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Pearson Edexcel International GCSE (9–1)

Friday 26 May 2023

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 giving further explanation.

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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 People use networks in all aspects of their lives.

(a) An office building has desktop computers connected in a network.

One reason for networking computers is to enable technicians to maintain them remotely.

State **two other** reasons for connecting computers in a network.

(2)

1

.....

2

.....

(b) Access to data must be controlled.

(i) Identify **one** reason that encryption is used.

(1)

- ☐ **A** To compress the file so it takes up less storage space
- ☐ **B** To make sure both sender and receiver use the same key
- ☐ **C** To make sure data is only understood by the intended receiver
- ☐ **D** To stop malicious hackers getting into a computer network



(ii) File servers are in a small room at the back of an office.

The office has a burglar alarm.

Give **two other** ways that the servers can be secured using physical methods.

(2)

1

2

(iii) Phishing is a type of social engineering.

State what is meant by the term **social engineering**.

(1)

.....

(c) 5G is a communication standard.

Identify the characteristic that is true for the 5G communication standard.

(1)

- ☐ **A** It has a high transmission latency
- ☐ **B** It has built-in security
- ☐ **C** It has a lower bandwidth than 3G and 4G
- ☐ **D** It uses wireless communication

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(d) Programmers write and test code.

They use modular testing.

State what is meant by the term **modular testing**.

(1)

(e) Computer scientists are viewed as professionals, in the same way that doctors are viewed as professionals.

Give **two** ways that computer scientists can demonstrate professionalism.

(2)

1

.....

2

.....

(Total for Question 1 = 10 marks)



2 Computers manipulate binary patterns. People interpret those patterns.

- (a) Complete the table by adding the hexadecimal notation for each of the denary values.

(2)

Denary	Hexadecimal
8	
12	

- (b) Identify the expression to give the number of unique binary patterns that can be stored in six bits.

(1)

- ☐ **A** 6^2
- ☐ **B** 6×2
- ☐ **C** $6^2 - 1$
- ☐ **D** 2^6

- (c) Binary patterns are manipulated by shifts.

- (i) Give the result of applying a logical shift right by two to the binary pattern 0101 1100

(1)

- (ii) Give the result of applying an arithmetic shift right by three to the binary pattern 1100 0101

(1)



(d) Binary patterns can be interpreted as signed or unsigned integers.

(i) Convert the denary unsigned integer 60 to 8-bit binary.

(2)

(ii) Here is a binary bit pattern for a signed integer in sign and magnitude format.

1001 0110

Convert the binary bit pattern to denary.

Be sure to include a sign symbol in your answer.

(2)

- (iii) Negating a signed integer means changing its sign without changing its value.

The negation of +16 is -16. The negation of -24 is +24.

Here is the binary bit pattern for a signed integer in two's complement format.

1110 0101

Convert the binary pattern to its negation in two's complement.

(2)

- (e) Construct an expression to convert 13 kilobytes to kibibytes.

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

(2)

(Total for Question 2 = 13 marks)



3 Software programs carry out tasks on computers.

- (a) A headteacher uses a computer simulation to model the effect of increasing class sizes.

Explain **one** problem with using simulations to predict the effects of changes.

(2)

- (b) Images are stored as files before being displayed or printed.

- (i) Give **one** measurement of image resolution.

(1)

- (ii) Increasing the colour depth of an image leads to an increase in the image file size.

Describe the reason for the increase in file size.

(2)



(c) Software is divided into two categories.

Describe **one** difference between system software and application software.

(2)

.....

.....

.....

.....

(d) Here is an image of secondary storage.

Two files (W and Z) are stored on it.

Each file is made up of several blocks (e.g. Z1, Z2, Z3).

	W4	Z1					W2			W3	Z3		W1		Z2
--	----	----	--	--	--	--	----	--	--	----	----	--	----	--	----

Complete the image to show the state after running a defragmentation utility.

(2)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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(e) Here is part of a file that contains electric meter readings.

04631 04984 05103 05163 05271 05383 05487 05722

Explain the effect on the file of applying a run-length encoding algorithm to this data file.

(2)

(f) A series of tasks is written in different programming languages.

Complete the table to show the correct programming language translator for each task.

(4)

Task	Translator
A guessing game that can be used on different computing platforms	
A screen driver for a new smartphone	
A new version of a spreadsheet program for sale next year	
Control software for an embedded system inside a new washing machine	

(Total for Question 3 = 15 marks)



4 Data packets travel across networks from one device to another.

(a) Identify the measurement of network speeds.

(1)

- ☐ A Mebibits per second
- ☐ B Mebibytes per second
- ☐ C Megabits per second
- ☐ D Megabytes per second

(b) Data packets contain the addresses of the sender and the receiver.

Complete the table to give the number of bits that make up each type of network address.

(2)

Type	Example	Number of bits
IPv4	192.169.0.3	
IPv6	1050:a500:00c0:0440:0006:0300:700d:436f	

(c) Data packets travel over physical media.

(i) Describe **one** difference between the media used by a wired network and a wireless network.

(2)

.....

.....

.....

.....



(ii) Some people confuse Ethernet® and Wi-Fi.

Describe what is meant by the term **Ethernet®**.

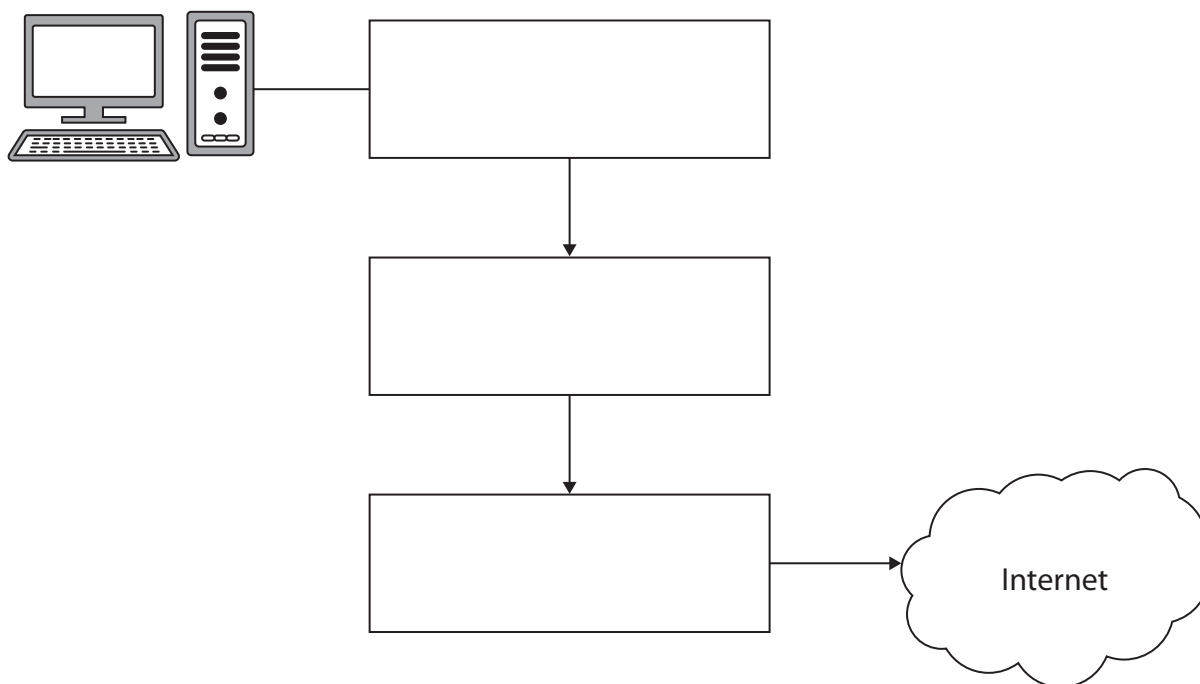
(2)

(d) A single physical box connects a desktop computer to the Internet.

The box incorporates three different components.

Complete the diagram to show the names of the components in the correct order.

(3)



- (e) Users enter passwords when logging onto a network and when creating accounts using a web page.

Describe **one** difference between validation and authentication.

(2)

(Total for Question 4 = 12 marks)



5 Hardware devices execute programs to carry out a variety of tasks.

(a) A program controls a bee character in an animation.

The bee can turn to face North, East, South or West.

The bee can move any number of steps in the direction it is facing.

Complete the table to show one input and one output required to move the bee.

(2)

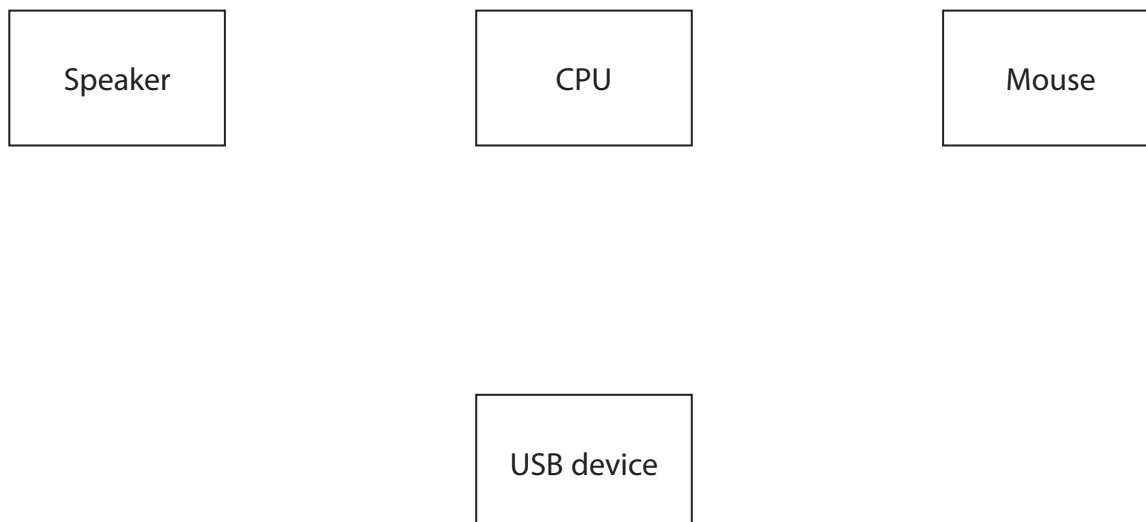
Requirement	Example
Input	
Process	Calculate the path the bee will move along to its new position
Output	



(b) Computers are made up of hardware components.

- (i) Complete the diagram by adding directional arrows between the components to show the flow of communication.

(3)



(ii) Identify what is stored in ROM.

(1)

- ☐ **A** The software firewall
- ☐ **B** The basic input output system
- ☐ **C** The operating system
- ☐ **D** The user interface code

(iii) Cache is used as temporary storage.

One type of cache is located between main memory and the CPU.

Explain **one** reason cache is used in a computer.

(2)



(c) A washing machine uses several different embedded systems.

One embedded system uses a switch to identify the type of wash cycle selected by the user.

Describe **one other** example of an embedded system found in a washing machine.

(2)

.....

.....

.....

.....

(d) Programs use logic statements to control physical hardware.

(i) A window shuts when the temperature is too cool or it is a rainy night.

The values are defined as:

- A shows it is night time
- B shows it is too cool
- C shows it is raining.

Complete the truth table to show the results of each operation.

Two rows have been done for you.

(3)

A	B	C	A AND C	(A AND C) OR B
0	0	0	0	0
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1	1	1

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(ii) A warehouse has an automated alarm system.

When the alarm system is activated it will sound if:

- a movement sensor (M) is activated
- a pressure pad (P) is activated
- a key code (C) to deactivate the alarm system has not been entered.

Construct a logic statement, using AND, OR and NOT with the letters M, P and C, to show the conditions that will sound the alarm.

(3)

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(e) A computer with a single CPU runs several processes at the same time.

This computer is multitasking.

Describe how the operating system enables processes to share a single CPU.

(2)

(Total for Question 5 = 18 marks)



6 Programmers share algorithms with different people and write algorithms for different reasons.

(a) A programmer is showing a new algorithm to a group of non-technical managers.

State an appropriate method for writing the algorithm.

Justify your answer.

(2)

Method

Justification

(b) **Figure 1** shows an algorithm that displays a string based on the number input by the user.

```

1 SEND ("Enter a number: ") TO DISPLAY
2 RECEIVE inNum FROM (INTEGER) KEYBOARD
3 IF ((inNum = 1) OR (inNum = 2)) THEN
4     IF (inNum = 1) THEN
5         SEND ("First") TO DISPLAY
6     ELSE
7         IF (inNum = 2) THEN
8             SEND ("Second") TO DISPLAY
9         END IF
10    END IF
11 ELSE
12    SEND ("Invalid input") TO DISPLAY
13 END IF

```

Figure 1

Give **one** reason why the selection statement on line 7 is not required.

(1)



(c) **Figure 2** shows an algorithm that manipulates arrays.

The algorithm works with any number of scores.

```
1 SET oldScores TO [10, 20, 30, 40, 50]
2 SET newScores TO [0, 0, 0, 0, 0]
3 SET newIndex TO 0
4
5 FOR oldIndex FROM (LENGTH (oldScores) - 1) TO 0 STEP -1 DO
6     SET newScores[newIndex] TO oldScores[oldIndex]
7     SET newIndex TO newIndex + 1
8 END FOR
```

Figure 2

(i) Describe what happens to the variable **oldIndex** when line 5 is executed.

(2)

(ii) State the purpose of the algorithm in **Figure 2**.

(1)



(d) Cloud storage has become an increasingly popular service.

Discuss the benefits and drawbacks of using cloud storage.

(6)

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 80 MARKS



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Paper
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Computer Science

Component 1

Pseudocode command set

Resource Booklet

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Pseudocode command set

Questions in the written examination that involve code will use this pseudocode for clarity and consistency. However, students may answer questions using any valid method.

Data types

INTEGER

REAL

BOOLEAN

CHARACTER

Type coercion

Type coercion is automatic if indicated by context. For example $3 + 8.25 = 11.25$ (integer + real = real)

Mixed mode arithmetic is coerced like this:

	INTEGER	REAL
INTEGER	INTEGER	REAL
REAL	REAL	REAL

Coercion can be made explicit. For example, RECEIVE age FROM (INTEGER) KEYBOARD assumes that the input from the keyboard is interpreted as an INTEGER, not a STRING.

Constants

The value of constants can only ever be set once. They are identified by the keyword CONST. Two examples of using a constant are shown.

CONST REAL PI

SET PI TO 3.14159

SET circumference TO radius * PI * 2

Data structures

ARRAY

STRING

Indices start at zero (0) for all data structures.

All data structures have an append operator, indicated by &.

Using & with a STRING and a non-STRING will coerce to STRING. For example, SEND 'Fred' & age TO DISPLAY, will display a single STRING of 'Fred18'.

Identifiers

Identifiers are sequences of letters, digits and '_', starting with a letter, for example: MyValue, myValue, My_Value, Counter2

Functions

LENGTH()

For data structures consisting of an array or string.

RANDOM(n)

This generates a random number from 0 to n.

Comments

Comments are indicated by the # symbol, followed by any text.

A comment can be on a line by itself or at the end of a line.

Devices

Use of KEYBOARD and DISPLAY are suitable for input and output.

Additional devices may be required, but their function will be obvious from the context. For example, CARD_READER and MOTOR are two such devices.

Notes

In the following pseudocode, the < > indicates where expressions or values need to be supplied. The < > symbols are not part of the pseudocode.

Variables and arrays

Syntax	Explanation of syntax	Example
SET Variable TO <value>	Assigns a value to a variable.	SET Counter TO 0 SET MyString TO 'Hello world'
SET Variable TO <expression>	Computes the value of an expression and assigns to a variable.	SET Sum TO Score + 10 SET Size to LENGTH(Word)
SET Array[index] TO <value>	Assigns a value to an element of a one-dimensional array.	SET ArrayClass[1] TO 'Ann' SET ArrayMarks[3] TO 56
SET Array TO [<value>, ...]	Initialises a one-dimensional array with a set of values.	SET ArrayValues TO [1, 2, 3, 4, 5]
SET Array [RowIndex, ColumnIndex] TO <value>	Assigns a value to an element of a two dimensional array.	SET ArrayClassMarks[2,4] TO 92

Selection

Syntax	Explanation of syntax	Example
IF <expression> THEN <command> END IF	If <expression> is true then command is executed.	IF Answer = 10 THEN SET Score TO Score + 1 END IF
IF <expression> THEN <command> ELSE <command> END IF	If <expression> is true then first <command> is executed, otherwise second <command> is executed.	IF Answer = 'correct' THEN SEND 'Well done' TO DISPLAY ELSE SEND 'Try again' TO DISPLAY END IF

Repetition

Syntax	Explanation of syntax	Example
WHILE <condition> DO <command> END WHILE	Pre-conditioned loop. Executes <command> whilst <condition> is true.	WHILE Flag = 0 DO SEND 'All well' TO DISPLAY END WHILE
REPEAT <command> UNTIL <expression>	Post-conditioned loop. Executes <command> until <condition> is true. The loop must execute at least once.	REPEAT SET Go TO Go + 1 UNTIL Go = 10
REPEAT <expression> TIMES <command> END REPEAT	Count controlled loop. The number of times <command> is executed is determined by the expression.	REPEAT 100-Number TIMES SEND '*' TO DISPLAY END REPEAT
FOR <id> FROM <expression> TO <expression> DO <command> END FOR	Count controlled loop. Executes <command> a fixed number of times.	FOR Index FROM 1 TO 10 DO SEND ArrayNumbers[Index] TO DISPLAY END FOR
FOR <id> FROM <expression> TO <expression> STEP <expression> DO <command> END FOR	Count controlled loop using a step.	FOR Index FROM 1 TO 500 STEP 25 DO SEND Index TO DISPLAY END FOR
FOR EACH <id> FROM <expression> DO <command> END FOREACH	Count controlled loop. Executes for each element of an array.	SET WordsArray TO ['The', 'Sky', 'is', 'grey'] SET Sentence to "" FOR EACH Word FROM WordsUArray DO SET Sentence TO Sentence & Word & '' END FOREACH

Input/output

Syntax	Explanation of syntax	Example
SEND <expression> TO DISPLAY	Sends output to the screen.	SEND 'Have a good day.' TO DISPLAY
RECEIVE <identifier> FROM (type) <device>	Reads input of specified type.	RECEIVE Name FROM (STRING) KEYBOARD RECEIVE LengthOfJourney FROM (INTEGER) CARD_READER RECEIVE YesNo FROM (CHARACTER) CARD_READER

File handling

Syntax	Explanation of syntax	Example
READ <File> <record>	Reads in a record from a <file> and assigns to a <variable>. Each READ statement reads a record from the file.	READ MyFile.doc Record
WRITE <File> <record>	Writes a record to a file. Each WRITE statement writes a record to the file.	WRITE MyFile.doc Answer1, Answer2, 'xyz 01'

Subprograms

Syntax	Explanation of syntax	Example
PROCEDURE <id> (<parameter>, ...) BEGIN PROCEDURE <command> END PROCEDURE	Defines a procedure.	PROCEDURE CalculateAverage (Mark1, Mark2, Mark3) BEGIN PROCEDURE SET Avg to (Mark1 + Mark2 + Mark3)/3 END PROCEDURE
FUNCTION <id> (<parameter>, ...) BEGIN FUNCTION <command> RETURN <expression> END FUNCTION	Defines a function.	FUNCTION AddMarks (Mark1, Mark2, Mark3) BEGIN FUNCTION SET Total to (Mark1 + Mark2 + Mark3)/3 RETURN Total END FUNCTION
<id> (<parameter>, ...)	Calls a procedure or a function.	Add (FirstMark, SecondMark)

Arithmetic operators	
Symbol	Description
+	Add
-	Subtract
/	Divide
*	Multiply
^	Exponent
MOD	Modulo
DIV	Integer division

Relational operators	
Symbol	Description
=	equal to
<>	not equal to
>	greater than
>=	greater than or equal to
<	less than
<=	less than or equal to

Logical operators	
Symbol	Description
AND	Returns true if both conditions are true.
OR	Returns true if any of the conditions are true.
NOT	Reverses the outcome of the expression; true becomes false, false becomes true.

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