Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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COMPUTER SCIENCE **0478/13**

Paper 1 Computer Systems **May/June 2023**

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.

[Turn over

1 Computers store data as binary. The binary number 10101110 is stored.

(a) Convert the binary number to denary.

.... [1]

Working space

....

....

....

(b) Convert the binary number to hexadecimal.

.... [2]

Working space

....

....

....

(c) A logical left shift of **three** places is performed on the binary number.

(i) Give the 8-bit binary number that would be stored after this logical left shift.

.... [1]

(ii) Tick (✓) **one** box to show which statement is true about the impact the logical left binary shift would have on the binary number.

A	The least significant bits are lost.	☐
B	The most significant bits are lost.	☐
C	The number has been divided by six.	☐
D	The number stays the same.	☐

[1]

(d) Add the **two** 8-bit binary numbers 11101110 and 00110001 using binary addition.

Give your answer in binary. Show all your working.

....

....

....

....

....

.... [4]

(e) The denary number 301 needs to be stored.

Calculate the least number of bits that can be used to store the denary number 301.

.... [1]

Working space

....

....

....

(f) The hexadecimal number A4D needs to be stored.

Calculate the least number of bits that can be used to store the hexadecimal number A4D.

.... [1]

Working space

....

....

....

2 A library has a self-checkout system that allows customers to register books that they want to borrow.

The self-checkout system has a central processing unit (CPU).

The CPU has two cores.

(a) State the purpose of a core in the CPU.

....

.... [1]

(b) The CPU is replaced with one that has four cores.

Explain the effect this has on the performance of the self-checkout system.

....

....

....

.... [2]

(c) The CPU contains registers and buses.

(i) Describe the role of a register in the CPU.

....

....

....

.... [2]

(ii) Identify **one** bus that can be found in the CPU and explain its purpose in the fetch–decode–execute cycle.

Bus ....

Purpose ....

....

....

....
[3]

(d) The self-checkout system allows the user to input their library membership number.

Give **two** appropriate input devices that would allow the user to do this.

1 ....

2 ....

[2]

(e) The self-checkout system uses a monitor to display information about the book.

Users who are blind also need to use the self-checkout system.

Give an appropriate output device that would allow a blind user to be given this information.

.... [1]

(f) The self-checkout system uses two types of primary storage.

Circle **two** types of primary storage that would be used in the system.

compact disk (CD)   digital versatile disk (DVD)

hard disk drive (HDD)   random access memory (RAM)

read only memory (ROM)   universal serial bus (USB) flash memory drive

[2]

(g) The self-checkout system is linked to a stock control system that is updated every time a book is borrowed from the library.

A microprocessor is used in the stock control system to update the stock.

Explain the role of the microprocessor in this system and how it is used to update the stock when a book is borrowed.

....

....

....

....

....

.... [3]

3   **Five** network terms or definitions are given in the table.

Complete the table by giving the missing term or definition.

Term	Definition
router	....
....	This address is assigned by the network and used to identify a device on a network.
network interface card (NIC)	....
....	This address is assigned by the manufacturer and is used to uniquely identify the device.
....	This can be hardware or software based and filters traffic coming into and out of a network.

[5]

4 A programmer writes a computer program in a high-level language.

(a) Tick (✓) **one** box to show which statement is a benefit of writing a program in a high-level language, instead of a low-level language.

A The program can directly manipulate the hardware. ☐

B The program is machine independent. ☐

C The program is more memory efficient. ☐

D The program is quicker to execute. ☐

[1]

(b) Translators are used to translate the high-level language so that it can be processed by the computer.

(i) State what the high-level language is translated into.

.... [1]

(ii) One translator converts and executes the code line by line.

Identify which type of translator would do this.

.... [1]

(iii) One translator creates an error report displaying all the errors in the code before it can be executed.

Identify which type of translator would do this.

.... [1]

(iv) One translator creates an executable file.

Identify which type of translator would do this.

.... [1]

5 Complete and annotate the diagram to demonstrate how packet switching is used to transmit data across a network, including the use of routers, from Device A to Device B.

Device A		Device B

[4]

6 A student is writing a help guide about how to recognise and avoid the cyber-security threat of pharming.

(a) Give **three** appropriate solutions he could include.

1 ....

....

2 ....

....

3 ....

....

[3]

(b) The student also wants to include information in the help guide about the use of social engineering as a cyber-security threat.

Describe what is meant by social engineering.

Include **one** example of social engineering in your answer.

....

....

....

....

....

.... [3]

(c) The student includes information about the security solution of access levels.

Describe what is meant by access levels.

....

....

....

....

....

.... [3]

7 The rule base and the inference engine are two components of an expert system.

(a) Identify the other **two** components of an expert system.

1 ....

2 ....
[2]

(b) Describe the role of the rule base in an expert system.

....

....

....

.... [2]

8   Complete the statements about a distributed denial of service (DDoS) attack.

Use the terms from the list.

Some of the terms in the list will **not** be used. You should only use a term once.

anti-virus	bot	botnet	hacker

internet	malware	secondary storage

spyware	web browser	web server	website

The attacker encourages people to download .... onto

their computer. This will turn each computer into a .... ,

creating a network called a ....

When the attacker wants the DDoS to take place, repeated requests are simultaneously sent from

the computers to a .... This causes it to crash, meaning

that users can no longer access the .... that is stored on

this hardware.

[5]

9   A device can be given an internet protocol (IP) address. This can be an IPv4 or IPv6.

(a) Give **one** similarity between IPv4 and IPv6.

    ....

    .... [1]

(b) Describe **two** differences between IPv4 and IPv6.

    1 ....

    ....

    ....

    ....

    2 ....

    ....

    ....

    ....

[4]

(c) A web page is requested using an IP address.

(i) Identify the system that stores a database of uniform resource locators (URLs) and their corresponding IP addresses.

.... [1]

(ii) Identify the software that sends a request to the IP address to obtain the web page data.

.... [1]

10 A computer has pages A, B and C that are stored in RAM. Page D needs to be sent to the RAM but the RAM is full.

Page B is **not** needed immediately.

Explain how virtual memory can be used in this scenario.

....

....

....

....

....

....

....

.... [4]

11 Software is installed on a computer to manage files, memory and multitasking.

(a) State the name of the software that can do these tasks.

.... [1]

(b) Give **one** task that the software allows the user to do to manage files.

.... [1]

(c) Describe what is meant by managing memory.

....

....

....

.... [2]

(d) A signal is sent within the computer to allow multitasking to occur.

State the name of this type of signal.

.... [1]

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.

Mark scheme abbreviations

/	separates alternative words / phrases within a marking point
//	separates alternative answers within a marking point
<u>underline</u>	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be awarded
( )	the word / phrase in brackets is not required, but sets the context

Note: No marks are awarded for using brand names of software packages or hardware.

Question	Answer	Marks
1(a)	• 174	1
1(b)	• A • E	2
1(c)(i)	• 01110000	1
1(c)(ii)	• B	1
1(d)	**One** mark for each correct nibble **One** mark for correct carries (or other correct working method) **One** mark for identification of overflow error 1 1 • 1 0001 1111	4
1(e)	• 9	1
1(f)	• 12	1

Question	Answer	Marks
2(a)	Any **one** from: • To perform a fetch-decode-execute cycle • To **process** / **execute** an instruction	1
2(b)	**Two** from: • It may increase the performance • … because more instructions can be processed **simultaneously**	2
2(c)(i)	**Two** from: • To store / holds **data** / **address** / **instruction** • … temporarily	2

Question	Answer	Marks
2(c)(ii)	**One** mark for correct name of bus. **Two** marks for matching description. Address bus Transmit / carries addresses … … between **components** in the CPU Data bus Transmit / carries data … … between **components** in the CPU Control bus Transmits control signals … … from the **control unit** to other **components** in the CPU	3
2(d)	Any **two** from: e.g. • Keyboard // Keypad • Mouse • Touchscreen • Digital camera • QR code scanner • Barcode scanner • 2D scanner • Microphone	2
2(e)	• Any **one** from: • Speakers • Headphones	1
2(f)	• random access memory (RAM) • read only memory (ROM)	2

Question	Answer	Marks
2(g)	Any **three** from: • Receives data from the self-checkout system • Compares the book data received to stored book data • … that is a **database** of stock • If the book is found it decrements the book stock by 1 • If the book is not found an error message is displayed	**3**

Question	Answer	Marks
3	**One** mark for each correct missing term or definition: <table><tr><th>Term</th><th>Definition</th></tr><tr><td>router</td><td>a device that forwards packets to their correct destinations in a network</td></tr><tr><td>IP address</td><td>this address is assigned by the network and used to identify a device on a network</td></tr><tr><td>network interface card (NIC)</td><td>this is a component in a device that enables it to connect to a network</td></tr><tr><td>MAC address</td><td>this address is assigned by the manufacturer and is used to uniquely identify the device</td></tr><tr><td>firewall // proxy-server</td><td>this can be hardware or software based and filters traffic coming into and out of a network</td></tr></table>	**5**

Question	Answer	Marks
4(a)	• B	1
4(b)(i)	• Machine code // low-level language // object code	1
4(b)(ii)	• Interpreter	1
4(b)(iii)	• Compiler	1
4(b)(iv)	• Compiler	1

Question	Answer	Marks
5	The diagram demonstrates (**one** mark for each): • Packets sent through several routers • … taking different routes from device A to device B • Packets arrive out of order • Packets being reordered when all arrived at device B	4

Question	Answer	Marks
6(a)	Any **three** from: e.g. • Checking the spelling and tone of the email/website • Checking the URL attached to a link • Scanning a download with anti-malware • Only downloading data / software from trusted sources • Never providing personal details online • Install a firewall to check if the website is valid	3

Question	Answer	Marks
6(b)	**Two** marks for description, **one** mark for example: • Manipulating / deceiving / tricking people … • … to obtain data // to force them to make an error • Any suitable example of social engineering	**3**
6(c)	Any **three** from: • Providing users with different **permission** for the data • Limiting access to reading data limiting the data that can be viewed • Limiting access to editing data // limiting the data that can be deleted / changed • Normally linked to a username	**3**

•

Question	Answer	Marks
7(a)	• Interface • Knowledge base	**2**
7(b)	Any **two** from: • **Stores** the rules for the system • … for the inference engine to use • Used to link the facts in the knowledge base	**2**

Question	Answer	Marks
8	**One** mark for each correct term in the correct order: • Malware • Bot • Botnet • Web server • Website	**5**

Question	Answer	Marks
9(a)	Any **one** from: • They can both be used to identify a device (on a network) • They can both be static / dynamic • They are both unique (to a device on a network) • They can both be assigned by a router • They can both be public/private	1
9(b)	**Four** from: • IPv4 is usually written as denary • … IPv6 usually written as hexadecimal • IPv4 is separated using dots • … Pv6 is separated using colons • IPv4 is 32-bit • … IPv6 is 128-bit • IPv4 is 4 groups of digits • … IPv6 is 8 groups of digits • IPv4 digits are between 0 and 255 • … IPv6 digits are between 0000 and FFFF • IPv4 all 0s are displayed • … IPv6 can use double colons to replace repeated groups of 0000 • IPv4 has fewer available unique addresses • ... IPv6 has more available unique addresses	4
9(c)(i)	• Domain name server // DNS	1
9(c)(ii)	• Web browser	1

Question	Answer	Marks
10	Any **four** from: • The secondary storage / hard drive can be partitioned to create the virtual memory • … and page B sent to the virtual memory … • … which makes space for page D in RAM • … Once page A / C / D / another page is not required / has been processed • … page B can be sent from the virtual memory back to RAM when it is required	**4**

Question	Answer	Marks
11(a)	• Operating system	**1**
11(b)	Any **one** from: • Create a file • Copy a file • Open a file • Close a file • Move a file • Delete a file • Rename a file • Save a file • Sort files	**1**
11(c)	Any **two** from: e.g. • Keeping track of the status of each memory location • Managing the movement of data to and from RAM • Checks that processes have enough memory located to them • Makes sure that two processes don't try to access the same memory location • Manage the transfer of pages between virtual memory and RAM • Allows multitasking	**2**
11(d)	• Interrupt	**1**