



CANDIDATE  
NAME

--

CENTRE  
NUMBER

--	--	--	--	--

CANDIDATE  
NUMBER

--	--	--	--

## 0478/12

October/November 2021

**1 hour 45 minutes**

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- Calculators must **not** be used in this paper.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **12** pages. Any blank pages are indicated.

- 1 (a) Denary is a number system that is used by programmers.

Tick (✓) **one** box to show whether denary is a base-2, base-10 or base-16 number system.

**Tick**  
(✓)

☐

Base-2

☐

Base-10

☐

Base-16

[1]

- (b) Hexadecimal values can be used to represent denary values.

Convert these **four** hexadecimal values into denary values.

05 .....

20 .....

1A .....

AB .....

[4]

Working space

.....

.....

.....

.....

.....

(c) Hexadecimal values can also be converted to binary values.

Tick (✓) **one** box to show the correct 8-bit binary value for each hexadecimal value.

(i) Hexadecimal value 25

Tick  
(✓)

☐

00011001

☐

00100101

☐

10100001

[1]

(ii) Hexadecimal value 1B

Tick  
(✓)

☐

00011011

☐

10110001

☐

00011010

[1]

(d) (i) Give **one** way that hexadecimal is used in website development.

..... [1]

(ii) Give **one** way that hexadecimal is used in low-level programming.

..... [1]

2 A train company wants to install a self-service ticket machine system for its train stations. When the customer has purchased their tickets, the machine will provide a paper ticket.

(a) **One** output device that is used in the ticket machine is a display screen.

Identify **one** other output device that is used in the ticket machine system.

..... [1]

(b) The train company does **not** want users to use a keyboard or a mouse to enter their data, when buying a ticket. The company is worried that they may be stolen or get too dirty.

Identify **one** other input device that would be suitable for use in the ticket machine system, to allow users to enter their data.

..... [1]

3 (a) Six statements are given about methods of data transmission.

Tick (✓) to show if each statement applies to serial simplex, parallel simplex, parallel half-duplex or serial duplex data transmission. Some statements may apply to more than **one** data transmission method.

Statement	Serial simplex (✓)	Parallel simplex (✓)	Parallel half-duplex (✓)	Serial duplex (✓)
bits are transmitted along a single wire				
data is transmitted in both directions				
it is only suitable for distances less than 5 metres				
bits from the same byte are transmitted one after the other				
data may <b>not</b> arrive in the correct sequence				
data is transmitted in both directions, but only <b>one</b> direction at a time				

[6]

(b) A Universal Serial Bus (USB) connection can be used to transmit data from a mobile device to a computer.

Give **three** benefits of using a USB connection for this purpose.

Benefit 1 .....

.....

Benefit 2 .....

.....

Benefit 3 .....

.....

[3]

- 4 The paragraph explains the operation of different touch screen technologies.

Complete the paragraph using the list of terms. **Not** all terms in the list need to be used.

- capacitive
- change
- circuit
- conductive
- coordinates
- grid
- heat
- infra-red
- insulating
- light
- manufacture
- pressure
- resistive

In ..... touch screen technology, an electrostatic field is present on the surface of the touch screen. The ..... properties of a user cause a ..... in the field. The ..... of the user's touch can be calculated.

In ..... touch screen technology, a user pushes the top layer of the screen and makes it connect with the bottom layer to complete a .....

This type of touch screen is cheaper to .....

[7]

- 5 Sammi works for a finance company and has a laptop that he uses for his work. He has confidential data about his customers stored on his laptop.

Sammi does **not** connect the laptop to any networks.

- (a) Sammi is concerned about his customers' confidential data being viewed by other people in his office.

**One** method he uses to prevent others viewing the data is encryption.

Identify **three** other methods Sammi could use to prevent his customers' confidential data being viewed.

- 1 .....
- 2 .....
- 3 ..... [3]

- (b) Sammi creates videos for the finance company website that give customers advice about their finances.

He uses lossy compression to reduce the file size of the videos for the website.

- (i) Give **three** ways that lossy compression can reduce the file size of the videos.

- 1 .....
- .....
- 2 .....
- .....
- 3 .....
- ..... [3]

- (ii) Give **one** drawback of using lossy compression to reduce the file size of the videos.

- .....
- ..... [1]

(c) Sammi could have used lossless compression to compress the videos for the website.

- (i) Give **one** reason why he would use lossless compression, rather than lossy compression, for the videos.

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

- (ii) Give **two** disadvantages of Sammi using lossless compression, rather than lossy compression, for the videos.

Disadvantage 1 .....  
 .....  
 Disadvantage 2 .....  
 ..... [2]

6 A programmer can use translators, such as an interpreter and a compiler, when developing a computer program.

- (a) Give **one** similarity between a compiler and an interpreter.

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

- (b) Describe **two** differences between a compiler and an interpreter.

Difference 1 .....  
 .....  
 .....  
 .....  
 Difference 2 .....  
 .....  
 .....  
 ..... [4]

- (c) Identify **one** other type of translator.

..... [1]

**7 Five statements are given about devices.**

Tick (✓) to show if each statement applies to a 3D scanner, barcode reader or a Quick Response (QR) code reader. Some statements may apply to more than **one** type of device.

Statement	3D scanner (✓)	Barcode reader (✓)	QR code reader (✓)
uses position and alignment markers for orientation when scanning			
scans the shape and appearance of an object			
uses reflected light from a laser to convert a black-and-white pattern into binary			
can often be built into an Electronic Point Of Sale (EPOS) terminal, for example, a supermarket checkout			
it is an example of an input device			

[5]

**8 An electronic game has **three** square mats that are coloured red, green and blue.**

The player will see a colour displayed on a screen and has 1 second to hit the mat that matches the colour. If the player hits the correct mat, within 1 second, a counter is incremented. When a player hits an incorrect mat, the game ends.

The game uses sensors and a microprocessor to determine if the player hits the correct mat within 1 second.

Explain how the game uses sensors and a microprocessor to count the number of times a player hits a correct mat within 1 second.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



.....

.....

..... [7]

- 9 Padma opens an application on her computer.

An interrupt is generated to inform the Central Processing Unit (CPU) that the application has been opened.

- (a) Give **three** other examples of when an interrupt signal could be generated.

1 .....

2 .....

3 ..... [3]

- (b) State what would happen if interrupt signals were **not** used in a computer.

.....

..... [1]

- 10 Jermain uses the Secure Socket Layer (SSL) protocol for secure transmission when sending data using the internet.

- (a) Explain how the SSL protocol secures the data for transmission.

.....

.....

.....

..... [2]

- (b) Identify an alternative protocol that could be used for secure transmission of data using the internet.

..... [1]

- (c) Give **two** ways that a user can identify if a website uses secure data transmission.

1 .....

.....

2 .....

..... [2]

11 Consider the following logic statement:

$$X = (((A \text{ AND } B) \text{ OR } (\text{NOT } (B \text{ OR } C))) \text{ NAND } C)$$

(a) Draw a logic circuit to represent the given logic statement.

Do **not** attempt to simplify the logic statement. All logic gates must have a maximum of **two** inputs.



[5]

(b) Complete the truth table for the given logic statement.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(c) Identify **two** logic gates that are **not** included in the given logic statement.

Logic gate 1 .....

Logic gate 2 .....

[2]

**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.



# Cambridge IGCSE™

---

COMPUTER SCIENCE

0478/12

Paper 1

October/November 2021

MARK SCHEME

Maximum Mark: 75

---

**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

---

This document consists of **12** printed pages.

**PUBLISHED****Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)	– Base-10	<b>1</b>
1(b)	<ul style="list-style-type: none"> <li>– 5</li> <li>– 32</li> <li>– 26</li> <li>– 171</li> </ul>	<b>4</b>
1(c)(i)	– 00100101	<b>1</b>
1(c)(ii)	– 00011011	<b>1</b>
1(d)(i)	Any <b>one</b> from: <ul style="list-style-type: none"> <li>– To represent <b>HTML colour</b> codes</li> <li>– In error messages</li> </ul>	<b>1</b>
1(d)(ii)	Any <b>one</b> from: <ul style="list-style-type: none"> <li>– Assembly code/language</li> <li>– Memory address locations</li> <li>– In error messages</li> <li>– Memory dump</li> </ul>	<b>1</b>



Question	Answer	Marks
2(a)	Any <b>one</b> from: – Printer – Speaker – Light/LED – Actuator	<b>1</b>
2(b)	Any <b>one</b> from: – Touchscreen – Trackpad / touchpad – Microphone – QR code reader – Barcode reader – Magnetic strip reader – RFID reader	<b>1</b>

Question	Answer	Marks																																			
3(a)	<p><b>One</b> mark per each correct row.</p> <table><tr><th>Statement</th><th>Serial simplex (✓)</th><th>Parallel simplex (✓)</th><th>Parallel half-duplex (✓)</th><th>Serial duplex (✓)</th></tr><tr><td>bits are transmitted along a single wire</td><td>✓</td><td></td><td></td><td>✓</td></tr><tr><td>data is transmitted in both directions</td><td></td><td></td><td>✓</td><td>✓</td></tr><tr><td>it is only suitable for distances less than 5 metres</td><td></td><td>✓</td><td>✓</td><td></td></tr><tr><td>Bits from the same byte are transmitted one after the other</td><td>✓</td><td></td><td></td><td>✓</td></tr><tr><td>data may <b>not</b> arrive in the correct sequence</td><td></td><td>✓</td><td>✓</td><td></td></tr><tr><td>data is transmitted in both directions, but only <b>one</b> direction at a time</td><td></td><td></td><td>✓</td><td></td></tr></table>	Statement	Serial simplex (✓)	Parallel simplex (✓)	Parallel half-duplex (✓)	Serial duplex (✓)	bits are transmitted along a single wire	✓			✓	data is transmitted in both directions			✓	✓	it is only suitable for distances less than 5 metres		✓	✓		Bits from the same byte are transmitted one after the other	✓			✓	data may <b>not</b> arrive in the correct sequence		✓	✓		data is transmitted in both directions, but only <b>one</b> direction at a time			✓		6
Statement	Serial simplex (✓)	Parallel simplex (✓)	Parallel half-duplex (✓)	Serial duplex (✓)																																	
bits are transmitted along a single wire	✓			✓																																	
data is transmitted in both directions			✓	✓																																	
it is only suitable for distances less than 5 metres		✓	✓																																		
Bits from the same byte are transmitted one after the other	✓			✓																																	
data may <b>not</b> arrive in the correct sequence		✓	✓																																		
data is transmitted in both directions, but only <b>one</b> direction at a time			✓																																		
3(b)	<p>Any <b>three</b> from:</p> <ul style="list-style-type: none"><li>– Can charge/power the mobile device (at the same time)</li><li>– (Uses serial transmission so) data less likely to be skewed / corrupted</li><li>– Universal / industry standard / connection</li><li>– Cable can only be plugged in one way // Cannot be inserted incorrectly</li><li>– Fast transmission speed</li><li>– Backward compatible</li><li>– Supports different transmission speeds</li><li>– <b>Automatically</b> detects device // <b>Automatically</b> downloads drivers</li></ul>	3																																			

Question	Answer	Marks
4	<p><b>One</b> mark per each correct term in the correct order.</p> <ul style="list-style-type: none"> <li>– Capacitive</li> <li>– Conductive // Capacitive</li> <li>– Change</li> <li>– Coordinates</li> <li>– Resistive</li> <li>– Circuit</li> <li>– Manufacture</li> </ul>	<b>7</b>

Question	Answer	Marks
5(a)	<p>Any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>– Password</li> <li>– Add a biometric device to the laptop // set biometric password</li> <li>– Use two-step verification // Use two factor authentication</li> <li>– Physically lock the laptop away in a secure cupboard // Taking laptop with him at all times</li> </ul>	<b>3</b>
5(b)(i)	<p>Any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>– A compression algorithm is used</li> <li>– The resolution could be reduced</li> <li>– <b>Colour</b> depth could be reduced // bits per pixel reduced</li> <li>– <b>Sounds</b> not heard by human ear could be removed // Perceptual music shaping can be used</li> <li>– Repeating frames could be removed</li> </ul>	<b>3</b>
5(b)(ii)	<p>Any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>– Quality may be reduced</li> <li>– Data is lost // <b>original</b> file cannot be reconstructed</li> </ul>	<b>1</b>
5(c)(i)	<p>Any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>– Maintains quality // quality better than lossy</li> <li>– Original file is retained // Data is not <b>permanently</b> lost</li> <li>– A significant reduction in file size is not required</li> </ul>	<b>1</b>

Question	Answer	Marks
5(c)(ii)	Any <b>two</b> from: <ul style="list-style-type: none"> <li>– Takes more time to transmit file // Takes more time to upload <b>to web server</b> // Takes more time to download <b>to customer</b> // Web page will load slower</li> <li>– Takes up more <b>storage</b> space</li> <li>– Data usage would be increased</li> <li>– Uses more bandwidth</li> </ul>	<b>2</b>

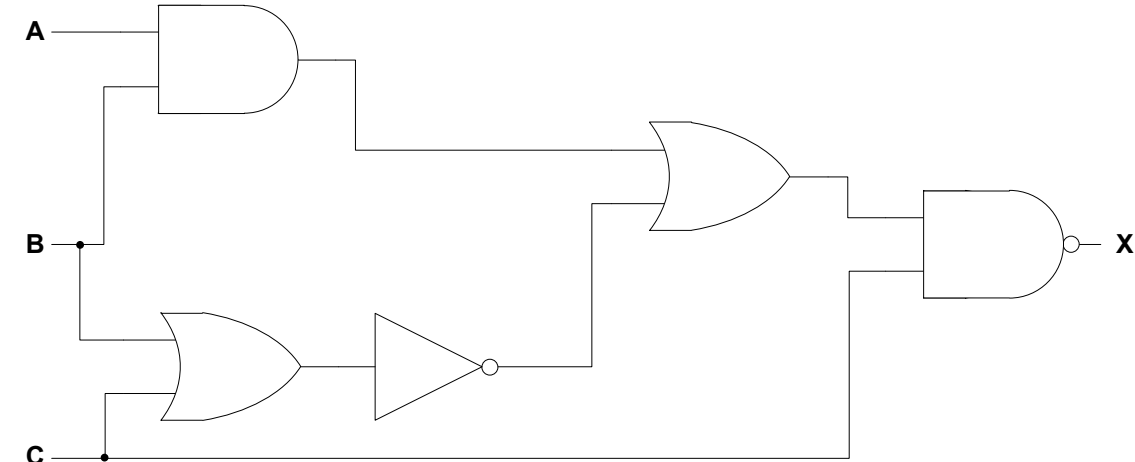
Question	Answer	Marks
6(a)	Any <b>one</b> from: <ul style="list-style-type: none"> <li>– They both translate <b>high-level language</b> into <b>machine code</b> / <b>low-level language</b></li> <li>– They both check for errors</li> <li>– They both report errors</li> </ul>	<b>1</b>
6(b)	<b>Four</b> from (Max 2 per translator): <ul style="list-style-type: none"> <li>– An interpreter translates and executes the code line by line</li> <li>– ... whereas a compiler translates and executes the whole code all in one go</li> <li>– An interpreter stops translating and reports an error as it finds one</li> <li>– ... whereas a compiler produces an error report at the end of translation</li> <li>– An interpreter does not produce an executable file</li> <li>– ... but a compiler does produce an executable file</li> <li>– An interpreter will execute the code until it finds an error</li> <li>– ... whereas a compiler will not execute any code if there are errors present</li> <li>– An interpreter allows correction of errors in real-time</li> <li>– ... whereas a compiler needs to retranslate the code each time after errors are found and corrected</li> </ul>	<b>4</b>
6(c)	– Assembler	<b>1</b>

Question	Answer				Marks
7	<b>One</b> mark per each correct row.				5
	Statement	3D scanner (✓)	Barcode reader (✓)	QR code reader (✓)	
	uses position and alignment markers for orientation when scanning			✓	
	scans the shape and appearance of an object	✓			
	uses reflected light from a laser to convert a black-and-white pattern into binary		✓	(✓)	
	can often be built into an Electronic Point Of Sale (EPOS) terminal, for example, a supermarket checkout		✓	(✓)	
	it is an example of an input device	✓	✓	✓	

Question	Answer	Marks
8	<p><b>Seven</b> from:</p> <ul style="list-style-type: none"> <li>– Timer is started</li> <li>– Pressure sensor (within each mat)</li> <li>– Sensor sends data to microprocessor</li> <li>– Analogue data is converted to digital (using ADC)</li> <li>– Microprocessor compares data to stored value(s)</li> <li>– If data matches / in/out range <b>microprocessor</b> stops timer</li> <li>– If data matches / in/out range <b>microprocessor</b> checks if <b>data has come</b> from <b>correct</b> colour mat <b>sensor</b></li> <li>– If data matches / in/out range <b>microprocessor</b> checks to see if <b>timer</b> is stopped at less than 1 second</li> <li>– If data matches / in/out range <b>microprocessor</b> increments counter if timer is less than 1 second and colour/mat is correct</li> <li>– If correct colour/mat is hit, timer is reset and the whole process is repeated</li> <li>– If <b>data has not come</b> from the <b>correct</b> colour mat <b>sensor</b> the game ends</li> </ul>	7

Question	Answer	Marks
9(a)	<p>Any <b>three</b> from: e.g.</p> <ul style="list-style-type: none"> <li>– A suitable description of any error that might occur</li> <li>– A peripheral is connected/disconnected</li> <li>– A key on a keyboard is pressed</li> <li>– A mouse button click</li> <li>– A phone/video call is received</li> <li>– A buffer requires more data</li> <li>– A printer has a paper jam</li> <li>– A printer runs out of paper</li> <li>– A printer runs out of ink</li> <li>– When switching from one application to another</li> </ul> <p>NOTE: If three suitable different errors are described, this can be awarded three marks.</p>	<b>3</b>
9(b)	<p>Any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>– The computer would only start a new task when it had finished processing the current task // by example</li> <li>– Computer will not be able to multitask</li> <li>– Errors may not be dealt with</li> <li>– Computer would become impossible to use</li> </ul>	<b>1</b>

Question	Answer	Marks
10(a)	<ul style="list-style-type: none"> <li>– Enables an encrypted link (between the browser and the web server) // It encrypts the data</li> <li>– ... based on the authentication of an (SSL) certificate // and will only send it if the certificate is authentic</li> </ul>	<b>2</b>
10(b)	<ul style="list-style-type: none"> <li>– Transport Layer Security // TLS</li> </ul>	<b>1</b>
10(c)	<p>Any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>– URL begins with HTTPS</li> <li>– Padlock symbol is locked</li> <li>– Check the certificate is valid</li> </ul>	<b>2</b>

Question	Answer	Marks
11(a)	<p data-bbox="338 217 1088 248"><b>One</b> mark per each correct logic gate with correct input(s)</p> 	<b>5</b>

Question	Answer	Marks																																													
11(b)	<div>4 marks for 8 correct outputs 3 marks for 6/7 correct outputs 2 marks for 4/5 correct outputs 1 mark for 2/3 correct outputs</div> <table><tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr><tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td><td></td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td></td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td></td><td>0</td></tr></table>	A	B	C	Working space	X	0	0	0		1	0	0	1		1	0	1	0		1	0	1	1		1	1	0	0		1	1	0	1		1	1	1	0		1	1	1	1		0	4
A	B	C	Working space	X																																											
0	0	0		1																																											
0	0	1		1																																											
0	1	0		1																																											
0	1	1		1																																											
1	0	0		1																																											
1	0	1		1																																											
1	1	0		1																																											
1	1	1		0																																											
11(c)	<div>– NOR – XOR / EOR</div>	2																																													