Please check the examination details below before entering your candidate information

Candidate surname   Other names

Pearson Edexcel
International GCSE (9–1)

Centre Number   Candidate Number

Monday 18 May 2020

Afternoon (Time: 2 hours) | Paper Reference **4CP0/01**

Computer Science

Paper 1: Principles of Computer Science

You must have:
Pseudocode command set (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question*.
- You are not allowed to use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- Marks will not be awarded for using product or trade names in answers without further explanation.

Turn over ▶

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Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1   Upeka manages the network in her office building.

(a) Upeka uses the network to install software updates on all the office computers.

Give **two other** reasons why computers are connected in a network.

(2)

1 ....

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2 ....

....

(b) The network uses wired and wireless connectivity.

(i)   State **two** advantages of using wired rather than wireless connectivity.

(2)

1 ....

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2 ....

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(ii) State **two** disadvantages of using wired rather than wireless connectivity.

(2)

1 ....

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2 ....

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(c) Some people confuse the terms 'internet' and 'world wide web'.

Describe the difference between the internet and the world wide web.

(2)

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(d) Networks use both IPv4 and IPv6 addresses to identify connected devices.

Explain why IPv6 addressing was introduced.

(2)

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(e) Network layouts can be based upon a number of different network topologies.

Figure 1 shows a network topology.

Figure 1

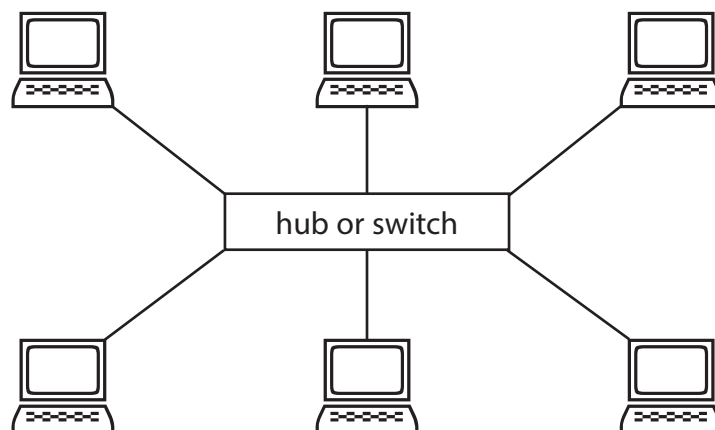(i) State the name of this network topology.

(1)

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....

(ii) State **one** benefit of using this network topology.

(1)

....

....

(iii) State **one** drawback of using this network topology.

(1)

....

....

(f) The network uses TCP/IP.

Figure 2 shows the TCP/IP protocol stack.

```
        ┌─────────────────┐
        │   Application   │
        └─────────────────┘
                ↕
        ┌─────────────────┐
        │    Transport    │
        └─────────────────┘
                ↕
        ┌─────────────────┐
        │     Network     │
        └─────────────────┘
                ↕
        ┌─────────────────┐
        │    Data link    │
        └─────────────────┘
```
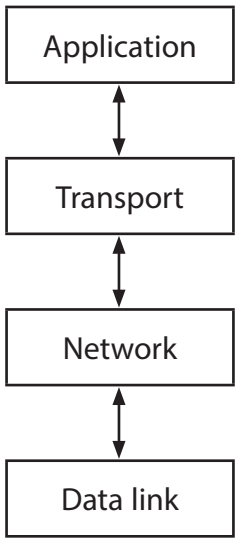
Figure 2

(i) One use of the application layer is to send and receive emails.

State **two** email protocols.

(2)

1 ....

2 ....

(ii) Upeka sends an email to Peter. The transport layer in Upeka's computer splits the email into data packets.

State **two** tasks performed by the transport layer in Peter's computer when the packets arrive from the network layer.

(2)

1 ....

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2 ....

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(Total for Question 1 = 17 marks)

2 Computers use binary digits to represent data.

(a) Sign and magnitude and two's complement are two ways of representing signed integer numbers.

(i) Convert the denary number -94 to a binary pattern using sign and magnitude representation.

(2)

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(ii) 1000 1001 is a signed integer that uses two's complement representation.

Convert this signed integer to denary.

(2)

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(b) Denary numbers use base 10

Identify the base for hexadecimal numbers.

(1)

☒ **A** 32

☒ **B** 16

☒ **C** 8

☒ **D** 2

(c) Computers encode characters using ASCII and Unicode.

(i) State the number of characters that can be represented using standard ASCII.

(1)

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....

(ii) The ASCII system uses 7 bits to represent a character. The ASCII code for the character 'A' using denary is 65; other alphabetical characters follow on from this in sequence.

Identify the ASCII code for 'H'.

(1)

☒ **A** 1000111

☒ **B** 1001010

☒ **C** 1001000

☒ **D** 1000101

(iii) Explain why Unicode was developed.

(2)

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(Total for Question 2 = 9 marks)

3 The central processing unit (CPU) and other hardware components work together with the operating system to run programs and store data.

(a) Here is a partially completed diagram showing the hardware components used in the fetch-decode-execute cycle.

The function of the I/O controller is to manage communication between the CPU and input/output devices.

Complete the diagram by:

• labelling the buses

• adding directional arrows to the dotted lines to show the flow of communication.

(6)
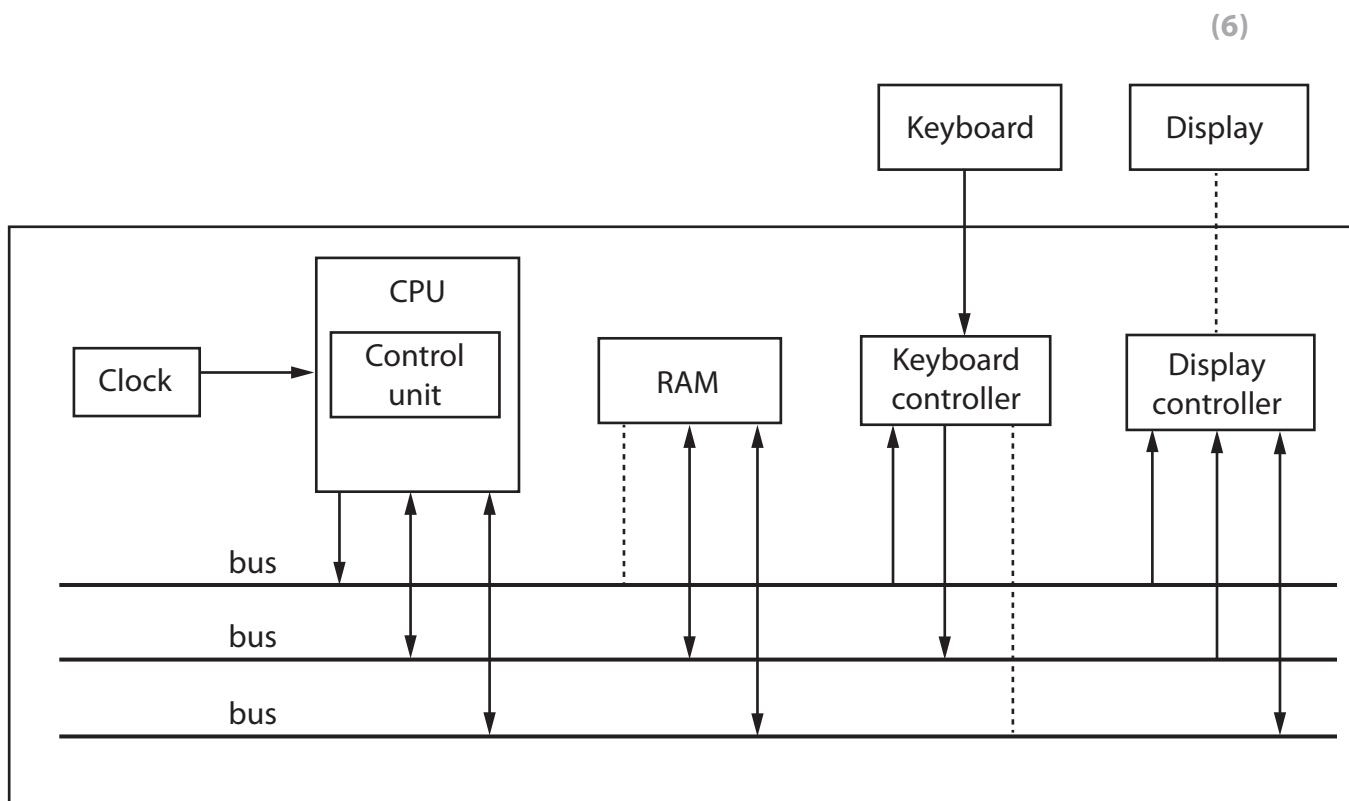
(b) The CPU includes an area of cache memory.

Increasing the size of the cache will improve the performance of the CPU.

Explain how increasing the size of the cache improves the performance.

(2)

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(c) Some computers have more than one CPU. The CPUs work in parallel to execute instructions.

Complete the table to show how two CPUs working in parallel could execute the expression:

$$(5 * 2) + (4 * 3) - (24 / 4)$$

(4)

CPU 1	CPU 2
5 * 2 = 10	

(d) One function of an operating system is to manage files on secondary storage.

Describe how an operating system manages the storage of a file on random access secondary storage.

(4)

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(Total for Question 3 = 16 marks)

4 Ibrahim works in the music industry.

(a) He is learning how sound is represented in binary.
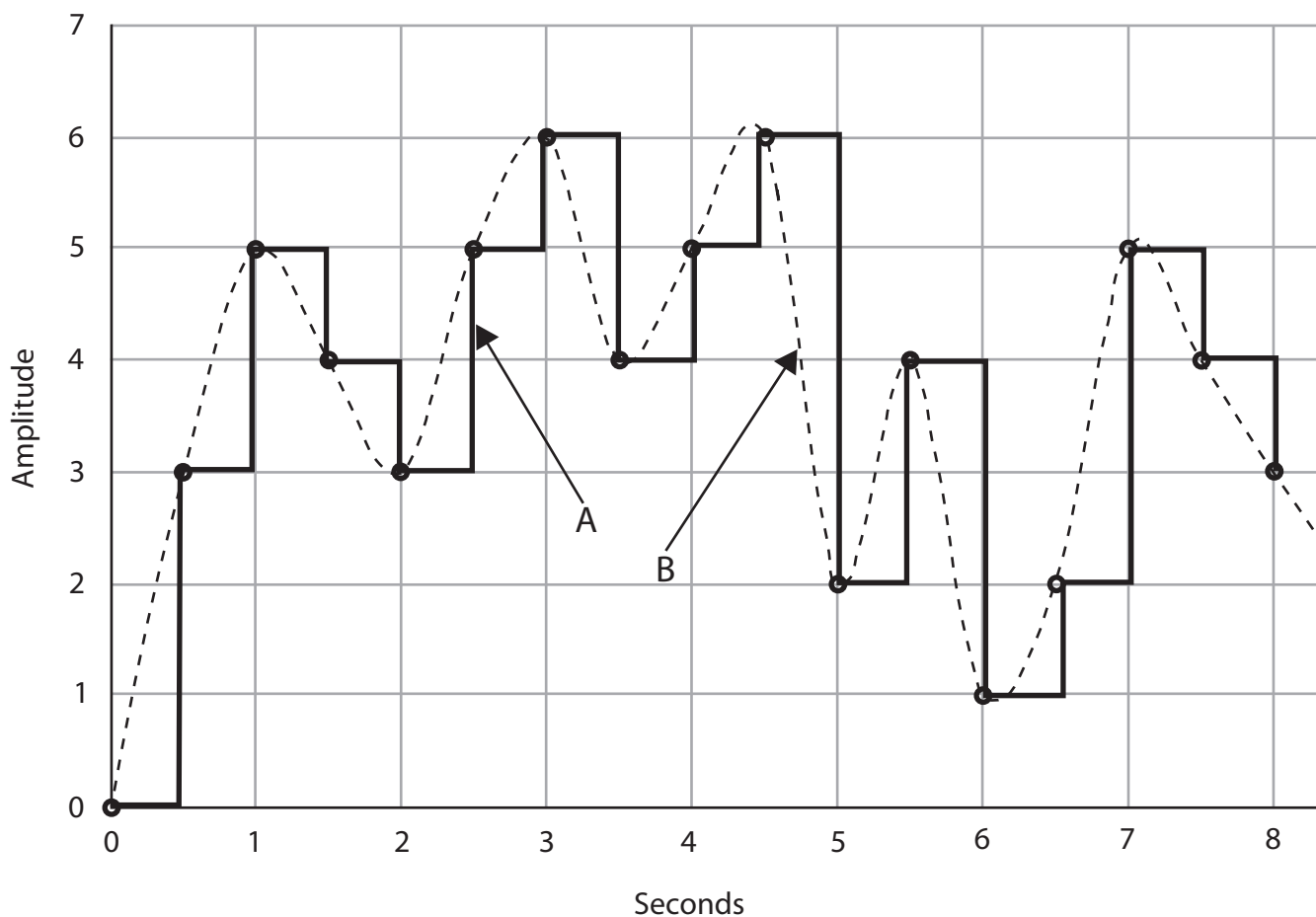
Figure 3 illustrates this process.

Figure 3

(i) State what the solid line labelled **A** represents.

(1)

....

....

(ii) State what the dashed line labelled **B** represents.

(1)

....

....

(iii) Give the sampling frequency, including the correct units.

(1)

....

....

(iv) Give **one** impact of increasing the sampling frequency.

(1)

....

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(v) The bit-depth measures the resolution of the sound sample.

State the minimum bit-depth needed to store the sound sampled in **Figure 3**.

Justify your answer.

(2)

Bit-depth

....

Justification

....

....

....

(vi) Give the value in binary of the audio sample at the 4th second.

(1)

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....

(b) Ibrahim wants to store a music file.

- The sampling frequency is 47 kHz.

- The bit-depth is 64

- The analogue signal lasts for 819 seconds.

Construct an expression to show how the file size, in bytes, is calculated.

You do **not** need to do the calculation.

(4)

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(c) Ibrahim wants to upload a music file to his online storage. The file has been compressed using a lossy algorithm.

Give **one** drawback of using a lossy algorithm for this purpose.

(1)

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(Total for Question 4 = 12 marks)

PMT

5 Programmers work as part of a team to develop software.

(a) They use truth tables to determine if an expression evaluates to true or false.

Complete this truth table for the Boolean expression

P AND (Q OR R)

You may not need to use all rows.

(3)

P	Q	R	Q OR R	P AND (Q OR R)

(b) The team is working on software for a ride-on lawn mower.

The lawn mower must not start unless it is safe for the driver.

- The brake (B) must be engaged.

- The driver's seat sensor (S) must be engaged.

- The blade safety lock (L) must be removed.

Construct a Boolean expression, using AND, OR, and NOT with the letters B, S and L to show the safe starting condition.

(2)

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(c) The team uses code reviews as part of the software development process.

State **two** ways in which code reviews can help protect software systems from cyber attacks.

(2)

1 ....

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2 ....

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(d) The team needs to protect its intellectual property rights over the systems that it develops.

Give **three** types of legal protection the team could use.

(3)

1 ....

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2 ....

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3 ....

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(Total for Question 5 = 10 marks)

6 A software engineer is working with some algorithms.
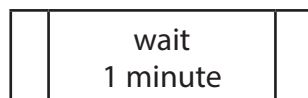
(a) An algorithm needs to be developed.

The algorithm must:

- check for a change of hour every minute

- use the library subprogram getHour() to get the hour part of the current time in the 24-hour clock (0 to 23)

- output "Good morning" when the hour is between 3 and 12, inclusive

- output "Good afternoon" when the hour is between 13 and 19, inclusive

- output "Good night" at all other times.

Complete the flowchart to represent this algorithm, in the space provided on the next page.

The call to the library subprogram getHour() has already been included.

Use this subprogram symbol to show waiting for 1 minute.

| | wait 1 minute | |

(6)

Draw your flowchart here.

```
        ┌─────────────────┐
        │      START       │
        └─────────────────┘
                 │
                 ▼
        ┌──┬────────────┬──┐
        │  │  getHour() │  │
        └──┴────────────┴──┘
```

P 6 1 8 8 4 R R A 0 1 7 2 0
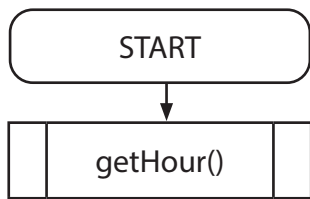
(b) Another algorithm determines when to change the flavoured syrups for a drinks dispensing machine.

Figure 4 shows this algorithm written in pseudocode.

```
 1  SET flavours TO ["anise", "mango", "cola", "apple", "papaya", "strawberry",
    "lychee", "banana"]
 2
 3  SET volume TO [0.7, 0.2, 0.6, 0.1, 0.05, 0.8, 0.4, 0.6]
 4
 5  SET i TO 0
 6
 7  WHILE i < 8 DO
 8
 9      IF (volume[i] < 0.1) THEN
10          SEND (flavours[i] & " needs changing") TO DISPLAY
11
12      ELSE
13          IF (volume[i] >= 0.3) AND (volume[i] <= 0.5) THEN
14              SEND (flavours[i] & " needs ordering")  TO DISPLAY
15          END IF
16      END IF
17
18      SET i TO i + 1
19
20  END WHILE
```

Figure 4

(i) Give the output produced by the algorithm.

(2)

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The algorithm works with a fixed number of flavours.

(ii) Give the number of the line in the algorithm that would need to be amended to allow for any number of flavours.

(1)

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(iii) State how the pseudocode needs to be changed to make this amendment.

(1)

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QUESTION 6(c) BEGINS ON THE NEXT PAGE.

(c) The algorithms will be coded in a high-level language.

Programs written in high-level languages must be translated in order to be executed by a computer.

Discuss the similarities and differences between a compiler and an interpreter.

(6)

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(Total for Question 6 = 16 marks)

TOTAL FOR PAPER = 80 MARKS