GradeMax

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 3 hours

Paper reference **4CP0/02**

Computer Science
PAPER 2: Application of Computational Thinking

You must have:
A computer workstation with appropriate programming language code editing software and tools, including a code interpreter/compiler, CODES folder containing code files, 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 **requiring a written answer** in the spaces provided
  – *there may be more space than you need*.
- Only **one** programming language (Python, C# or Java) must be used throughout the examination.
- 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 you need.
- The invigilator will tell you where to store your work.

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.
- Good luck with your examination.

Turn over ▶

Pearson

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.

Use only ONE programming language throughout the examination.

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

| C# | ⊠ | | Java | ⊠ | | Python | ⊠ |

1 Computer programs make use of many programming constructs.

(a) Identify which **one** of these is a logic operator.

(1)

⊠ **A** modulus

⊠ **B** OR

⊠ **C** >=

⊠ **D** =

(b) Describe **one** difference between a one-dimensional array and a two-dimensional array.

(2)

....

....

....

....

(c) Open **Q01c** in the code editor.

The program should calculate how many £20 are in £113 and how much is left over.

There are **three** errors in the code.

Amend the code to correct the errors.

Save your amended code as **Q01cFINISHED** with the correct file extension for the programming language.

(3)

(d) Raoul has written a program that counts the number of vowels in a sentence.

Open **Q01d** in the code editor.

Amend the code by adding a suitable comment (you may need to add more than one comment to a line):

(i) at the end of the line where there is a **relational operator**

(1)

(ii) at the end of a line where **iteration** starts

(1)

(iii) at the end of the line where **selection** starts

(1)

(iv) at the end of a line where a **data structure** is initialised.

(1)

Save your amended code as **Q01dFINISHED** with the correct file extension for the programming language.

(Total for Question 1 = 10 marks)
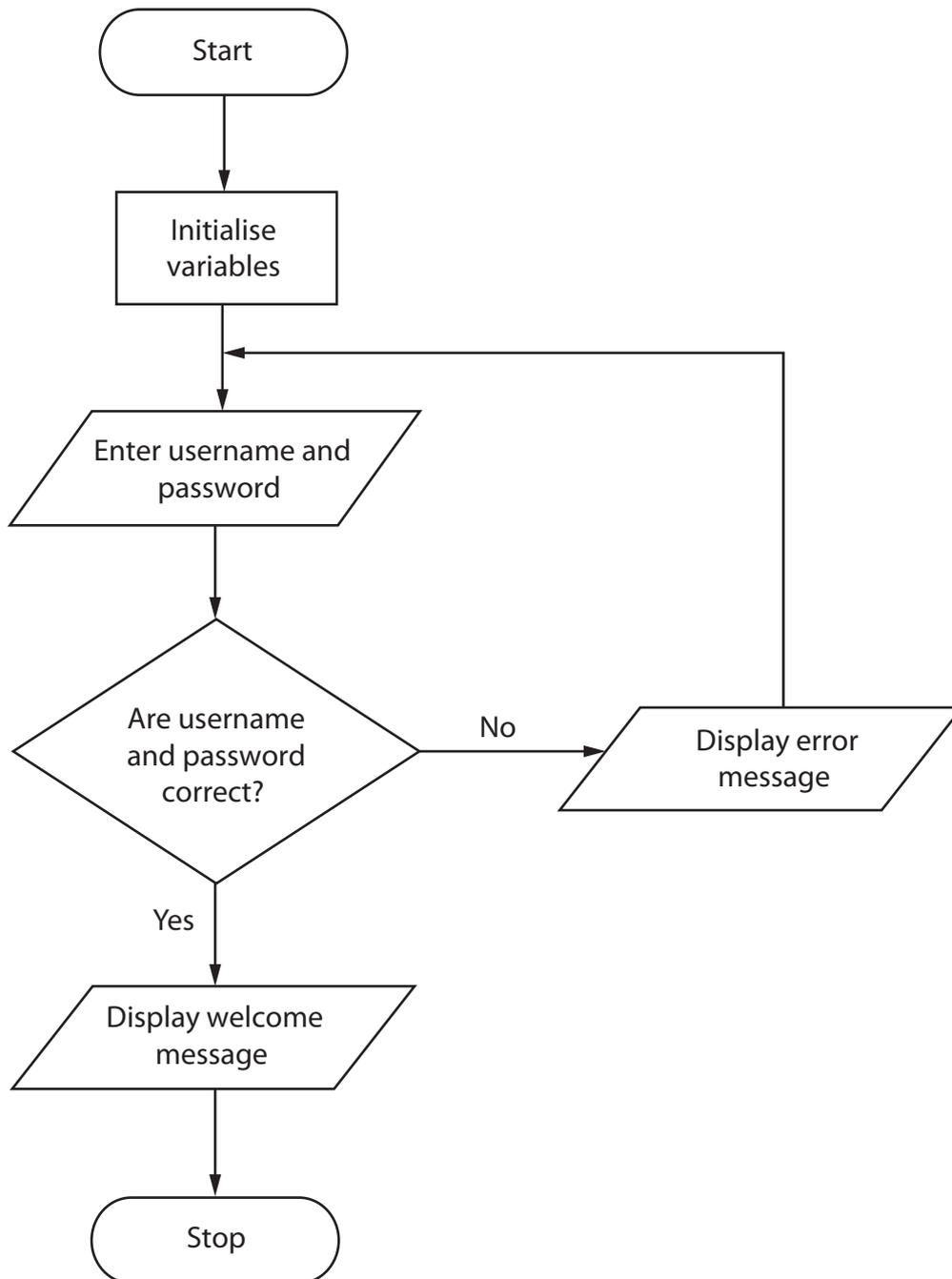
2 A book club uses computer applications.

(a) The club wants a program to ensure that logins are valid.

A flowchart for a test version of the program has been designed.

The test version uses:

• a username of bard423

• a password of nX2934?

Here is the flowchart.

```
                    ┌──────────────┐
                    │    Start     │
                    └──────┬───────┘
                           │
                           ▼
                    ┌──────────────┐
                    │  Initialise  │
                    │  variables   │
                    └──────┬───────┘
                           │           ◄───────────────────┐
                           ▼                                │
                    ╱──────────────╲                       │
                   ╱ Enter username ╲                      │
                   ╲  and password   ╱                     │
                    ╲────────┬───────╱                      │
                             │                              │
                             ▼                              │
                       ╱───────────╲                        │
                      ╱   Are user  ╲      No      ╱────────────────╲
                     ╱ name and pass ╲─────────── ╱  Display error   ╲
                     ╲ word correct? ╱            ╲    message        ╱
                      ╲─────┬───────╱              ╲─────────────────╱
                            │ Yes
                            ▼
                    ╱───────────────╲
                   ╱ Display welcome ╲
                   ╲    message       ╱
                    ╲───────┬────────╱
                            │
                            ▼
                    ┌──────────────┐
                    │    Stop      │
                    └──────────────┘
```

Write a program to implement the logic in the flowchart.

Open **Q02a** in the code editor.

You must use the structure given in **Q02a** to write the program.

Do not add any further functionality.

Save your code as **Q02aFINISHED** with the correct file extension for the programming language.

(11)

(b) The club sells books.

It needs a computer program to monitor:

- the number of books sold

- the amount of profit made.

Q02b provides a structure for the program.

Open **Q02b** in the code editor.

Amend the code to complete the If statement used to produce the outputs described in the table.

Condition	Output message
Number of books sold is at least 5 and profit made is at least 10	Sales and profit are good this week
Number of books sold is over 20 and profit made is at least 20	Sales and profit are excellent this week
Number of books sold is under 5 or profit made is under 5	Poor performance this week
All other inputs	Alert manager

Do not add any further functionality.

Save your code as **Q02bFINISHED** with the correct file extension for the programming language.

(4)

(c) Boundary testing is an important part of program development.

The boundary value is the most extreme value that will pass the test.

For example, if the boundary condition is no more than 30 then the boundary test data would be 30.

Complete the test table to show the boundary test data that could be used for each test.

(3)

		Test data	Expected output
booksSold			Poor performances this week
profit			
booksSold			Sales and profit are good this week
profit			
booksSold			Sales and profit are excellent this week
profit			

(Total for Question 2 = 18 marks)

3   Several encryption algorithms have been developed.

(a) Ahmed has started to create a Caesar cipher encryption program.

Caesar cipher encryption works by giving a number value to a key.

Each letter in a plaintext message is replaced by a new ciphertext letter using the key.

For example, as shown in the table, a key value of +2 would change the plaintext message **encrypt** to the ciphertext message **gpetarv**.

Plaintext	e	n	c	r	y	p	t
Ciphertext	g	p	e	t	a	r	v

Ahmed's program already converts from plaintext to ciphertext.

He wants to extend the program to:

•   accept the input of a plaintext message

•   accept the input of the key, which must be a positive integer between 1 and 25

•   write the generated ciphertext to a text file named **Cipher.txt**

•   display the ciphertext.

Open **Q03a** in the code editor.

Complete the program code.

You must use the structure given in the file **Q03a** to complete the program.

Do not add any further functionality.

Save your code as **Q03aFINISHED** with the correct file extension for the programming language.

(8)

(b) Explain **one** reason why the Caesar cipher is a weak encryption algorithm.

(2)

....

....

....

....

(c) The Vigenere cipher encrypts plaintext using a series of Caesar ciphers, based on the letters of a keyword and a Vigenere square.

Figure 1 shows a Vigenere square.

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
a	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
b	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a
c	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b
d	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c
e	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d
f	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e
g	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f
h	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g
i	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h
j	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i
k	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j
l	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k
m	m	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l
n	n	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m
o	o	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n
p	p	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
q	q	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
r	r	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
s	s	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
t	t	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s
u	u	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t
v	v	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u
w	w	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v
x	x	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w
y	y	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x
z	z	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y

Figure 1

Complete the table to perform a Vigenere decryption of the ciphertext message **flmktrwhee** using the keyword **thirty**.

(4)

Encrypted letter	f	l	m	k	t	r	w	h	e	e
Keyword letter	t	h	i	r	t	y	t	h	i	r
Decrypted letter	m	e	e	t	a	t	d	a	w	n

(d) A user-defined function uses a Vigenere cipher to encrypt plaintext into ciphertext.

This pseudocode shows how the function is called.

SET ciphertext TO ciphertext & getCipherLetter(keywordLetter, plaintextLetter)

(i) State what would be returned by this function.

(1)

....

....

(ii) Give the name of **one** parameter passed to this function.

(1)

....

(iii) State what is meant by a **built-in subprogram**.

(1)

....

....

(Total for Question 3 = 17 marks)

4 Zak sells snacks at an after-school club.

(a) He wants a program that will hold details of the products he sells.

The program must:

• generate a five-character product code that:

– starts with the first three letters of the product name

– ends with a random number between 10 and 30

• display the product code followed by the product name.

Open **Q04a** in the code editor.

Write the program.

You must use the structure given in the file **Q04a** to complete the program.

Do not add any further functionality.

Save your code as **Q04aFINISHED** with the correct file extension for the programming language.

(7)

(b) Zak plans to implement a binary search algorithm to search a table of products.

(i) Explain **one** advantage of a binary search compared to a linear search.

(2)

....

....

....

....

(ii) **Figure 2** shows an algorithm for a binary search.

```
1      #      Initialise variables
2      SET productSearch TO " "
3      SET startPosition TO 1
4      SET midPosition TO 0
5      SET endPosition TO LENGTH(productList)
6      SET found TO False
7
8      #      Print prompts, take and check input from user
9      SEND "Enter the product code" TO DISPLAY
10     RECEIVE productSearch FROM (STRING) KEYBOARD
11     REPEAT
12         midPosition = (startPosition + endPosition) DIV 2
13         IF productList[midPosition] < productSearch THEN
14             startPosition = midPosition + 1
15         END IF
16         IF productList[midPosition] > productSearch THEN
17             endPosition = midPosition – 1
18         END IF
19     UNTIL productList[midPosition] = productSearch OR startPosition = endPosition
```

Figure 2

This binary search algorithm will be used to search the product list for the product code **str15**.

Complete the table to indicate the order in which the product codes will be examined by the algorithm.

Write the number 1 by the first product code to be examined, 2 by the second code to be examined, and so on.

(4)

Position in list	Product code	Order examined
1	ark11	
2	asp11	
3	bar13	
4	dri15	
5	mil19	
6	rib10	
7	str15	
8	tor16	

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(iii) Zak has another list containing the names of five students who attend the after-school club.

Give the maximum number of names that would need to be examined by the binary search algorithm to determine whether a name appears in the list.

(1)

....

(iv) Give the name of an algorithm that could be used to sort a list.

(1)

....

(Total for Question 4 = 15 marks)

5 Bianca has started to write a program.

The program is a guessing game about countries and their capital cities.

Open **Q05** in the code editor.

The program already:

*   displays this menu

```
                        Menu
-------------------------------------------
[1] Add player name
[2] Play guess the capital city
[3] End game
-------------------------------------------
Input your menu choice: |
```

*   asks for the user's menu choice.

Write the program code for the menu choices.

Menu choice [1] Add player name

If a player chooses this option, then they must input a player name.

Menu choice [2] Play guess the capital city

If a player chooses this option, then:

*   they must answer five questions

*   they select a question to answer by choosing a valid question number

*   each question can only be selected once (they must not be able to choose a number more than once)

*   the question should be displayed

*   they must input the name of the capital city

*   if they guess correctly their score must be incremented by 1

*   if they guess incorrectly the correct answer must be displayed.

Menu choice [3] End game

If the user chooses this option, then the player name and score should be displayed.

Your program should function correctly even if the number of countries and capital cities in the file is increased.

Save your code as **Q05FINISHED** with the correct file extension for the programming language.

(20)

You may use this space for planning / design work.

The content of this page will **not** be assessed.

(Total for Question 5 = 20 marks)

TOTAL FOR PAPER = 80 MARKS

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