# Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

**COMPUTER SCIENCE** **0478/13**

Paper 1 Computer Systems **May/June 2024**

**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 The size of a file can be measured in different units.

(a) State how many bits there are in a byte.

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

(b) State how many kibibytes (KiB) there are in 2 mebibytes (MiB).

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

(c) Identify the unit of data that is equal to 4 bits.

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2 An image has a 16-bit colour depth and a resolution of 1000 × 1750 pixels.

(a) State what is meant by a 16-bit colour depth.

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

(b) The resolution of the image is changed to 750 × 1500 pixels.

Give the effect this will have on the file size of the image.

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

**3** A programmer is creating a computer game. One character is **not** moving correctly.

The programmer needs to debug the program. To do this they need to look at addresses that are locations in memory.

The addresses are displayed as hexadecimal numbers.

**(a)** One address is A2F.

    **(i)** Convert the address to binary.

       ........................................................................................................................................ [3]

    **(ii)** Convert the address to denary.

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

       Working space

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**(b)** The binary number stored for another address is 000110011011.

    **(i)** Convert the binary number to hexadecimal.

       ........................................................................................................................................ [3]

    **(ii)** Convert the binary number to denary.

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

       Working space

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**(c)** Give **one** reason why the addresses are displayed in hexadecimal instead of binary.

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

**(d)** Identify **two** other ways that hexadecimal is used in computer science.

1 ........................................................................................................................................................

2 ........................................................................................................................................................

[2]

**(e)** The health value for a character in the computer game can sometimes be a negative value. The negative values are stored as two's complement 8-bit integers.

A character has a health value of –25.

Calculate the two's complement 8-bit integer for –25. Show all your working.

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.................................................................................................................................................. [2]

**4** The table contains statements about types of secondary storage.

Complete the table by writing the correct type of secondary storage for each statement.

| type of secondary storage | statement |
|---|---|
| ......................................... | Pits and lands are created on a reflective surface. |
| ......................................... | NAND or NOR technology is used. |
| ......................................... | Platters are spun that are divided into tracks and sectors. |
| ......................................... | Electromagnets are used to read and write data. |
| ......................................... | Transistors are used as control gates and floating gates. |
| ......................................... | A red or blue laser is used to read and write data. |

[6]

**5** A computer uses both random access memory (RAM) and read only memory (ROM).

**(a)** Tick (✓) **one** box to show which statement is correct about RAM.

**A** It is non-volatile storage. ☐

**B** It stores the bootloader. ☐

**C** It stores data that is currently in use. ☐

**D** It is **not** directly accessible by the central processing unit (CPU). ☐

[1]

**(b)** ROM is a type of primary storage.

State the characteristic of ROM that makes it a type of primary storage.

.............................................................................................................................................

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

**6** A sensor is an input device that is used to capture data from its surrounding environment.

**(a)** Circle **three** other input devices.

touch screen          hard disk drive (HDD)          headphones

speaker          microphone          actuator

universal serial bus (USB) drive          printer          keyboard

[3]

**(b)** Sensors can be used in an automated system.

Give **two** benefits of using sensors in this type of system.

1 .........................................................................................................................................

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2 .........................................................................................................................................

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[2]

**(c)** The table contains different types of sensors and a use for each.

Complete the table by giving a suitable use for each type of sensor. The first one has been done for you.

| type of sensor | use |
|---|---|
| acoustic | to monitor whether a water pipe has cracked and is leaking and dripping onto the floor |
| temperature | ............................................................................................................................................ ............................................................................................................................................ ............................................................................................................................................ |
| humidity | ............................................................................................................................................ ............................................................................................................................................ ............................................................................................................................................ |
| infra-red | ............................................................................................................................................ ............................................................................................................................................ ............................................................................................................................................ |
| magnetic field | ............................................................................................................................................ ............................................................................................................................................ ............................................................................................................................................ |

[4]

**7** A company has a network that includes a web server.

Data is transmitted across the network using serial half-duplex data transmission.

**(a)** Draw and annotate a diagram to show how the data is transmitted using serial half-duplex data transmission.

[4]

**(b)** Give **two** benefits of the company using serial half-duplex data transmission for this purpose.

1 ...........................................................................................................................................

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2 ...........................................................................................................................................

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[2]

**(c)** Give **one** drawback of the company using serial half-duplex data transmission for this purpose.

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**(d)** The company uses a proxy server to help protect the web server and the network from cyber security threats.

**(i)** Give **three** cyber security threats that the proxy server can help protect against.

1 ..........................................................................................................................................

2 ..........................................................................................................................................

3 ..........................................................................................................................................
[3]

**(ii)** Identify **two** functions of the proxy server that can be used to help protect the web server and the network.

1 ..........................................................................................................................................

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2 ..........................................................................................................................................

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[2]

**(e)** Customers access the company's web pages that are stored on the web server.

Describe how the web pages are located, retrieved and displayed on a customer's computer.

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**8** A student has a computer that has a central processing unit (CPU).

**(a)** Describe the role of the CPU in the computer.

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.......................................................................................................................................... [2]

**(b)** The CPU contains registers.

**(i)** State the purpose of a register.

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

**(ii)** Give **three** registers that are built into the CPU.

1 ......................................................................................................................................

2 ......................................................................................................................................

3 ......................................................................................................................................
[3]

**(c)** One component in the CPU is the arithmetic logic unit (ALU).

Describe the purpose of the ALU.

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**(d)** The student wants to replace the CPU to increase the performance of the computer.

Explain why a different CPU can increase the performance.

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**9** A printer runs out of ink and needs a new ink cartridge. An interrupt is sent and a message is generated to notify the user that the ink cartridge is empty.

**(a)** Complete the paragraph about the use of an interrupt in this process.

Use the terms from the list.

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

|  |  |  |  |  |
|---|---|---|---|---|
| binary | clock | computer | data | error |
| fetch–decode–execute cycle | | hexadecimal | higher | interrupt queue |
| interrupt service routine (ISR) | | lower | printer | priority level |
| secondary storage | | sorting | transmission | |

The ................................................... sends an interrupt to the

................................................... . The interrupt is given a

................................................... . The processor completes its current

................................................... and checks the

................................................... to see if there is an interrupt with

................................................... priority than the current task. If there is, it stores

the current task and fetches the interrupt. It then calls the

................................................... , which is a sequence of instructions that

handles the interrupt. The interrupt is handled, which generates a message to the user to

notify them that the ink cartridge is empty.

[7]

**(b)** Handling interrupts is one function of an operating system.

Give **two** functions of an operating system that relate to memory.

1 ......................................................................................................................................................

2 ......................................................................................................................................................

[2]

**12**

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