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

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.
- Good luck with your examination.

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P 6 6 4 8 9 A 0 1 2 0

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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 Binary digits (bits) are grouped together to represent different types of data.

(a) Hexadecimal notation is sometimes used to represent patterns of binary digits.

Identify **one** reason why programmers use hexadecimal notation.

(1)

☒ **A** Easier for a computer to understand.

☒ **B** Easier for humans to read.

☒ **C** Takes up less computer memory.

☒ **D** Quicker than binary to execute.

(b) Convert the bit pattern 0101 1010 to hexadecimal.

(2)

(c) Identify the number of binary patterns that can be represented by 8 bits.

(1)

☒ **A** 128

☒ **B** 256

☒ **C** 512

☒ **D** 1024

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(d) Complete the table by adding these two 8-bit binary integers.

(2)

0	0	1	1	0	0	1	0
0	0	1	1	0	0	1	1

(e) Give the result of performing a logical left shift of 1 place on the binary integer 0100.

(1)

.....

(f) Give the number of bits per character used by standard ASCII.

(1)

.....

(g) **Figure 1** shows a black and white bitmap image.

The pixels in row 5 are represented by the binary pattern 1001 1001

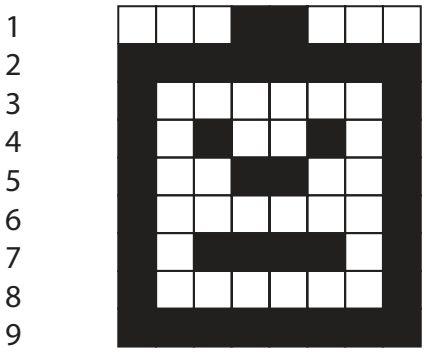

Figure 1

(i) State what is meant by the term **pixel**.

(1)

.....

(ii) Construct an expression to show the number of pixels in the image.

(1)

(iii) The image is changed so that any pixel can be one of 16 different colours.

State the minimum number of bits that would be needed to represent **one** pixel.

(1)

.....

(Total for Question 1 = 11 marks)

2 Many organisations use networks.

(a) One reason for networking computers is to share access to the internet.

Give **one other** reason for connecting computers in a local area network.

(1)

.....

.....

(b) State the purpose of network protocols.

(1)

.....

.....

(c) Data is transmitted in packets.

(i) Identify the layer of the TCP/IP model that would add the File Transfer Protocol (FTP).

(1)

☒ **A** Application

☒ **B** Data

☒ **C** Network

☒ **D** Transport

(ii) Give **one** task carried out by the network layer.

(1)

.....

.....

(d) Complete the table by adding a tick (✓) to match each item to its name.

(3)

Item	Domain Name	IP Address	URL
https://www.pearson.com			
216.33.251.195			
pearson.com			

(e) **Figure 2** shows a network topology.

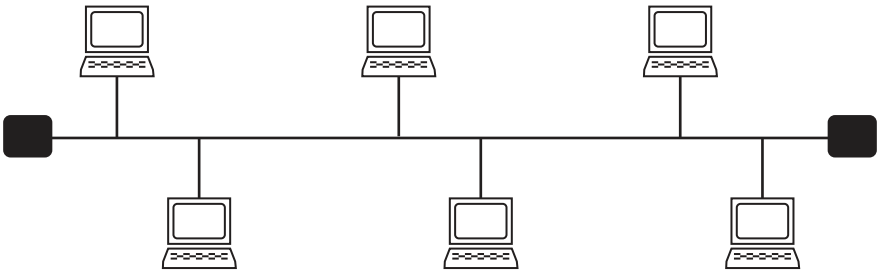

Figure 2

(i) State the name of this network topology.

(1)

.....

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

(1)

.....

.....

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

(1)

.....

.....

(f) Files may be compressed using lossless or lossy algorithms.

(i) Music files are distributed over the internet.

Give **two** reasons why lossy compression is used when distributing music files over the internet.

(2)

1 .....

.....

2 .....

.....

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(ii) Identify which **one** of these file formats uses lossy compression.

(1)

- ☒ **A** BMP
- ☒ **B** DOC
- ☒ **C** JPEG
- ☒ **D** PNG

(iii) Here is a string of data.

CCCWWWCCWWWWWWCCC

Give the result of compressing the string using a run-length encoding algorithm.

(1)

.....

.....

(g) A video file is to be transmitted over the internet.

- The network transmission speed is 54 Mbps.
- The file size is 6 gigabytes (GB).

Construct an expression to show how the transmission time, in seconds, is calculated.

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

(4)

(Total for Question 2 = 18 marks)

3 Zakir wants to buy a new laptop.

(a) He knows that a laptop has both hardware and software.

Explain why the laptop needs both hardware and software.

(2)

(b) Zakir needs to choose between a solid state drive and a hard disc drive.

(i) Give **two** reasons, other than cost and capacity, why Zakir may choose a solid state drive rather than a hard disc drive.

(2)

1

2

(ii) Solid state drives store data on flash memory, which is similar to RAM.

Explain **one** difference between flash memory and RAM.

(2)

(c) One of the laptops has 4 megabytes (MB) of cache memory.

Explain the purpose of cache memory.

(2)

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(d) Zakir uses many devices.

Complete the table by adding **one** tick (✓) in each row to show whether the device is an input device, an output device or both.

(2)

Device	Input	Output	Both
Headset			
Mouse			
Printer			
Touch screen			

(e) Zakir needs to protect his laptop against malware.

Give **two** types of anti-malware software he could install.

(2)

1 .....

2 .....

(Total for Question 3 = 12 marks)

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4 Scientists often use models and simulations.

(a) Give **one** reason, other than cost, why scientists use simulations.

(1)

.....

.....

(b) Explain **one** reason why a simulation may require a powerful processor.

(2)

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.....

(c) A scientist uses Boolean logic in programs.

Complete the table to show the results of each operation.

(3)

R	S	W	NOT S	R AND W	(NOT S) OR (R AND W)
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

(d) Von Neumann developed the stored program concept.

(i) Describe the **stored program concept**.

(2)

.....

.....

.....

.....

(ii) The fetch-decode-execute cycle is the cycle the central processing unit (CPU) follows in order to process instructions.

Name **two** registers used in the cycle.

(2)

1 .....

2 .....

(iii) Describe the role of the address bus and the data bus during the **fetch** part of the cycle.

(2)

.....

.....

.....

.....

(iv) Complete the table to show the effect on a computer system of increasing the width of a bus.

(2)

Change made	Effect
Increasing the width of the data bus	
Increasing the width of the address bus	

(Total for Question 4 = 14 marks)

5 Isaac is a program developer.

(a) **Figure 3** shows an algorithm Isaac has written.

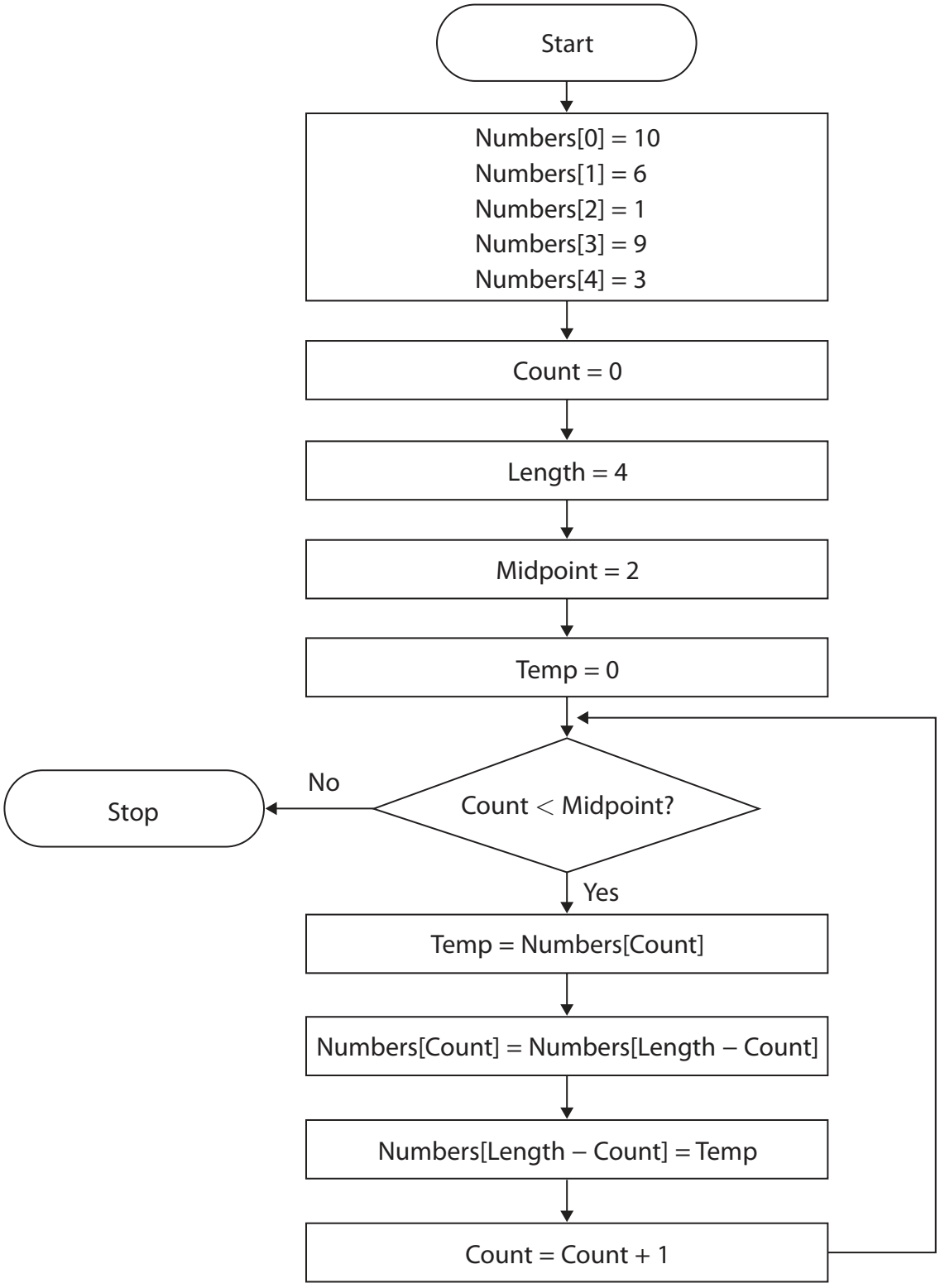

Figure 3

(i) Complete the trace table. You may not need to use all of the rows.

(5)

				Numbers array				
Count	**Length**	**Midpoint**	**Temp**	[0]	[1]	[2]	[3]	[4]
0	4	2	0	10	6	1	9	3

(ii) Give the purpose of the algorithm.

(1)

.....

.....

(iii) Explain why the variable Temp is needed.

(2)

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(b) **Figure 4** shows an algorithm Isaac has written using pseudocode.

The algorithm should display the average of the numbers that have been input.

```
1    SET total TO 0
2    SET number TO 0
3    SET count TO 0
4    WHILE number <> −1 DO
5        SEND 'Input a number or −1 to end the program' TO DISPLAY
6        RECEIVE number FROM (INTEGER) KEYBOARD
7        SET total TO total + number
8        SET count TO count + 1
9    END WHILE
10   SET average TO total / count
11   SEND 'The average is ' & average TO DISPLAY
```

Figure 4

Isaac uses the input 2, 3, 5, 2, −1 to test the algorithm. He discovers an error.

Expected result	Actual result
The average is 2.75	The average is 2.2

(i) Explain why the **Actual** result is not the same as the **Expected** result.

(2)

.....

.....

.....

.....

(ii) Give the number of the line that contains the error.

(1)

.....

(iii) Amend a single line of pseudocode to correct the error.

(1)

.....

(c) Isaac is going to sell one of his programs and distribute it on a DVD.

Give **two** advantages of choosing a programming language that uses a compiler, rather than an interpreter, for a program that will be distributed on a DVD.

(2)

1 .....

.....

2 .....

.....

(Total for Question 5 = 14 marks)

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6 (a) Two emerging technologies are DNA computing and quantum computing.

(i) Explain **one** difference between DNA computing and traditional computing.

(2)

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.....

(ii) Give a definition of the term **superposition** in quantum computing.

(1)

.....

.....

(b) Ethically, everyone should be able to access the benefits of technology.

Give **two** reasons why this may not be possible.

(2)

1 .....

.....

2 .....

.....

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(c) Widespread use of computer technology has a negative environmental impact.

Discuss the negative environmental impact of using computers and actions that could be taken to reduce it.

(6)

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 80 MARKS

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Paper reference **4CP0/01**

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 pseudocode on the following pages, 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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