Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Friday 9 May 2025

Morning (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.

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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 Computers can be networked together.

(a) Complete the table by adding a cross ☒ to match **each** statement to **one** networking term.

(4)

Statement	DNS	PAN	WAN	WWW
A network of networks **not** limited to a single location	☒	☒	☒	☒
A network that connects devices within the range of a single user	☒	☒	☒	☒
A set of hypertext documents accessed through the HTTP protocol	☒	☒	☒	☒
A system that maps domain names to IP addresses	☒	☒	☒	☒

(b) Networks use the TCP/IP protocol model.

The application layer and the network layer are two layers in the TCP/IP model.

Give the names of the **other two** layers.

(2)

1 .....

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(c) Emails can be sent between computers on a network.

Identify the protocol required to **send** an email.

(1)

☒ **A** HTTP

☒ **B** IMAP

☒ **C** POP3

☒ **D** SMTP

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(d) A library sets up a network using a star topology.

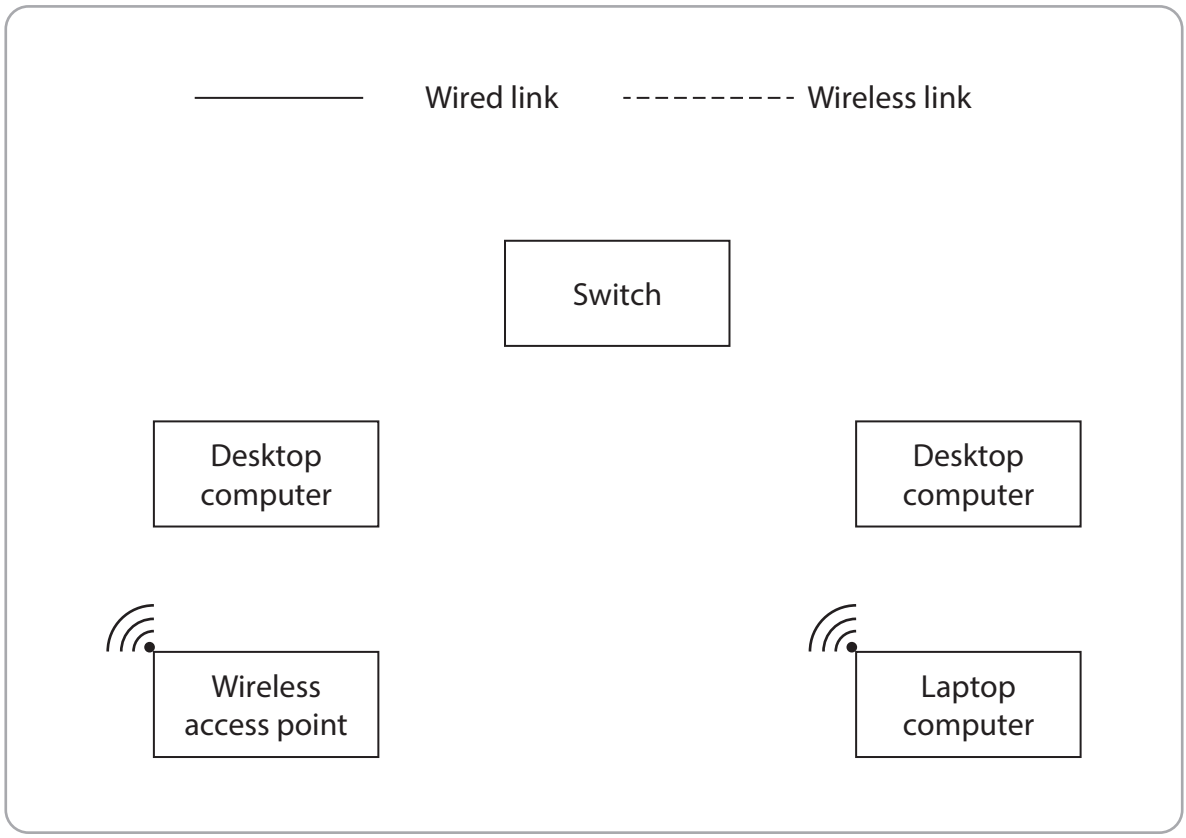
The library is connecting:

- two desktop computers with wired network interface cards
- a laptop with a wireless network interface card
- a switch
- a wireless access point.

Complete the diagram to show how the devices are connected.

Use a solid line to indicate a wired link and a dashed line to indicate a wireless link.

(3)



(e) IT teams carry out network penetration testing.

Describe the purpose of penetration testing.

(2)

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(Total for Question 1 = 12 marks)

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2 Computer systems use both hardware and software.

(a) Give **two** output devices found on smartphones.

(2)

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(b) Computer systems use both primary and secondary storage.

(i) Identify which **one** of these uses storage space on the hard drive as additional memory.

(1)

☒ **A** Cache memory

☒ **B** Random-access memory

☒ **C** Read-only memory

☒ **D** Virtual memory

(ii) Computer systems can use cloud storage.

Describe what is meant by **cloud storage**.

(2)

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(c) The CPU performs the fetch-decode-execute cycle.

(i) Give **three** factors that affect the performance of the CPU.

(3)

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3 .....

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(ii) Describe how the address bus is used during the fetch-decode-execute cycle.

(2)

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(d) Classical computers store data using bits that exist in one of two binary states, 1 or 0.

Quantum computers store data in a superposition of states.

Give **two other** characteristics of quantum computers.

(2)

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(Total for Question 2 = 12 marks)

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3 Computers use binary to represent and store data.

(a) Binary and hexadecimal can be used to represent numbers.

(i) Convert the binary pattern 1011 1001 to hexadecimal.

(2)

(ii) Identify the statement that is true for hexadecimal.

(1)

☒ **A** Hexadecimal can be processed faster by a computer than binary

☒ **B** Hexadecimal digits can be represented using one nibble

☒ **C** Hexadecimal uses less storage space in RAM than binary

☒ **D** Hexadecimal uses the number base 6

(iii) Describe the binary shift that is equivalent to dividing an unsigned binary number by 4.

(2)

(b) **Figure 1** shows a bitmap image in a 16 × 16 grid. The image uses three colours.

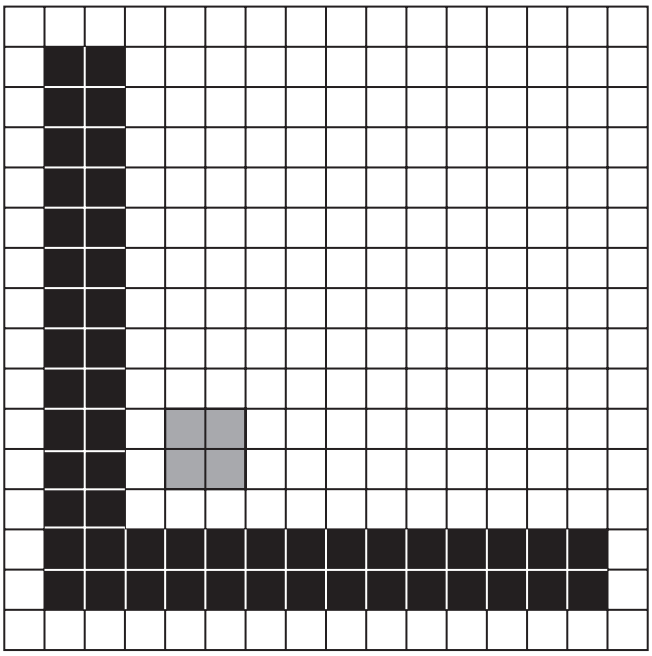

Figure 1

(i) State the smallest component of a bitmap image.

(1)

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(ii) Construct an **expression** to show the number of images, like the one in **Figure 1**, that can be stored in 1 KB.

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

(4)

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(iii) Explain why a run-length encoding algorithm is a good choice for compressing the image in **Figure 1**.

(2)

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(c) The **Pigpen** cipher shown in **Figure 2** has been used to encrypt a message.

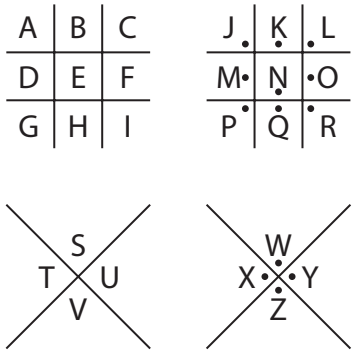
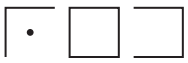


Figure 2

Complete the table to give the decrypted plain text.

(2)

Encrypted text	Plain text
	

(Total for Question 3 = 14 marks)

4 A house has solar panels and a battery storage system.

(a) A smartphone application is used to monitor the battery storage system remotely. The smartphone uses a 5G connection.

(i) Give **two** benefits of a 5G connection.

(2)

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2 .....

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(ii) The application requires users to authenticate their identity.

One method of authentication is a user ID and password.

Describe **one other** method the application could use.

(2)

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(iii) Software developers perform code reviews.

Give **two** reasons for carrying out a code review.

(2)

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(b) The battery storage system stores readings as signed 8-bit binary integers in **sign and magnitude** format.

Complete the table to show the 8-bit binary pattern and denary value for the lowest and the highest values that can be stored.

(2)

	8-bit binary pattern	**Denary value**
Lowest value		
Highest value		

(c) The solar panels and battery storage system are controlled by a program.

(i) An LED is displayed when the system is on (**O**), the sun is shining (**S**), and the house is not using all the power (**P**) generated by the solar panels.

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

(3)

O	S	P	O AND S	NOT P	(O AND S) AND (NOT P)
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

(ii) The start-up instructions for the solar panels and battery storage system are stored in read-only memory (ROM).

Explain why the start-up instructions are stored in ROM.

(2)

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(Total for Question 4 = 13 marks)

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5 Smartwatches are a form of wearable technology.

(a) Embedded systems are used in smartwatches.

(i) A smartwatch has a step tracker that uses a built-in accelerometer sensor.

Complete the table by adding **one other** built-in sensor a smartwatch could use and its purpose.

(2)

Sensor	Purpose
Accelerometer	To measure body movement and step count

(ii) One characteristic of an embedded system in a smartwatch is that it uses sensors.

Give **two other** characteristics of an embedded system that make it suitable for use in a smartwatch.

(2)

1 .....

.....

2 .....

.....

(b) A software development team writes the software for a smartwatch using assembly language.

(i) Identify the purpose of an assembler.

(1)

☒ **A** To convert a low-level language into a high-level language

☒ **B** To convert low-level source code into machine code

☒ **C** To execute machine code

☒ **D** To translate a high-level language into a low-level language

(ii) Explain **one** benefit of writing the software for the smartwatch in a low-level language.

(2)

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(iii) Members of the software development team are computing professionals.

Give **two** ways that members of the team can demonstrate ethical behaviour.

(2)

1 .....

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2 .....

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(iv) The software for the smartwatch takes up 500,000 bytes of storage.

Identify the value that is equivalent to 500,000 bytes.

(1)

☒ **A** 0.5 MB

☒ **B** 500 KiB

☒ **C** 0.5 MiB

☒ **D** 5 MB

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(c) Wearable technology, such as smartwatches, has become very popular with many groups of people including athletes.

Discuss how the use of wearable technology can be a benefit to health.

(6)

(Total for Question 5 = 16 marks)

6 Algorithms can be represented using flowcharts or pseudocode.

(a) An algorithm has been designed to perform these steps:

- A user is asked to input a number **n**
- If the number **n** is 0 the program stops
- If the number **n** is positive a message to display 'Positive' is output
- If the number **n** is negative a message to display 'Negative' is output
- The program repeats until a value of 0 has been input.

Draw a flowchart to represent this algorithm.

(6)

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(b) **Figure 3** shows an algorithm written in pseudocode that performs a mathematical process.

```
01
02  RECEIVE number FROM (INTEGER) KEYBOARD
03
04  SET flag TO FALSE
05
06  IF number = 1 THEN
07     SET flag TO TRUE
08  ELSE
09     SET testNum TO 1
10     REPEAT
11        SET testNum TO testNum + 1
12        IF (number MOD testNum) = 0 THEN
13           SET flag TO TRUE
14        END IF
15     UNTIL (testNum = number) OR (flag = TRUE)
16  END IF
17
18  IF NOT (flag = TRUE)
19     SEND number TO DISPLAY
20  END IF
21
```

Figure 3

Trace tables are used to show the outputs from algorithms.

(i) Complete the trace table for an input of 7

(2)

number	flag	testNum	DISPLAY

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(ii) Complete the trace table for an input of 9

(2)

number	flag	testNum	DISPLAY

(iii) State the purpose of the algorithm.

(1)

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(iv) Lines 10 to 15 of the pseudocode in **Figure 3** use a post-conditioned loop.

Explain **one** reason why it is better for the algorithm to use a post-conditioned loop rather than a count controlled loop.

(2)

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(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 80 MARKS

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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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