefit *It makes the audio clearer*

Drawback *Takes up <sup>more</sup> ~~more~~ storage space in a file*

1/2

*Marks and explanation*

The clearness or quality of the audio in playback is affected by many other factors, such as the quality of the speakers. (0 marks)

More storage in a file earns a mark. (1 mark)

*Additional information*

The sound we hear in our ears is affected by many factors. From a computer science perspective, the important factor is how closely the digital representation matches the original analogue wave.

**Response C**

(ii) State **one** benefit and **one** drawback of increasing the bit depth of audio.

(2)

Benefit *Increases sound quality*

Drawback *Increases size*

0/2

*Marks and explanation*

Again, quality has been identified as a benefit, but there are more subject-specific ways to describe this. (0 marks)

The second part lacks identification of what increases in size. (0 marks)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 4g

**Question 4g assesses students' ability to explore aspects of a scenario and make connections leading to explanations or solutions.**

(g) A company is designing promotional products for a band. Products include CDs, toys, greeting cards and digital downloads. All the products use sound.

Discuss the choice of lossless or lossy compression for sound in these products.

Your answer should consider:

- the types of product
- lossless compression
- lossy compression.

(6)

More information can be found here:

- Textbook – Topic 2.3 Compression
- Scheme of Work – Block 9, P17

The command word is 'discuss'. The command word requires exploration of a scenario using the fundamental knowledge and understanding of areas of computer science.

The mark scheme is levels-based, which means it is a best-fit mark, rather than a set of bulleted mark points.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Mark scheme

Question Number	Indicative content
<b>4(g)</b>	<ul style="list-style-type: none"> <li>• Compression reduces data used to represent the original sound</li> <li>• Both types require encoding and decoding</li> <li>• Lossy compression reduces the accuracy of the representation (Lossless - Reverse)</li> <li>• Lossy compression increases the reduction in file size. (Lossless - Reverse)</li> <li>• Lossy better for online transmission of sound, e.g. streaming technologies as it takes less time to download / can facilitate access by users with low-speed connections.</li> <li>• Lossy better for cases where limited storage available, e.g. embedded systems (toys/cards)</li> <li>• Lossless better for physical media (CDs), since it supports high quality audio.</li> <li>• Lossy audio removes data representing frequencies that humans cannot hear (or are masked) so they cannot tell the difference</li> <li>• Lossy compression can be variable so that different amounts of compression can be offered depending on a user's bandwidth.</li> </ul>

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–2	Basic, independent points are made, showing elements of understanding of key concepts/principles of computer science. (AO1)  The discussion will contain basic information with little linkage between points made or application to the context. (AO2)
Level 2	3–4	Demonstrates adequate understanding of key concepts/principles of computer science. (AO1)  The discussion shows some linkages and lines of reasoning with some structure and application to the context. (AO2)
Level 3	5–6	Demonstrates comprehensive understanding of key concepts/principles of computer science to support the discussion being presented. (AO1)  The discussion is well developed, with sustained lines of reasoning that are coherent and logically structured, and which clearly apply to the context. (AO2)

## Response A

(6)

lossless compression doesn't remove any data but it can compress repeating data (runs) into frequency pairs. This means the quality isn't effected but the size isn't reduced massively. lossy compression removes unnecessary data which cannot be recovered once ~~it~~ deleted. It therefore usually creates smaller file sizes than lossless.

CDs = lossless, CDs can ~~have~~ <sup>store</sup> large file sizes and the quality needs to be better.

Toys = lossy, little room to store large file sizes and the quality doesn't need to be <sup>that good</sup>

Greeting cards = lossy there is very little space in a card to store large sound files & the sound doesn't need to be that clear.

digital downloads = lossless, there is much more room to store sound files on a computer and quality is expected to be better

digital downloads can recover the data once it has been transferred.

6/6

**Marks and explanation**

Good demonstration of subject-specific knowledge and understanding. Knowledge tied to the products given in the context. Good level 3 response that meets all the requirements of the question. (6 marks)

**Additional information**

It is possible to gain very good marks in the discussion question by covering all of the bullets given and tying that information to the context of the question. Remember do not write outside the area given on the answer paper.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response B

(6)

Lossy and lossless compression are both different, lossy reduced file size at the cost of reducing the sound quality, this would be most useful at the boy and the greeting cards as they wouldn't require the best audio.

CD's and Digital downloads on the other hand would require lossless as the user would need the best audio quality, they would both have much larger file sizes but sound alot better as these products are required for their sound as their purpose and whilst the boy and greeting cards have other purposes.

**4/6**

#### *Marks and explanation*

Good application of knowledge to products. For a level 3 response, it should incorporate expansion addressing the reasons for the choices. (4 marks)

#### *Additional information*

In the discussion question, remember to cover the bullet points, in context, and present justification for the choices made.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response C

(6)

Lossless Compression can be used for sound in these products as it will reduce the file size of the sound storage but can be restored if needed.

Lossy Compression will get rid of certain sounds which humans can't hear, this will make it sound like nothing changed but it has reduced the file size, this can not be restored.

I think lossy compression is the best method for this as it will remove sounds we can't hear and make it sound ~~different~~ no different whilst reducing file size.

3/6

#### *Marks and explanation*

There are some good points of knowledge. There are no references to the products given in the context of the question. Does not fully meet level 2 descriptor. (3 marks)

#### *Additional information*

Always consider the context of the question. There is sufficient answer space to afford a full range of marks.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response D

(6)
<p><u>Lossless</u></p> <ul style="list-style-type: none"> <li>• Reduces the file size without losing data</li> <li>• Looks for data that is stored twice or more and compresses it into groups.</li> <li>• <del>used in text files</del> used for graphic files with low colour depths.</li> </ul>
<p><u>lossy</u></p> <ul style="list-style-type: none"> <li>• Reduces file size by removing unnecessary data.</li> <li>• Removing colours you can't see or sound you can't hear.</li> <li>• Used for digital sound recordings.</li> </ul>
2/6

#### Marks and explanation

Some points of knowledge have been presented. There is application to the context of the problem set out in the question. Therefore, only level 1 marks can be awarded. (2 marks)

#### Additional information

Bullet points are actually fine for this question. However, they must be tied back to the context for level 2 and level 3 marks.

Response E

(6)

lossless compression is when it's been compressed but not much ~~data~~ is lost.

lossy compression is when it deletes high frequencies and colours we can't see to reduce the file size but when it's deleted and you can't get it back.

1/6

*Marks and explanation*

There are some elements of understanding demonstrated here. However, they are in the context of images rather than in the context of the question scenario. There is just enough to award a mark. (1 mark)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

## Question 5

### Introduction

Question 5 covers topic 4 of the specification, networks. The subtopics found here are networks and network security

### Question 5a

**Question 5a assesses students' understanding of network addressing.**

#### 5 Networks

(a) Identify the reason why all computers need a unique IP address.

(1)

- A** Enables a firewall to protect devices
- B** Identifies devices on a network
- C** Increases the speed of transmission
- D** Reduces reliance on the transport layer

More information can be found here:

- Textbook – Topic 4.1 Networks
- Scheme of Work – Block 6, P31; Block 7, P2

The command word is 'identify'. This command word is used with multiple-choice questions.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>5(a)</b>	<p>B Identifies devices on a network</p> <p><i>A is not correct because unique IP addresses do not enable a firewall to protect devices</i></p> <p><i>C is not correct because unique IP addresses do not increase the speed of transmission</i></p> <p><i>D is not correct because unique IP addresses do not reduce the reliance on the transport layer</i></p>		<b>1</b>

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

## Response A

**5 Networks**

(a) Identify the reason why all computers need a unique IP address.

(1)

- A** Enables a firewall to protect devices
- B** Identifies devices on a network
- C** Increases the speed of transmission
- D** Reduces reliance on the transport layer

0/1

*Marks and explanation*

The option is not the required one. (0 mark)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Question 5b

**Question 5b assesses students' understanding of network topologies.**

(b) Describe <b>one</b> disadvantage of using a bus topology. <span style="float: right;">(2)</span>

More information can be found here:

- Textbook – Topic 4.1 Networks
- Scheme of Work – Block 6, P35

The command word is 'describe'. This use of describe is looking for a linked description where the first mark is for a statement and the second is an expansion of that statement.

#### Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>5(b)</b>	If the main cable fails / is damaged (1) the whole network will fail (1) If more computers are connected (1) the transmission time is increased / increased chance of data collisions (1) Every computer receives all of the data on the network (1) causing a security risk (1)		<b>2</b>

#### Response A

(b) Describe <b>one</b> disadvantage of using a bus topology. <span style="float: right;">(2)</span>
If the wire breaks the whole network will break

2/2

#### Marks and explanation

The whole network breaks earns a mark. (1 mark)

If the wire breaks, is just enough for the other mark. (1 mark).

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

*Additional information*

The reference to 'wire' is vague. Remember to use subject-specific vocabulary, such as 'network cable'.

Response B

(b) Describe **one** disadvantage of using a bus topology. (2)

has loads of data collisions when two devices transmit at the same time

**1/2**

*Marks and explanation*

Data collisions are a disadvantage. (1 mark)

The reference to two devices does not imply that there are many connected to a network. (0 marks)

*Additional information*

Be as specific as possible with using the vocabulary in computer science.

Response C

(b) Describe **one** disadvantage of using a bus topology. (2)

if the server breaks everything goes off

**0/2**

*Marks and explanation*

This is a vague response. There does not have to be a 'server' on a bus network. A machine can be turned off without the communications going down. (0 mark)

*Additional information*

Think about the terminology used. Don't assume that server or client is translatable to any machine at all. Those words have subject-specific meanings.

### Question 5c

**Question 5c assesses students' understanding of ways to protect files on a network.**

(c) A company stores statistics about its business on a server.

Explain **one** type of access to the statistics file a student on work experience at the company should be given. (2)

.....

.....

.....

More information can be found here:

- Textbook – Topic 4.2 Network security
- Scheme of Work – Block 5, P28

The command word is 'explain'. It requires that a linked explanation be given. That is a statement and an expansion. Try using the word 'because' in the response to ensure the expansion is provided.

### Mark scheme

Question Number	Answer	Additional Guidance	Mark
5(c)	<p>An explanation to include <b>one</b> mark for a type of access and <b>one</b> mark for a linked reason, such as:</p> <ul style="list-style-type: none"> <li>• To recommend read only (1) because the student cannot accidentally change/delete the data / because the student cannot share the data (1)</li> <li>• No access (1) because the student cannot see any sensitive/irrelevant information (1)</li> </ul>		<b>2</b>

### Response A

(c) A company stores statistics about its business on a server.

Explain **one** type of access to the statistics file a student on work experience at the company should be given. (2)

Read only as they shouldn't modify critical details

2/2

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

*Marks and explanation*

Read only is the type of access required. (1 mark)

A reason for that choice is given. (1 mark)

Response B

They might change it by accident

1/2

*Marks and explanation*

The response is actually the expansion required for a mark. (1 mark)

The response is missing the actual recommended access. (0 mark)

*Additional information*

Remember, the 'Explain' command word requires a statement and an expansion.

Response C

(c) A company stores statistics about its business on a server.

Explain **one** type of access to the statistics file a student on work experience at the company should be given.

(2)

Username and password.

0/2

*Marks and explanation*

Username and password are required for network or machine access, not access to a file. Response lacks type of access and expansion. (0 mark)

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

## Question 5d

**Question 5d assesses students' ability to create an expression to calculate values based on transmitting files across networks.**

<p>(d) Construct an expression to calculate the minimum transmission rate required to transmit a 250 MiB file in exactly one hour.</p> <p>There are 3600 seconds in an hour.</p> <p style="text-align: right;">(3)</p>

More information can be found here:

- Textbook – Topic 4.1 Networks
- Scheme of Work – Block 6, P32

The command word is 'construct'. This command requires the creation of an artefact. Students should use subject-specific annotation, including symbols, rules, and syntax. As this is an arithmetic expression, the normal rules of BIDMAS apply as well.

## Mark scheme

Question Number	Answer	Additional Guidance	Mark
<b>5(d)</b>	<p>Total number of bits:</p> <ul style="list-style-type: none"> <li>• <math>250 \times 1024 \times 1024</math> (1)</li> <li>• <math>\times 8</math> (1)</li> </ul> <p>3600 as denominator (1)</p> <p>Award all marks for the correct answer (582,542bps)</p> <p>Example expression:</p> $(250 \times 1024 \times 1024 \times 8) / 3600$	<p>Ignore conversion to Mbps etc.</p> <p>Award equivalent expressions.</p>	<b>3</b>

Response A

(d) Construct an expression to calculate the minimum transmission rate required to transmit a 250 MiB file in exactly one hour.

There are 3600 seconds in an hour.

250 MiB  
 $250 \times 8 \times \frac{1000000}{1000 \times 1000}$  (3)

---

3600

2/3

*Marks and explanation*

The value of 3600 is in the denominator. (1 mark)

The value of x 8 is in the numerator. (1 mark)

No marks as the conversion units are SI, not IEC. (0 mark)

*Additional information*

These questions will always require responses that recognise the difference in the base 10 and base 2 units.

Response B

(d) Construct an expression to calculate the minimum transmission rate required to transmit a 250 MiB file in exactly one hour.

There are 3600 seconds in an hour.

$\frac{250}{3600} = 0.0694 \text{ MiB/s}$  (3)

1/3

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

*Marks and explanation*

The value of 3600 is in the denominator. (1 mark)

*Additional information*

The actual calculation does not need to be evaluated.

Response C

(d) Construct an expression to calculate the minimum transmission rate required to transmit a 250 MiB file in exactly one hour.

There are 3600 seconds in an hour.

(3)

transmission rate =  $\frac{250 \text{ MiB}}{3600}$

0/3

*Marks and explanation*

The partial equation is upside down. If it were reversed, it would have earned a mark. (0 marks)

*Additional information*

Remember, the normal rules of BIDMAS apply to all arithmetic expressions. As many brackets can be used as required to help make the logic clear.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

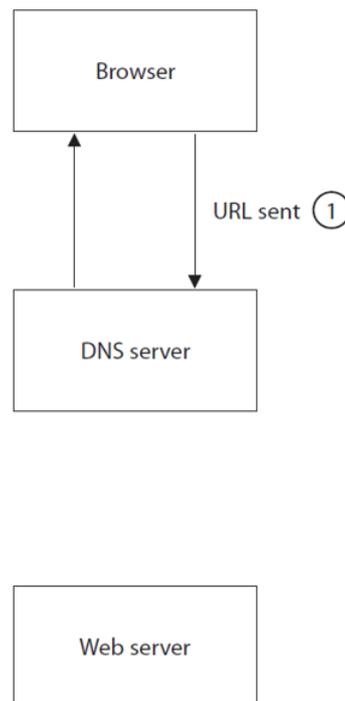
### Question 5e

**Question 5e assesses students' understanding of network transmissions in the context of a client requesting and receiving a web page.**

(e) Complete the diagram to show the processes used to find the IP address of a web server and download a page.

Include labels, arrows and numbers in your diagram to show the order in which processes are carried out.

(6)



More information can be found here:

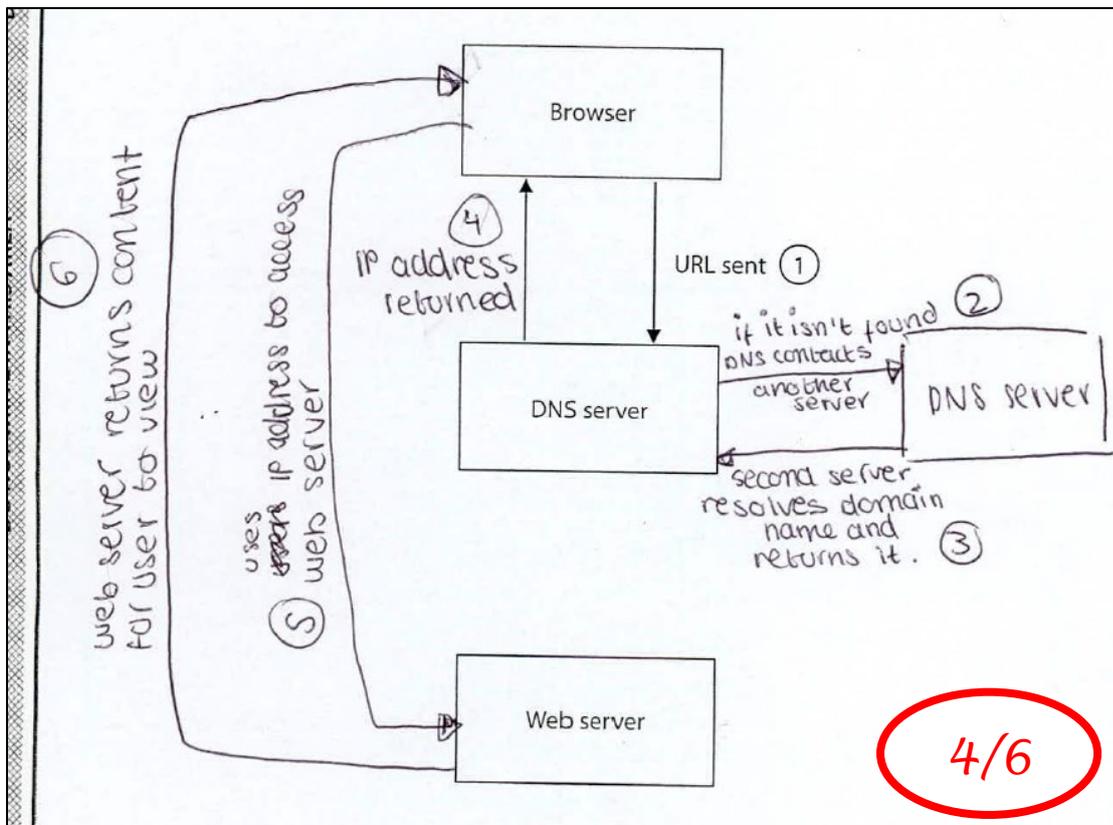
- Textbook – Topic 4.1 Networks
- Scheme of Work – Block 7, P4, P5

The command word is 'complete'. In this case, it is a diagram that is to be completed. The partially complete diagram provides examples of the types of symbols that could be used.

Mark scheme

Question Number	Answer	Additional Guidance	Mark
5(e)	<p>A drawing to include <b>six</b> from:</p> <ul style="list-style-type: none"> <li>Label showing IP address being returned to browser</li> <li>Arrow from Browser to Web server</li> <li>HTTP GET request labelled</li> <li>Arrow from Web server to Browser</li> <li>HTTP response labelled</li> <li>Correct order shown</li> </ul>		6

Response A



Marks and explanation

Label showing IP address returned. (1 mark)

Arrow from browser to web server. (1 mark)

Get request missing. (0 mark)

Arrow from web server to browser (1 mark)

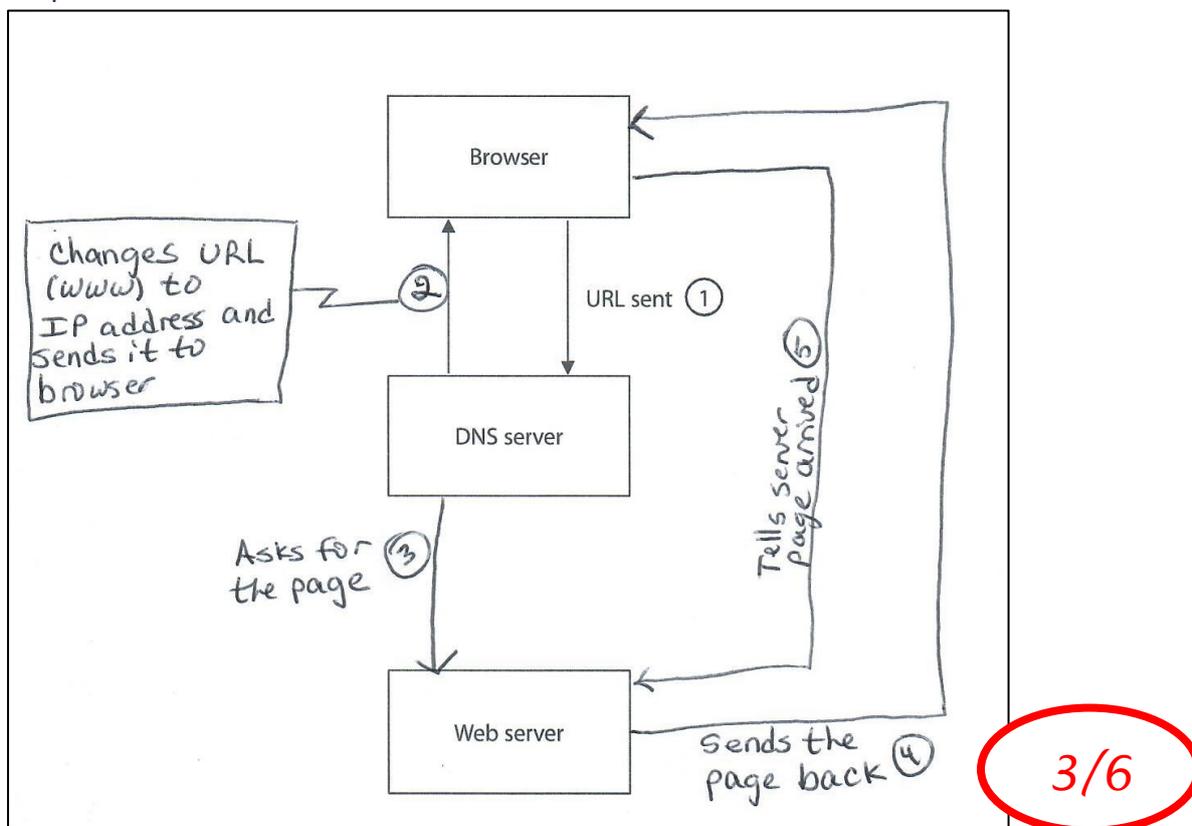
HTTP response missing. (0 mark)

Order is accurate. (1 mark)

*Additional information*

A very good response, with added clarification to ensure that the examiner understands the logic.

**Response B**



*Marks and explanation*

Label showing IP address returned. (1 mark)

Arrow from browser to web server not labelled correctly nor in the correct order. (0 mark)

Get request missing. (0 mark)

Arrow from web server to browser (1 mark)

HTTP response missing. (1 mark)

Order is accurate. (0 mark)

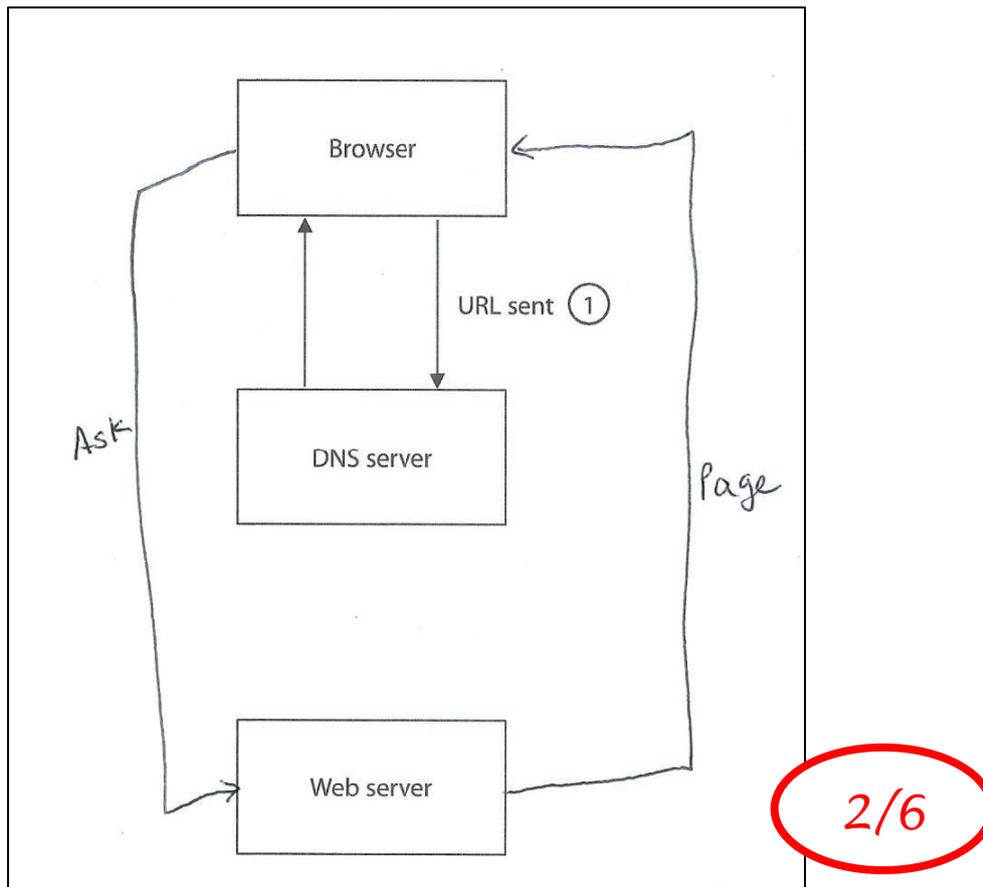
[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Additional information

The response has the idea of dealing with the IP address and its location in the sequence. Further it indicates that a request is made and a page is returned. The components doing those jobs are not accurately identified nor is the sequence in order.

### Response C



### Marks and explanation

The response has the idea that the browser asks for a page (bullet 2). (1 mark).

It also has the idea that a page is returned from the server (bullet 4). (1 mark).

There are no accurate labels nor sequence ordering.

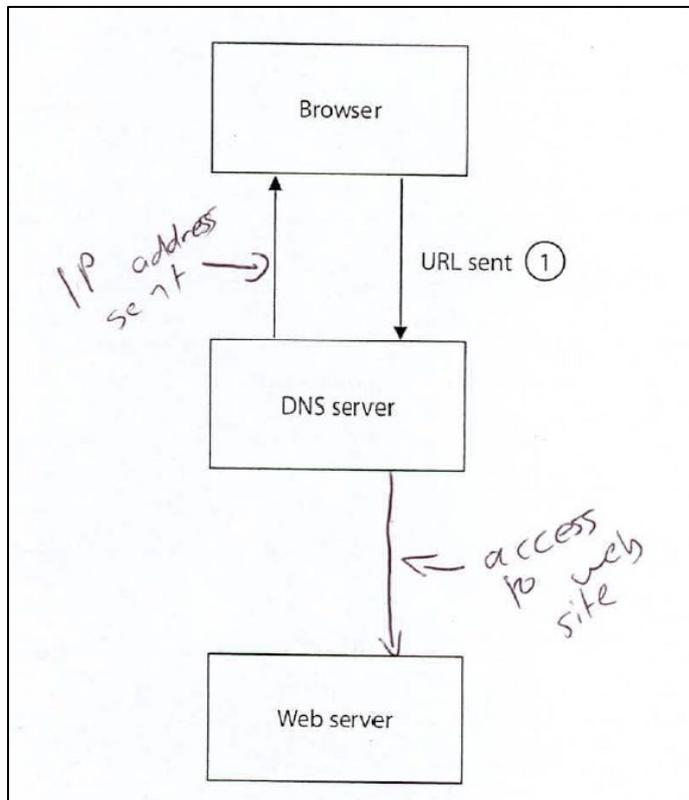
### Additional information

The question asks specifically that the order of operations is included in the diagram.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

### Response D



1/6

#### *Marks and explanation*

There is a mark for the IP being sent back from the DNS. (1 mark)

#### *Additional information*

When diagrams need to be completed, it's a good idea to use the same types of symbols already used on the diagram. The meaning of any additional symbols should be made very clear.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

## Creating a question

This section has been created to aid teachers, both new to teaching computer science and those more experienced, to understand the requirements of practical, onscreen assessment, as featured in Paper 1 of the Pearson Edexcel GCSE (9-1) Computer Science qualification.

This section demonstrates how to create a question, like the ones in Paper 1, that can be used by teachers and students in the classroom.

### Basic rules

The best advice for creating questions is to think about the process in reverse. Don't write a question; write the answer you want to get. This might sound counter intuitive, but it will help focus your mind precisely on what you want to achieve in the question. The more specific the question, the more precise and predictable the response.

The next two slides are going to take you through an example, using these six steps.

1. Choose a specification point or topic
2. Choose a recall or application type question
3. Write a general answer first
4. Choose a command word
5. Refine the answer to fit the command word
6. Write the question last

### Example 1: Representation of sound

- Choose a recall or application type question
- We'll choose a recall question, so the students only have to remember and relate facts.
- Write a general answer first
- Why can analogue sound not be reproduced on a computer?
- Choose a command word
- The choice of command words is quite open. A 'state', 'describe', or 'explain' seems suitable. An 'identify' multiple-choice question would also work.
- Let's choose a command word that requires linking. 'Explain' is a good option.
- Answer
- We should write the answer we want next. It doesn't need to be in any formal way. Just write a general answer. Make sure you use good subject-specific terminology, though.
- Continuous wave, converted based on amplitude, sampled at points, converted to binary, some parts can't be sampled
- Refine the answer to fit the command word
- Read the command taxonomy to understand the requirements of the command word. Look at examples of questions on the specimen papers that use the same command word.
- Refine your answer to fit the format, the number of marks, and the construction of the responses. In the case of 'explain', the response should be two marks, a statement and a linked expansion.

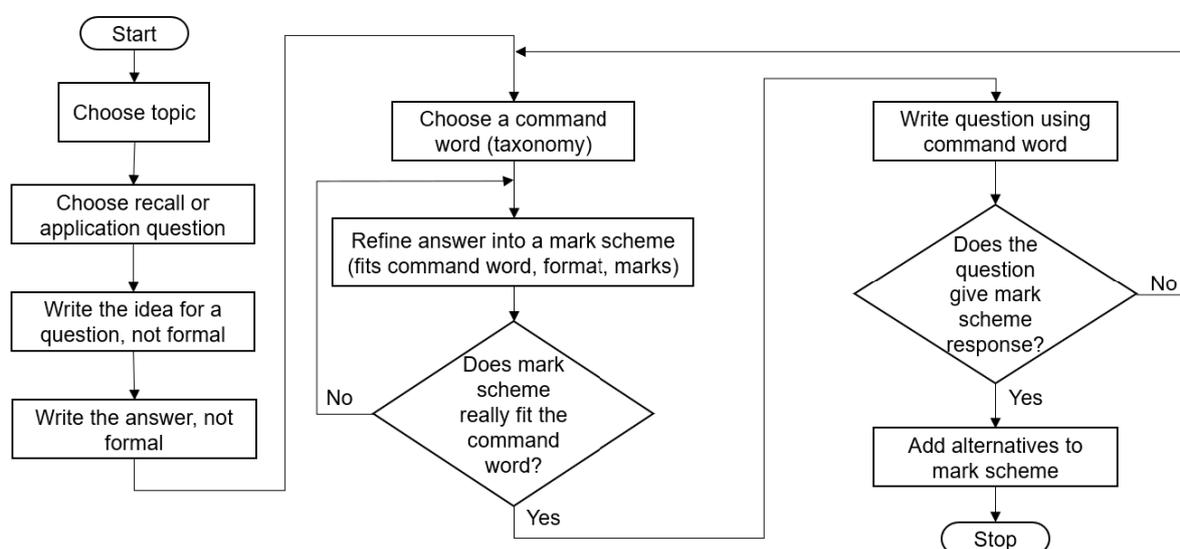
[Contents](#) | [About this booklet](#) | [How to use this booklet](#)

[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

- Only parts of the continuous wave are sampled because readings are taken of the amplitude at set points/intervals.
- The amplitude of some samples may not be represented because there is a limit to how many different values the bit-depth can represent.
- Write the question last. Always start with the command word.
- Explain one reason an analogue sound is never fully reproducible in a digital format.

### Flowchart

This flowchart can help you with the process of creating questions and mark schemes like the ones in Paper 1.



## Exam technique

### Requirements of the command word taxonomy

The 'explain' command word requires a linked response. Use joining words such as because, therefore, and so that to ensure that the second part of the response is provided.

The 'describe' command word may require a description of a process or a list of characteristics. When used with a word that includes 'different to' or 'differs', then a contrast is required. Both areas set out in the question should be included. Use joining words such as on the other hand or whereas to ensure both parts are provided.

In the discussion question, it is important that responses be developed. A bulleted list of facts will earn some marks, but for more, the facts need to be addressed in the context of the question. Applying knowledge to the content of the scenario will achieve the highest marks.

### Format of questions

Pay attention to words in bold or quote marks in a question. The emboldened numbers will help determine how many different response points are required. The emboldened words will show the important contexts required in the response.

[Contents](#) | [About this booklet](#) | [How to use this booklet](#)  
[Q1](#) | [Q2](#) | [Q3](#) | [Q4](#) | [Q5](#)

---

In questions requiring arithmetic, the final result does not need to be calculated. It's not even necessary to reduce an expression. In many cases, the logic of the expression is clearer without reducing. This is especially true when working with units of storage or transmission.

When notation has been used in a question, such as 0s and 1s in a truth table, then use that notation throughout. When students need to choose their own notation, it's recommended to use a conventional notation such as T/F. Clearly indicate both states. A tick or a blank are not conventional, so have no clear meaning in computer science.

### General

Keep all writing inside the grey borders on the paper.

Make writing as clear as possible. This might mean writing a bit larger than normal. It's just fine to print; joined up writing is not required.

If a response is to be ignored, just draw a line through it.

Attempt to answer every question.