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2081743851

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.

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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.

..... [1]

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.

.....

..... [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.

.....

..... [1]

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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

.....

.....

.....

.....

(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

.....

.....

.....

.....

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

.....

..... [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.

.....

.....

.....

.....

.....

..... [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]

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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 .....

.....

2 .....

.....

[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]

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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 .....

.....

2 .....

.....

[2]

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

.....

..... [1]

(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 .....

.....

2 .....

.....

[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.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

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

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

.....

.....

.....

..... [2]

(b) The CPU contains registers.

(i) State the purpose of a register.

.....

..... [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.

.....

.....

.....

.....

.....

..... [3]

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

Explain why a different CPU can increase the performance.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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]

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