Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE **0478/12**

Paper 1 Theory **February/March 2020**

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. Blank pages are indicated.

[Turn over

1 The Von Neumann model for a computer system uses components, such as registers and buses, in the fetch-execute cycle.

   (a) Draw a line to connect each component to its correct description.

Component	Description
Control Bus	Increments to point to the address of the next instruction to be fetched
Program Counter (PC)	Holds the result of a calculation. It is located within the Arithmetic Logic Unit (ALU)
Memory Data Register (MDR)	Carries signals to synchronise the fetch-execute cycle
Accumulator (ACC)	Temporary storage between the Central Processing Unit (CPU) and primary memory

[3]

   (b) State **two** buses, other than the control bus, used in the Von Neumann model for a computer system.

   1 ....

   2 ....

[2]

2 A school network is used to transmit and store data about students.

   (a) Different types and methods of transmission can be used to send data across the network.

   Three descriptions about data transmission are given.

   Tick (✓) **one Method** and tick (✓) **one Type** for each description.

Description	Method		Type		
	Serial (✓)	Parallel (✓)	Simplex (✓)	Half-duplex (✓)	Duplex (✓)
Data is sent down a single wire in a single direction only.					
Data is sent down multiple wires in both directions, at the same time.					
Data is sent down a single wire in both directions, but never at the same time.					

[3]

(b) Parity bits are used to help detect errors in data transmission. A parity bit is added to each binary value before transmission.

Three binary values are to be transmitted using **even** parity.

(i) Complete the parity bit that would be added to each binary value for even parity.

Binary value							Parity bit
1	1	0	0	1	1	1	
1	0	1	0	1	0	1	
0	1	1	0	1	0	0	

[3]

(ii) A number of errors occurred during data transmission.

State why a parity check may **not** detect transmission errors.

....

.... [1]

(c) Data is encrypted using 128-bit symmetric encryption before it is transmitted.

(i) Explain what is meant by encryption.

....

....

....

.... [2]

(ii) State how the strength of the encryption can be improved.

....

.... [1]

(d) Describe how the school could prevent the loss of stored data.

....

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.... [6]

3 Priya studies music at school. She is buying a new computer to complete her school work at home.

(a) Priya has a choice between an internal Hard Disk Drive (HDD) and an internal Solid State Drive (SSD) to store data.

(i) Give **one** similarity between an HDD and an SSD.

....

.... [1]

(ii) Explain **three** differences between an HDD and an SSD.

1 ....

....

....

2 ....

....

....

3 ....

....

....

[3]

(b) Priya needs to transfer files between the school and her home computer.

Identify **one** off-line storage device she could use to transport the files.

.... [1]

(c) Priya is using sound editing software to record and edit different music tracks.

(i) Identify **two** input devices she would use for this task.

Device 1 ....

Device 2 ....
[2]

(ii) Identify **two** output devices she would use for this task.

Device 1 ....

Device 2 ....
[2]

(d) Priya shares her sound files with other students. Before sharing the sound files, she compresses the files using lossless compression.

Describe how lossless compression reduces the size of a sound file.

....

....

....

.... [2]

(e) Priya currently uses MIDI files to store her music. Priya's friends have asked her if they can have an MP3 version of the file.

(i) Give **two** features of a MIDI file.

1 ....

....

2 ....

....
[2]

(ii) Give **two** features of an MP3 file.

1 ....

....

2 ....

....

[2]

4 Assemblers, compilers and interpreters are types of translators.

Tick (✓) to show which statements apply to each translator. Each statement may apply to more than one type of translator.

Statement	Assembler (✓)	Compiler (✓)	Interpreter (✓)
Translates low-level language to machine code			
Translates high-level language to machine code			
Produces error messages			
Translates high-level language one line at a time			
Produces an executable file			

[5]

5 Programmers can use denary and hexadecimal values. These values are stored in a computer system using binary.

(a) Explain why binary is used to store data in a computer system.

....

....

....

.... [2]

(b) Complete the table to show how the denary value would be stored as binary in an 8-bit register.

Denary value	8-bit register
129	
56	

[2]

Working space

....

....

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....

(c) Complete the table to show how the hexadecimal value **3A9** would be stored as binary in a 12-bit register.

[3]

(d) Identify **two** uses of hexadecimal values in computer science.

1 ....

2 ....

[2]

6 **(a)** Complete the truth table for the given logic circuit.

Do **not** attempt to simplify the logic circuit.
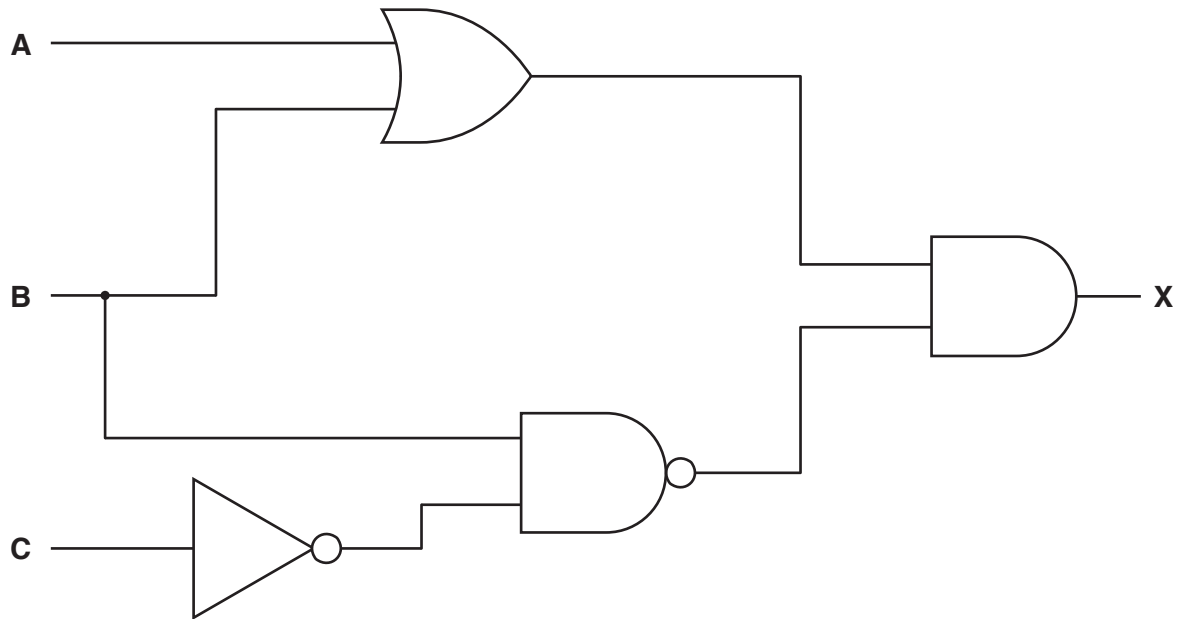
A	B	C	Working space	X
0	0	0		0
0	0	1		0
0	1	0		0
0	1	1		1
1	0	0		1
1	0	1		1
1	1	0		0
1	1	1		1

[4]

(b) A water control system uses a switch and two pressure sensors.

The outputs of the switch and sensors are shown in the table.

Sensor or Switch	Output of 1	Output of 0
Switch (**S1**)	On	Off
Pressure Sensor (**P1**)	>= 3	< 3
Pressure Sensor (**P2**)	>= 3	< 3

Create a logic circuit that will produce an output (**X**) of 1 when:

The switch **S1** is on

and

either P1 is less than 3 **or P2** is less than 3, **but not both**.

All logic gates used must have a maximum of two inputs.

S1 ─

P1 ─   ─ **X**

P2 ─

[4]

7   A room has an automatic lighting system. Electric lights are automatically turned on when a person enters the room and the natural light level in the room is 10 or less.

Explain how sensors and a microprocessor are used to control the electric lights in the room.

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.... [7]

8 A student website provides research support and software downloads.

(a) Students use a browser to access the web pages. Explain the role of a browser in this process.

....

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....

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....

....

....

....

.... [5]

(b) The website owners are worried about a denial of service (DoS) attack.

Explain the term denial of service attack.

....

....

....

....

....

.... [3]

(c) The website owners are also concerned about the ethical issues of copyright and plagiarism.

(i) State what is meant by the term copyright.

....

.... [1]

(ii) State what is meant by the term plagiarism.

....

.... [1]

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Cambridge IGCSE™

COMPUTER SCIENCE	**0478/12**
Paper 1	**March 2020**
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 March 2020 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **14** printed pages.

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	Mark
1(a)	**Component** **Description** Control Bus Program Counter (PC) Memory Data Register (MDR) Accumulator (ACC) Increments to point to the address of the next instruction to be fetched Holds the result of a calculation. It is located within the Arithmetic Logic Unit (ALU) Carries signals to synchronise the fetch-execute cycle Temporary storage between the Central Processing (CPU) and primary memory 1 mark for 1 correct line 2 marks for 2 correct lines 3 marks for 3/4 correct lines	3
1(b)	Any **two** from: • Address bus • Data bus	2

Question	Answer	Mark
2(a)	1 mark per each correct row:	3

Description	Method		Type		
	Serial (✓)	Parallel (✓)	Simplex (✓)	Half-duplex (✓)	Duplex (✓)
Data is sent down a single wire in a single direction only.	✓		✓		
Data is sent down multiple wires in both directions, at the same time.		✓			✓
Data is sent down a single wire in both directions, but never at the same time.	✓			✓	

Question	Answer	Mark
2(b)(i)	1 mark for each correct parity bit:	3

Binary Value							Parity Bit
1	1	0	0	1	1	1	**1**
1	0	1	0	1	0	1	**0**
0	1	1	0	1	0	0	**1**

Question	Answer	Mark
2(b)(ii)	Any **one** from: • Transposition error // bits are interchanged • Bits still add up to **even** number • **Even** number of errors has occurred	1

Question	Answer	Mark
2(c)(i)	Any **two** from: • Scrambles data • … making it meaningless/unintelligible • Uses an algorithm / key • Data / plain text is changed to cipher text	**2**
2(c)(ii)	Any **one** from: • Increase the length of the key // use more than 128 bits • Uses a more complex encryption algorithm	**1**

Question	Answer	Mark
2(d)	Any **six** from (max **four** for identification of method only): • Backups • … if data is lost can be replaced • Install antivirus // Anti malware • … **detects/deletes viruses** that could **corrupt/delete** data • Install firewall • … helps prevent hackers gaining access **and** deleting/corrupting data • Password / Biometrics • Two factor authentication // two-step verification • … helps prevent unauthorised access **and** the deletion/corruption of data • Access rights • … helps prevent users accessing data they should not see **and** deleting it • Network/usage policy • … gives users guidance on data use // by example • Surge protection // Uninterrupted power supply (UPS) • … prevents loss of data that has not been saved • … prevents damage to hardware (that stores data) • Physical method // by example • … helps prevent unauthorised access **and** the deletion/corruption of data	**6**

Question	Answer	Mark
3(a)(i)	Any **one** from: • They are both non-volatile • They are both secondary storage // Both not directly accessed by the CPU • They both have a high capacity of storage • Both have read **and** write abilities	**1**
3(a)(ii)	Any **three** from: • HDD has moving parts but SSD does not • HDD uses magnetic storage whereas SSD uses flash memory • HDD is slower to **access data** than SSD // HDD has greater latency than SSD • HDD will create noise/heat, whereas SSD runs quieter/cooler • HDD has higher power consumption than SSD • HDD have greater longevity/more read-write cycles whereas SDD has lower longevity/limited number of read-write cycles • HDD larger in physical size/heavier than SSD • HDD is normally cheaper for the same capacity of storage as SSD • HDD is available in a larger storage capacity than SSD	**3**
3(b)	Any **one** from: • USB flash memory drive • **External** HDD/SSD • SD Card • CD / DVD / Blu-ray	**1**
3(c)(i)	Any **two** from: • Keyboard • Mouse • Microphone • Touchscreen	**2**
3(c)(ii)	Any **two** from: • Monitor / Screen • Speakers • Headphones • Printer	**2**
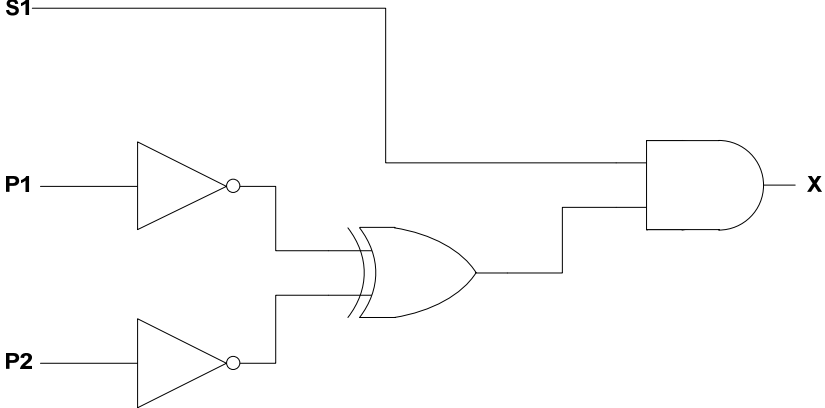
Question	Answer	Mark
3(d)	Any **two** from: • Uses a compression algorithm • Does not **permanently** remove any data • Repeated patterns of notes are identified … • … and are grouped, with an index NOTE: Other possible methods of lossless compression of sound can be credited	**2**
3(e)(i)	Any **two** from: • Stores the notes played and not the sound • Contains instructions/commands for digital instruments // Is recorded / played on a digital instrument e.g. synthesiser • Stores data about notes e.g. pitch byte (Note: Two examples can be awarded) • Can be a compressed format • Can edit **individual notes**	**2**
3(e)(ii)	Any **two** from: • Contains actual **sound** • Contains samples of the sound wave • Contains metadata // by example • Uses lossy compression • Recorded using microphone // Is recorded/played on an MP3 recorder/player	**2**

Question	Answer	Mark
4		5

Statement	Assembler (✓)	Compiler (✓)	Interpreter (✓)
Translates low-level language to machine code	✓		
Translates high-level language to machine code		(✓)	✓
Produces error messages	(✓)	✓	✓
Translates high-level language one line at a time			✓
Produces an executable file	(✓)	✓	

1 mark per each correct row:

NOTE: tick shown in brackets (✓) is optional

Question	Answer	Mark
5(a)	Any **two** from: • Computer consist of transistors / logic circuits • … that can **only store**/**process** data in two states / as high-low / on-off / 1 and 0	2
5(b)	1 mark per each correct 8-bit binary value:	2

Denary Value	8-bit binary register
129	**10000001**
56	**00111000**

Question	Answer	Mark
5(c)	1 mark per each correct conversion: 	3
5(d)	Any **two** from: • Represent colours in HTML // HTML colour **codes** • MAC address • Assembly Language • Error messages • IP address • ASCII values • URL • Memory dump • Memory locations	2

Question	Answer	Mark
6(a)	<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>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td></td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td></td><td>0</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>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr></table> 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	4

Question	Answer	Mark
6(b)	1 mark for each correct logic gate: NOTE: Can also award 4 marks to a circuit that shows X = (P1 XOR P2) AND (S1)	**4**

Question	Answer	Mark
7	Any **seven** from: • Uses light sensor **and** Infrared / Motion / Pressure sensor • Sensors send data to the microprocessor • Data is converted from analogue to digital (using ADC) • Microprocessor compares both values to stored values • If motion value is out of range/in range, light value is checked // If light value is **<= 10**, motion value is checked • If light value is **<= 10** lights are turned on // If motion value is out of range/in range lights are turned on … • … by sending a signal to actuator • Lights remain on for set period (and then turn off) // If motion is in range/out of range or light is > 10 then signal sent to turn lights off • Process repeats / is continuous	**7**

Question	Answer	Mark
8(a)	Any **five** from: • **Sends** the URL of the website • … to a DNS to find the IP address • Connects to the webserver (using the IP address) … • … using HTTP / HTTPS • Renders/Translates the HTML • Runs active/client-side scripts built into webpages • **Manages** SSL/TLS certificate process • Stores/retrieves cookies	**5**
8(b)	Any **three** from: • **Webserver** is sent multiple requests // Requests flood the **webserver** … • … at the **same** time • **Webserver** crashes / runs slow • Designed to prevent access to e.g. a website // Stops legitimate requests being processed/serviced	**3**
8(c)(i)	• A **law/legislation** that requires permission to use intellectual property / other people's work	**1**
8(c)(ii)	Any **one** from: • To claim other's work as your own • To use other people's work without consent / acknowledgement • Theft of intellectual property	**1**