

Paper reference 4CP0/02
Pearson Edexcel
International GCSE (9–1)

Total Marks

Computer Science
PAPER 2: Application of Computational
Thinking

Monday 5 – Wednesday 7 June 2023
Time: 3 hours

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

A computer workstation with appropriate programming language code editing software and tools, including a code interpreter/compiler, CODES folder containing code and data files, and pseudocode command set (enclosed)

YOU WILL BE GIVEN

Data Book.

INSTRUCTIONS

- **Answer ALL questions.**
- **Answer the questions REQUIRING A WRITTEN ANSWER in the spaces provided in this Question Paper or in the Data Book – there may be more space than you need.**
- **Only one programming language (Python, C# or Java) must be used throughout the examination.**

(continued on the next page)

Turn over

INSTRUCTIONS continued

- **Carry out practical tasks on the computer system and save new or amended code using the name given in the question with the appropriate file extension.**
- **Do NOT overwrite the original code and data files provided to you.**
- **You must not use the internet during the examination.**

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.**
- **This paper covers Python, C# and Java.**
- **The CODES folder in your user area includes all the code and data files you need.**
- **The invigilator will tell you where to store your work.**
- **There may be spare copies of some diagrams.**

ADVICE

- **Read each question carefully before you start to answer it.**
 - **Save your work regularly.**
 - **Check your answers if you have time at the end.**
-

Answer all questions.

Answer the questions requiring a written answer 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 ☐ .

Carry out practical tasks on the computer system and save new or amended code using the name given with the appropriate file extension.

(continued on the next page)

Use only ONE programming language throughout the examination.

Indicate the programming language that you are using with a cross in a box ☐ .

C#	<input type="checkbox"/>	Java	<input type="checkbox"/>	Python	<input type="checkbox"/>
-----------	--------------------------	-------------	--------------------------	---------------	--------------------------

(continued on the next page)

1. Programs are used to handle financial transactions.

(a) Monthly account statements are created by a program.

**Look at Figure 1 for
Question 1 (a) in the separate
Data Book.**

Figure 1 shows a statement.

**Look at the table for Question 1 (a)
in the separate Data Book.**

**Complete the table to identify
an input, an output and a process
used by the program to generate
the FURTHEST RIGHT COLUMN.
(3 marks)**

(continued on the next page)

Question 1 continued

- (b) A tax rate is applied to a gross value to give a net value.**

Open Q01b in the code editor.

USE THE CODE to answer these questions.

- (i) Give the contents of a comment.
(1 mark)**

- (ii) Identify a logical operator used in this program.
(1 mark)**

(continued on the next page)

Turn over

Question 1 (b) continued

**(iii) Give the name of a global variable.
(1 mark)**

**(iv) Give the name of a constant.
(1 mark)**

**(v) Give the name of a parameter.
(1 mark)**

(continued on the next page)

Turn over

Question 1 continued

(c) Variables and constants are used in program code.

**(i) State the purpose of a constant.
(1 mark)**

(continued on the next page)

Question 1 (c) continued

- (ii) Give ONE benefit of using
a constant.
(1 mark)**

(Total for Question 1 = 10 marks)

2. Solutions to problems are made up of many different components.

(a) Programmers use subprograms when developing code.

**(i) Give TWO reasons to use SUBPROGRAM LIBRARIES when developing code.
(2 marks)**

REASON 1 _____

REASON 2 _____

(continued on the next page)

Turn over

Question 2 (a) continued

**(ii) Identify which ONE of these must return a result.
(1 mark)**

☐

A Function

☐

B Iteration

☐

C Procedure

☐

D Selection

(continued on the next page)

Question 2 (a) continued

**(iii) State what is meant by the term LOCAL VARIABLE.
(1 mark)**

(continued on the next page)

Question 2 continued

(b) A school is planning a fish and chip dinner for the students and their families.

(i) Tickets are only sold to families.

A family is one to four adults and one to six children.

A program is being written to help manage ticket sales.

Look at the table for Question 2 (b) (i) in the separate Data Book.

Complete the table to show examples of normal, boundary and erroneous numeric test data for the program.

(3 marks)

(continued on the next page)

Turn over

Question 2 (b) continued

- (ii) The kitchen staff use a program to determine whether they have enough chips or how many more they need to order.**

Open Q02bii in the code editor.

There are FOUR errors in the code.

Amend the code to correct the errors.

Look at the test data for Question 2 (b) (ii) in the separate Data Book.

Use the test data to help you find the errors.

(continued on the next page)

Question 2 (b) (ii) continued

**Save your amended code
as 02biiFINISHED with the
correct file extension for the
programming language.
(4 marks)**

(Total for Question 2 = 11 marks)

3. Algorithms can be represented in flowcharts, pseudocode or program code.
- (a) Trace tables can be used with flowcharts or pseudocode.

Give TWO characteristics of a trace table.

(2 marks)

CHARACTERISTIC 1 _____

CHARACTERISTIC 2 _____

(continued on the next page)

Turn over

Question 3 continued

- (b) An algorithm has been written to validate numbers entered by the user.**

Look at Figure 2 for Question 3 (b) in the separate Data Book.

Figure 2 shows the pseudocode for the algorithm.

Look at the table for Question 3 (b) in the separate Data Book.

Complete the table to show the output for each set of inputs.

(3 marks)

(continued on the next page)

Question 3 continued

- (c) A program is required to calculate the result of raising one integer (the base) to the power of another (the exponent).**

Look at Figure 3 for Question 3 (c) in the separate Data Book.

Figure 3 shows a flowchart for the algorithm.

The program has these requirements:

- outputs meaningful error messages**
- outputs the final answer with the base and the exponent.**

(continued on the next page)

Question 3 (c) continued

Open Q03c in the code editor.

Write a program to implement the logic in the flowchart.

Do not add any further functionality.

Save your code as Q03cFINISHED with the correct file extension for the programming language.

(10 marks)

(Total for Question 3 = 15 marks)

4. Data is encoded for encryption and for identifying records in databases.

(a) A Caesar cipher is one method of encryption.

**(i) Look at the table for Question 4 (a) (i) in the separate Data Book. Complete the table to show the result of applying a Caesar cipher.
(2 marks)**

(continued on the next page)

Question 4 (a) continued

- (ii) Plaintext is encrypted using a Caesar cipher.**

Compare the ciphertexts produced for the plaintext GOLD by:

- a shift of -6 followed by a shift of $+8$**
 - a single shift of $+2$.**
- (2 marks)**

(continued on the next page)

Turn over

Question 4 (a) continued

(iii) Ann has written a Caesar cipher algorithm.

When the algorithm encrypts the plaintext **BYTE with a shift of +5 the result is **GVYJ**.**

This is incorrect.

**Explain the error.
(2 marks)**

(continued on the next page)

Turn over

Question 4 continued

- (b) A program is needed to create a key for a database.**

A user enters a two – letter word, a whole number and a decimal number.

The program must ensure the word is only two characters long.

The program must display an error message when the word is not two characters long.

A key is generated from the whole number, the reversed word and the whole number part of the decimal number.

(continued on the next page)

Question 4 (b) continued

Figure 4 below shows the input values and a valid key.

Figure 4

Enter a word: at

Enter a whole number: 12

Enter a decimal number: 7.89

12ta7

Open Q04b in the code editor.

Write the program.

**Do not add any further
functionality.**

**Save your code as Q04bFINISHED
with the correct file extension for
the programming language.**

(8 marks)

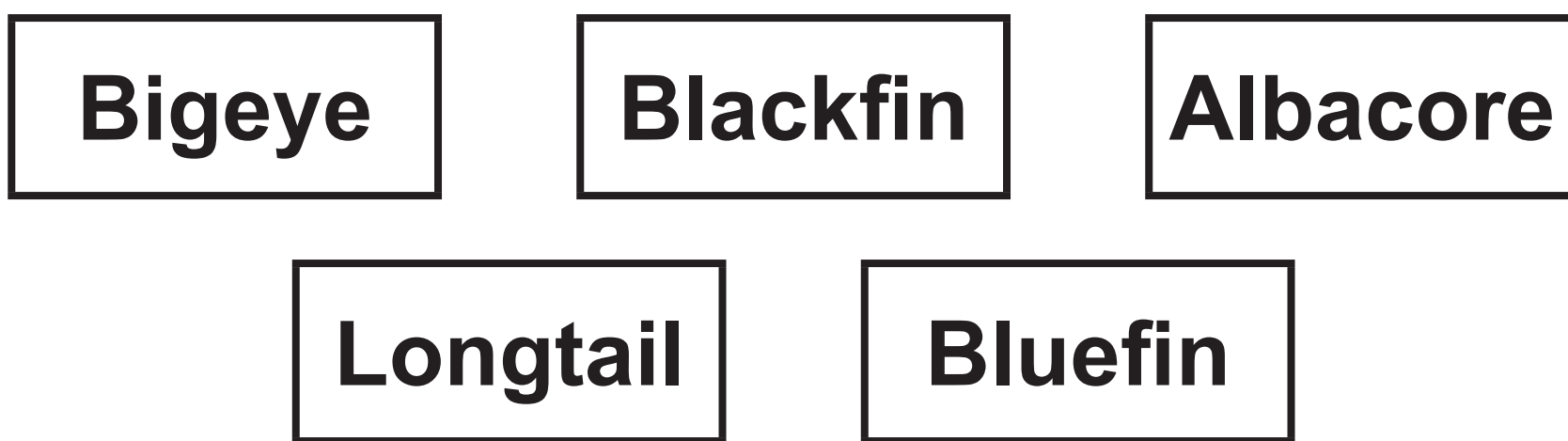
(Total for Question 4 = 14 marks)

5. A marine scientist is conducting a study of tuna in the world's oceans.

(a) A list of tuna species needs to be sorted into DESCENDING alphabetical order using a merge sort algorithm.

Figure 5 shows the lists created at the end of the splitting process. Each list is a single tuna species.

Figure 5



(continued on the next page)

Question 5 (a) continued

It will require three passes to merge the lists into a single sorted list in DESCENDING order.

On the blank space provided for Question 5 (a) in the separate Data Book, complete the merge sort.

(2 marks)

(continued on the next page)

Question 5 continued

- (b) A bubble sort could be used to sort the list of tuna species into ASCENDING order.**

Look at Figure 6 for Question 5 (b) in the separate Data Book.

Figure 6 shows an algorithm for a bubble sort.

There is an error in the loop between line 9 and line 16.

Look at the table for Question 5 (b) in the separate Data Book.

Complete the table to give the line number with an error and a corrected line of pseudocode.

(2 marks)

(continued on the next page)

Question 5 continued

- (c) The scientist is collecting and storing data about tuna.**

The data collected is:

- **species**
- **length in centimetres**
- **weight in kilograms**
- **age in years.**

The data is stored in an array.

**The collected data needs to be written to a file named
TUNADATA.TXT**

Each record stored in the file must have a code number in the first field.

Code numbers must start at 101

(continued on the next page)

Turn over

Question 5 (c) continued

Each field in a record should be separated by a comma.

Look at Figure 7 for Question 5 (c) in the separate Data Book. Figure 7 shows the contents of the file.

Open Q05c in the code editor.

Write the program.

You must use the structure given in Q05c to write the program.

Do not add any further functionality.

Save your code as Q05cFINISHED with the correct file extension for the programming language.

(6 marks)

(Total for Question 5 = 10 marks)

6. An agricultural college has a herd of dairy cows.

Data collected for the cows is stored in arrays.

The data stored is:

- **the name of the breed**
- **the ease of care rating for that breed (1 is highest and 3 is lowest)**
- **the number of cows in the herd of that breed**
- **the volume of milk per day for a cow of that breed.**

The college wants to present the data to farmers and to recommend the best breed of cows for them.

The best breed has the highest care rating and the largest volume of milk per day for a cow of that breed.

(continued on the next page)

Turn over

Question 6 continued

Open the file Q06 in the code editor.

Write a program to:

- **calculate the daily volume of milk produced by each breed**
- **add this daily volume to the data structure `tbl_dailyVolume`**
- **display a message informing the user what each field holds, such as breed, rating, volume per cow, count and total volume**
- **display the data for each breed**
- **calculate and display the total volume of milk produced each day by the herd**
- **find the recommended breed**
- **display the recommended breed by name.**

(continued on the next page)

Turn over

Question 6 continued

Look at Figure 8 for Question 6 in the separate Data Book.

Figure 8 shows the output from a functional program.

Your program should function correctly even if the number of breeds represented in the data is changed.

Save your amended code as Q06FINISHED with the correct file extension for the programming language.

You may use this space for planning/design work.

The content of this space will NOT be assessed.

(20 marks)

**Answer space continues on the next 3 pages
(continued on the next page)**

Turn over

Question 6 continued

Space for planning / design work.

Question 6 continued

Space for planning / design work.

Question 6 continued

Space for planning / design work.

(Total for Question 6 = 20 marks)

TOTAL FOR PAPER = 80 MARKS

END OF PAPER
