Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

1428246498

COMPUTER SCIENCE **0478/12**

Paper 1 Theory **February/March 2022**

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- 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.

INFORMATION

- 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 computer stores data in binary form. Binary numbers can be represented as hexadecimal and denary numbers.

(a) Convert the 8-bit binary number 01010101 to denary.

..... [1]

Working space

.....

.....

.....

(b) Convert the binary number 11000000 to hexadecimal.

..... [1]

Working space

.....

.....

.....

(c) Convert the hexadecimal number 1A to denary.

..... [1]

Working space

.....

.....

.....

(d) Binary numbers can be stored as bytes.

State how many bits are in **two** bytes.

..... [1]

2 Nadia creates a digital image for a school project.

(a) Give **one** example of an image format.

..... [1]

(b) Describe how a digital image file is stored by a computer.

.....

.....

.....

.....

.....

..... [3]

(c) Nadia compresses the digital image file before emailing it to a friend.

(i) State what is meant by data compression.

.....

..... [1]

(ii) Explain why Nadia compresses the digital image file before emailing it.

.....

.....

.....

..... [2]

(iii) Nadia's email service uses parity bits as a method of error detection during the transmission of data.

Describe how the parity bits are used to detect errors.

.....

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..... [5]

(iv) Identify and describe **one** other method of error detection used during the transmission of data.

Method .....

Description .....

.....

.....

.....

.....

.....

[4]

3 **(a)** Tick (✓) to show which logic gates will give an output of 1 for the given inputs A and B.

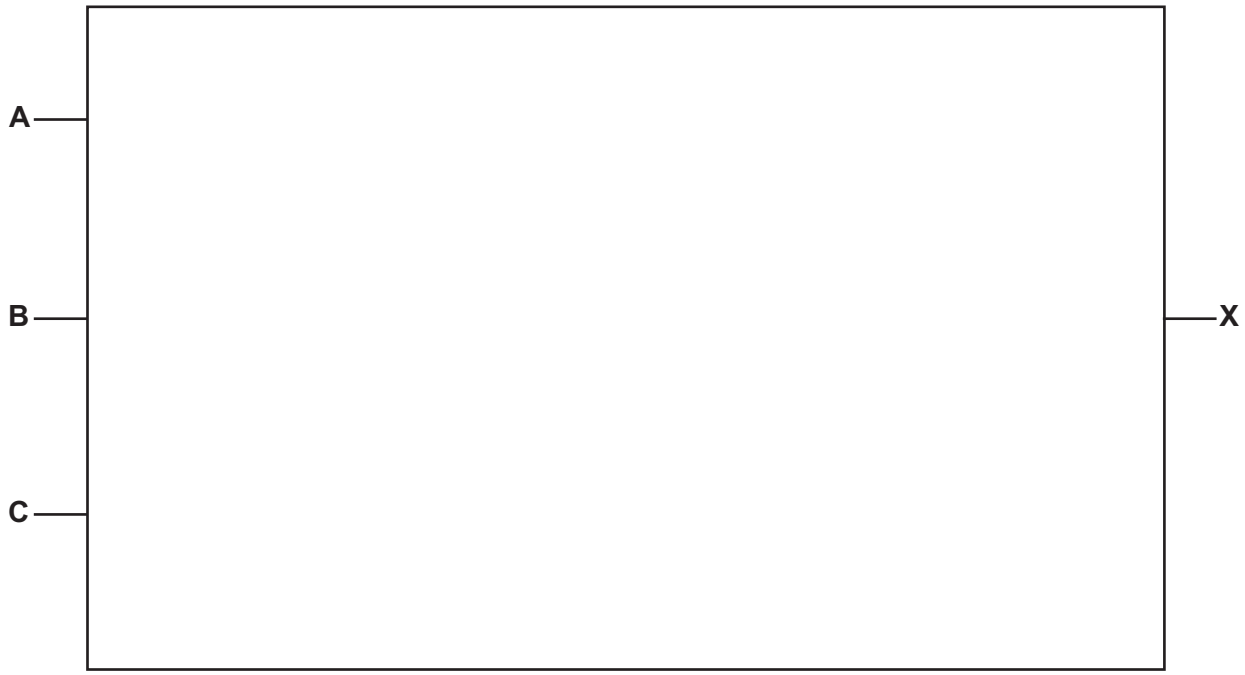
Inputs	AND	OR	NAND	NOR	XOR
A = 1 B = 1					
A = 0 B = 0					
A = 1 B = 0					

[3]

(b) Draw the logic circuit for the given logic statement:

X = (**A** XOR **B**) AND (**B** OR NOT **C**)

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



[4]

4 Pradeep uses his personal computer to complete work at home.

(a) Pradeep uses a mouse and a keyboard to control the computer.

(i) Complete the descriptions of the principles of operation of a mouse and a keyboard using the most appropriate terms from the list. **Not** all terms in the list need to be used.

- absorbs
- ball
- biometric
- circuit
- colour
- digital
- direction
- Light-Emitting Diode (LED)
- Liquid Crystal Display (LCD)
- reflects
- speed
- switch
- transparency

An optical mouse shines a red light from a ..... underneath the mouse. The light ..... back from a surface through a lens in the mouse and is converted to a value. This value is transmitted to the computer. The computer then determines the ..... and ..... of the movement.

When the user presses a key on a keyboard, the key pushes the ..... on the circuit board. This completes a ..... . Signals are sent to the computer. The computer uses the data to calculate which key was pressed.

[6]

(ii) Identify **two** other input devices Pradeep could use with his personal computer.

Input device 1 .....

Input device 2 .....

[2]

(b) Pradeep uses a projector attached to the ceiling at his home to watch high-definition (HD) films.

The projector has broken. He wants to buy a replacement. He needs to choose between an LCD projector and a Digital Light Projector (DLP).

Explain why an LCD projector would be more appropriate for Pradeep.

.....

.....

.....

.....

.....

..... [3]

(c) Pradeep stores his collection of films and his work files on his personal computer.

Pradeep wants to save a copy of all his films and files onto a single storage device.

Identify and justify an appropriate storage device to store the copies.

Storage device .....

Justification .....

.....

.....

.....

.....

.....

[4]

5 A holiday company has a website where customers can create accounts and can book and pay for holidays.

(a) The website is written in Hypertext Markup Language (HTML).

Give **two** examples of HTML structure and **two** examples of HTML presentation.

Structure 1 .....

Structure 2 .....

Presentation 1 .....

Presentation 2 .....

[4]

(b) The website is stored on a web server. Customers use their own computers to access the website.

Uniform Resource Locator (URL), Internet Protocol (IP) and Media Access Control (MAC) are three types of address used by computers when accessing the Internet.

Give **two** features of each type of address in the table.

Type of address	Features
URL	....
IP	....
MAC	....

[6]

(c) The company is concerned about threats to its web server.

Complete the table by identifying:

- **two** potential threats to its web server
- the impact each threat could have on the company
- software the company can use to help to limit each threat.

Each impact must be different.

Threat	Impact on company	Software
....	....	....
....	....	....

[6]

6 A business uses a closed-circuit television (CCTV) system that starts recording when motion is detected. It stops recording after two minutes if no further motion is detected. The system uses a motion sensor and a microprocessor.

Describe how the motion sensor and microprocessor work together to control the CCTV system.

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..... [7]

7 Ishani is a software developer who is creating a new computer game.

(a) Ishani uses an interpreter and a compiler at different stages of the game creation.

(i) Explain when it is most appropriate for Ishani to use an interpreter.

.....

.....

.....

.....

.....

..... [3]

(ii) Explain when it is most appropriate for Ishani to use a compiler.

.....

.....

.....

.....

.....

..... [3]

(b) Ishani has to decide between releasing her game as freeware or free software.

Describe freeware and free software.

Freeware .....

.....

.....

.....

Free software .....

.....

.....

.....

[4]

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COMPUTER SCIENCE **0478/12**

Paper 1 **February/March 2022**

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 February/March 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **13** 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:

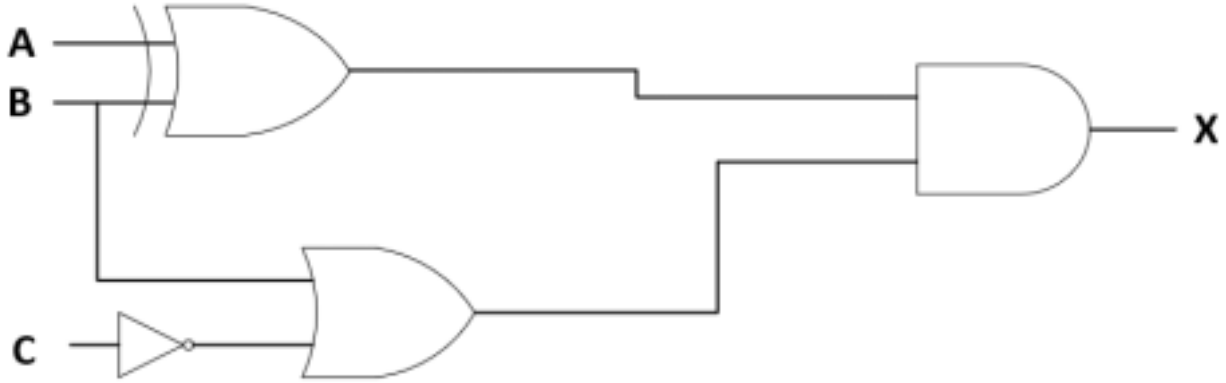
Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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)	85	**1**
1(b)	C0	**1**
1(c)	26	**1**
1(d)	16	**1**

Question	Answer	Marks
2(a)	e.g. JPEG	**1**
2(b)	Any three from: • Image is made of pixels • Each pixel stores **one** colour • Image has a set number of pixels wide by pixels high • Each **colour** has a **unique** binary value // Each **colour** has a **unique** colour code • The colour/binary value of each pixel is stored in **sequence** • File contains metadata to identify how the file should be displayed • … metadata can be the colour depth / resolution	**3**
2(c)(i)	Reducing the **file size**	**1**
2(c)(ii)	Any two from: • reduces the **storage/memory** space taken on email server // reduces the storage space taken on her friend's computer when downloaded • sending/receiving email accounts may have restricted file size for attachments • reduces the time taken to transmit/upload/download to destination • reduces amount of bandwidth needed to transmit/download • file will mean less data usage is taken (for mobile clients)	**2**

Question	Answer	Marks
2(c)(iii)	Any five from: • Parity can be set to **odd** or **even** • Sender and receiver agree on parity to use • Data/email/image is split into bytes // blocks of 7 bytes • **Sender** counts the number of **1s/0s** in each group/byte • Each group/byte is assigned a parity bit to match the parity/odd/even • **Receiving** device/server re**counts** the number of 1s/0s in each group/byte • … and compares to parity used/odd/even **and** if it does not match the parity, an error is reported/identified • (in block check) the location of the error(s) can be identified/estimated at the intersection	**5**
2(c)(iv)	1 mark for identification Any three for corresponding description: • Checksum • Value is calculated from the data … • …using an algorithm // by example • Value is transmitted with the data • Value recalculated by receiver (using same algorithm) … • …if checksum values are different there is an error // reverse • Automatic Repeat request/reQuery (ARQ) • Uses acknowledgement and timeout • Sender starts a timer when data is transmitted • Receiver uses an error checking method to check whether the data has been received accurately • If no error detected a positive acknowledgement is returned to sender • If error detected negative acknowledgement is returned to sender • If sender gets no acknowledgement within the set time it resends the data	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>1 mark per row
<table>
<tr><th>Inputs</th><th>AND</th><th>OR</th><th>NAND</th><th>NOR</th><th>XOR</th></tr>
<tr><td>A = 1
B = 1</td><td>✓</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>A = 0
B = 0</td><td></td><td></td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>A = 1
B = 0</td><td></td><td>✓</td><td>✓</td><td></td><td>✓</td></tr>
</table></td><td>3</td></tr>
<tr><td>3(b)</td><td>1 mark per gate
 

A XOR B
NOT C
(NOT C) OR B
AND
</td><td>4</td></tr>
</table>

Question	Answer	Marks
4(a)(i)	1 mark for each completed statement An optical mouse shines a red light from a **Light-Emitting Diode//LED** underneath the mouse. The light **reflects** back from a surface through a lens in the mouse and is converted to a value. This value is transmitted to the computer. The computer then determines the **direction** and **speed** of the movement. When the user presses a key on a keyboard, the key pushes the **switch** on the circuit board. This completes a **circuit**. Signals are sent to the computer that uses the data to calculate which key was pressed.	**6**
4(a)(ii)	1 mark each e.g. • touchscreen • touchpad • scanner • microphone	**2**
4(b)	Any three from: • More visible pixels // higher resolution • Higher colour **contrast** (in ambient lighting) // more vivid colours • Colours are (often) more accurate • Image (usually) appears brighter (with same wattage) • Will be stationary so does not need the portability of DLP • Does not need the compactness of DLP • Cost of purchase (usually) less • Run quieter • Any surface can be used as a display • Uses less power • Produces less heat • Does not give the rainbow effect DLP often gives • Longer lasting lamps	**3**

Question	Answer	Marks
4(c)	1 mark for naming appropriate device • hard disk / HDD / magnetic • solid state drive / SSD / USB memory stick / flash drive 1 mark each for matching justification to max 3. e.g. HDD • Large capacity storage • …for videos/films that have large file sizes / require large storage space • Longevity // Can be read from/written to large number of times • … the copies will be accessible for a long time // device will not break if accessed regularly • …may require large number of read/write to access fields • Relatively cheap per GB // cheaper than SSD per GB … • … there is a large capacity required therefore overall may cost less than other devices • Device will not be moved regularly so no need for portability/durability SSD • Large capacity storage • …for videos/films that have large file sizes / require large storage space • No moving parts • …can be carried/moved to other locations with limited risk of damage • Fast access speed • … videos are large files that will be stored/accessed in less time • Cost per GB is not significant (in comparison) • …there is a large capacity required therefore overall cost will not be significantly more than others • Used as a copy of files to may not be accessed regularly • … the limited number of read/write times/longevity is inconsequential • Uses less power // runs cooler • No latency // does not take time to start-up	**4**

Question	Answer	Marks
5(a)	1 mark for each example, allow description or tags Structure e.g. • head • body • table • heading • subheading • paragraph • object position on the page // alignment • margins • borders (position/size) • padding Presentation e.g. • colour • font size • font style • border (style)	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(b)</td><td>1 mark for each bullet to max 2 for each
<table>
<tr><th>Type of address</th><th>Features</th></tr>
<tr><td>URL</td><td>• protocol
• domain name
• top level domain
• file/folder name/address/directory/path
• made up of letters, numbers and symbols</td></tr>
<tr><td>IP</td><td>IPv4:
• 4 groups of numbers // 12 numbers
• separated by full stops (.)
• 0-255 in each group
• 4 bytes long // 32 bits
• Represented in denary

IPv6:
• 8 groups of numbers // 32 numbers
• separated by colons (:)
• 0-FFFF in each group
• 16 bytes long // 128 bits
• Consecutive groups of 0000 can be replaced with ::
• Represented in hexadecimal</td></tr>
<tr><td>MAC</td><td>• First part is manufacturer ID
• Second part is serial number
• Each part has 3 pairs of numbers // Each part has 6 numbers // 6 pairs of 2-digits // consists of 12 numbers
• …between 00 and FF
• ..separated by :
• Each part is 3 bytes // Is 6 bytes long // Is 48 bits long
• Represented using hexadecimal</td></tr>
</table></td><td>6</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(c)</td><td>1 mark for threat. 1 for impact. 1 for software.

Do not award identical impacts twice but read whole answer and award if additional impact given.
Allow the same software twice.
e.g.
<table>
<tr><th>Threat</th><th>Impact on company</th><th>Software</th></tr>
<tr><td>Denial of service</td><td>• Users cannot access the website
• Loss of sales (of holidays)
• Loss of reputation</td><td>Proxy/firewall</td></tr>
<tr><td>Virus/malware</td><td>• Data on the server may be deleted/changed
• Website may be deleted/changed
• Server may be filled with data and crash</td><td>Anti-virus</td></tr>
<tr><td>Unauthorised access // hacker</td><td>• Data could be deleted/stolen/changed</td><td>Proxy/Firewall</td></tr>
</table></td><td>6</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6</td><td>Any seven from:
• (Motion) sensor sends signals to microprocessor
• analogue signal is converted to digital
• microprocessor compares signal to stored value …
• …if it does not meet / meets the stored value (and if camera is not recording) the microprocessor sends signal (to camera) to start recording
• … if it does not meet / meets the stored value the microprocessor starts/resets the timer
• When the timer reaches 2 minutes the microprocessor sends signal (to camera) to stop recording
• Whole process is repeated continually/until turned off</td><td>7</td></tr>
</table>

Question	Answer	Marks
7(a)(i)	1 mark for when e.g. • Development // when writing the program // when debugging 1 mark for explanation to max 2 from: e.g. • … easier to debug • …stops when an error is detected • …reports one error at a time • …can correct errors in run-time // correct the line and then continue running from that point • …can test one section without the rest of the code being completed	**3**
7(a)(ii)	1 mark for when e.g. • After completion // For distribution // For final/repeated testing 1 mark each to max 2 from: e.g. After completion • It creates an executable file • …than can be distributed without source code • …so that other people cannot edit/view the code • …so end users do not need translator software // so end users do not need to compile/interpret each time • …so it is machine/platform independent (usually) In final testing • It creates an executable file • …do not need to retranslate for each test sequence • …can test repeatedly with different data faster	**3**

Question	Answer	Marks
7(b)	Any four from, max 2 from each: Freeware: • There is no cost to the user // free trial • No source code provided • …cannot be modified • Can be redistributed (in same state) • Is subject to copyright Free software: • User has access to the source code • Can be modified (without restriction) • Can be redistributed (without restriction) • Can have a cost associated **but** does not have to • Is subject to copyright	**4**