

# INTERNATIONAL GCSE

## Computer Science (9-1)

EXEMPLARS WITH EXAMINER COMMENTARIES

PAPER 2

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Pearson Edexcel International GCSE in Computer Science (4CP0)

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# Introduction

## 1.1 About this booklet

This booklet has been produced to support teachers delivering the Pearson Edexcel International GCSE in Computer Science specification. The Paper 2 exemplar materials will enable teachers to guide their students in the application of knowledge and skills required to successfully complete this course. The booklet looks at questions 1(c), 1(e), 1(f), 1(g), 2(a), 2(b)(iii), 2(c)(v), 2(c)(vi), 3(a), 3(b), 3(c), 4(c) and 5 from the June 2019 examination series, showing real candidate responses to questions and how examiners have applied the mark schemes to demonstrate how student responses should be marked.

## 1.2 How to use this booklet

Each example covered in this booklet contains:

- Question
- Mark scheme
- Exemplar responses for the selected question
- Example of the marker grading decision based on the mark scheme, accompanied by examiner commentary including the rationale for the decision and where relevant, guidance on how the answer can be improved to earn more marks.

The examples highlight the achievement of the assessment objectives at lower to higher levels of candidate responses.

Centres should use this content to support their internal assessment of students and incorporate examination skills into the delivery of the specification.

## 1.3 Further support

A range of materials is available from the Pearson qualifications website to support you in planning and delivering this specification.

Centres may find it beneficial to review this document in conjunction with: the [specification](#), [sample assessment materials](#), [Getting Started Guide](#) and the Principal Examiner's Report.

## Question 1(c)

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

The program should print out a counter and the counter with 7 added to it.

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.

## Mark scheme

### C#

1. Semicolon at the end of line 9 [maxValue=5;] (1)
2. Consistent capitalisation of 'count' on lines 10, 11, 13 and 14 (1)
3. constantValue needs to be defined and given the value 7 / replaced by value 7 (1)

### Java

1. Semicolon at the end of line 8 [maxValue = 5;] (1)
2. Consistent capitalisation of 'count' on lines 7, 9, 11 and 12 (1)
3. constantValue needs to be defined and given the value 7 / replaced by 7 (1)

### Python

1. Colon needed at end of line 7 [count, maxValue:] (1)
2. Consistent capitalisation of 'count' on line 3, 7, 8 and 9 (1)
3. constantValue needs to be defined and given the value 7 / replaced by 7 (1)

Candidates are required to open the file Q01c in the code editor.

Amended code should be saved as Q01cFINISHED.

Line numbers may have been changed by corrections to code (e.g. insertion of constantValue definition)

## Exemplar response A

Q01cFINISHED.py - 10 lines, 110 bytes

```
# Q01c

count = 0

maxValue = 5

while count < maxValue:
    print ("count 7")
    count = count + 5
```

### Examiner's comments:

**This response was given 2 marks.**

This response gains the first two marks using Python for:

- adding the colon after 'count < maxValue'
- changing all instances of the variable 'count' to have the same capitalisation

Candidate did not gain the third mark because they have deleted the variable 'constantValue' and have not initialised or replaced it with the value 7.

## Exemplar response B

```
10  {
11      static void Main(string[] args)
12  {
13      int maxValue = 5; //A syntax error was found: it should end
14      int count = 0;
15      int constantValue = 7; // constantValue needs to be
16      while (count < maxValue)
17      {
18          Console.WriteLine(count + " " + count + constantValue
19          ); //count with a capital 'c' will not be found in the
20          program; this is a syntax error.
21          count = count + 1;
22      }
23      Console.ReadLine();
24  }
```

### Examiner's comments:

**This response was given all 3 marks.**

This response (submitted in C#) gained all three marks. The added comments were not necessary to gain the marks.

- Semicolon after 'int maxValue = 5' on line 13
- Replacing the upper case 'c' for 'count' on line 18
- Defining the value for the variable 'constantValue' on line 15

The line numbers in the mark scheme refer to the original line numbers in the given data file.

## Question 1(e)

(e) Describe the difference between a local variable and a global variable in a computer program.

### Mark scheme

1. Global variables created in the main program / can be accessed from any part of the program / are in scope throughout the program (1)
2. Local variables are declared/created inside a function/blocked code (indented, brackets) and are only accessible there / are only in scope within the function in which they're declared (1)

### Exemplar response A

A local variable is only able to be used within the object it is created in, whereas global variables are visible by all objects throughout.

### Examiner's comments:

**This response was given 2 marks.**

The response was given the benefit of the doubt for both marks. There is some understanding of the difference and the candidate has indicated that a local variable is only used within a section of code whereas the global variable is available throughout the code.

## Exemplar response B

A local variable is created inside a clause or loop and cannot be called outside of that clause or loop. A global variable, on the other hand can be called anywhere in the code.

### Examiner's comments:

**This response was also given 2 marks.**

This is a better response to the question, clearly indicating a fuller understanding of the difference in the two types of variable.

## Question 1(f)

(f) Trevor is the manager of a shoe shop.

Sales assistants can earn a bonus based on the numbers of pairs of shoes they sell and the total income for the shop each day.

Open **Q01f** in the code editor.

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

Condition	Output
Shop income is more than £5000 or sales assistant has sold at least 10 pairs of shoes	Bonus is 10% of salary
Shop income is £2000 or more and sales assistant has sold at least 5 pairs of shoes	Bonus is 5% of salary

Do not add any further functionality.

Save your amended code as **Q01fFINISHED** with the correct file extension for the programming language.

## Mark scheme

Award 1 mark for **each** correct pair of relational operators and 1 mark for correct Boolean operator for **each** condition.

Condition	Coding
Shop income more than £5000 or assistant sold at least 10 pairs	<u>shopIncome &gt; 5000; assistantSales &gt;= 10</u> (1) correct <b>OR</b> operator (1)
Shop income at least £2000 and assistant sold at least 5 pairs	<u>shopIncome &gt;= 2000; assistantSales &gt;= 5</u> (1) correct <b>AND</b> operator (1)

Accept >9, >1999 and >4 for respective >= comparisons

Candidates are required to open the file Q01f in the code editor. Amended code should be saved as Q01fFINISHED.

Do not penalise candidates who attempt more than the stated requirements.

Do not award Boolean operator mark for single | or & as these are not correct.

## Exemplar response A

```
17      if ( shopIncome > 5000 || assistantSales >= 10 )
18      {
19          System.out.println("Assistant bonus = " + assistantSalary * 0.1);
20      }
21
22      else if ( shopIncome > 2000 & assistantSales >= 5 )
23      {
24          System.out.println("Assistant bonus = " + assistantSalary * 0.05);
25      }
26
27      else
28      {
29          System.out.println("Assistant bonus = " + 0);
30      }
```

### Examiner's comments:

**This response was given 2 marks.**

This response (using Java) was given one mark for the first pair of relational operators (shopIncome > 5000, assistantSales >=10) and one mark for the 'OR' logical operator (||). The first half of the second pair of relational operators '>2000' is incorrect and the logical operator is the incorrect BITWISE AND ('&') not the '&&' operator.

## Exemplar response B

```
if (shopIncome > 5000 or assistantSales >= 10):
    print ("Assistant bonus = ", assistantSalary * 0.1)

elif (shopIncome >= 2000 and assistantSales >= 5 ):
    print("Assistant bonus = ", assistantSalary * 0.05)
```

### Examiner's comments:

**This response was given 4 marks.**

This response was created using Python. The candidate has given the correct relational operators for each condition ('shopIncome>5000', 'assistantSales>=10', 'shopIncome>=2000', 'assistantSales>=5') and also the correct logical operators ('or', 'and').

The candidate therefore gained all four marks.

## Question 1(g)

(g) Car registration codes consist of seven characters.

The characters are two upper case letters followed by two numbers and then three upper case letters.

YH62KLV, EY09VPB and CK53PRJ are valid codes.

All codes need to be validated.

Complete the table to show **two** additional validation tests.

For each test give **one** example of erroneous data. The example that you give should fail **only** that test.

(4)

Validation test	Erroneous data
Is it 7 characters?	AB12CD

### Mark scheme

For up to **two** tests  
Award 1 mark for an appropriate validation test and 1 mark for an item of test data that would fail **only** the given test

Validation test	Erroneous data
Are the first two characters letters/upper case letters?	1234CCC
Are the third- and fourth- characters numerical digits?	CCCCBBB
Are the last three characters letters/upper case letters?	CC12345

Each test should target a different feature of one of the requirements

- Exactly 7 characters (in the stem)
- First two characters are letters / upper case letters
- Characters 3 & 4 are numeric
- Last three characters are letters / upper case letters

### Exemplar response A

Validation test	Erroneous data
Is it 7 characters?	AB12CD
Does it start with 2 uppercase letters?	ab12CDE
Does it contain 2 numbers?	AB123CD

### Examiner's comments:

**This response was given 2 marks.**

Candidates were expected to provide validation tests that could be implemented in simple code. The first response does this and supplies erroneous data that only fails this test. The second response is too vague. The erroneous data would also fail more than one test of the requirements.

## Exemplar response B

Validation test	Erroneous data
Is it 7 characters?	AB12CD
Are first two characters upper case letters?	ab12CDF
Are 3 <sup>rd</sup> and 4 <sup>th</sup> characters numbers?	<del>AB12CDF</del> ABQRCD

### Examiner's comments:

**This response was given 4 marks.**

The candidate has identified two good validation tests that target the criteria given in the question. The erroneous data presented would only fail the tests specified. Therefore, all four marks were awarded.

## Question 2(a)

(a) Anna wants to program a guessing game for Beatrice to play on the computer.

The program will generate a random number between 1 and 10.

Beatrice has to guess the number.

This pseudocode contains the logic required to create the game.

```
1 # Initialise variables
2   SET counter TO 1
3   SET answer TO RANDOM(9) + 1 # i.e. a random integer 1 to 10 inclusive
4   SET guess TO 0
5
6 # Print prompt and take guess from user
7   SEND "Enter a number from 1 to 10: " TO DISPLAY
8   RECEIVE guess FROM (INTEGER) KEYBOARD
9
10 # Create while loop to check guess
11  WHILE guess <> answer DO
12    SET counter TO counter + 1
13    IF guess > answer THEN
14      SEND (guess & " was too high. Try again.") TO DISPLAY
15    ELSE
16      SEND (guess & " was too low. Try again.") TO DISPLAY
17    END IF
18    SEND "Guess again: " TO DISPLAY
19    RECEIVE guess FROM (INTEGER) KEYBOARD
20  END WHILE
21
22 # Report the correct answer to the user and display the number of guesses
23  SEND ("You guessed " & guess & " in " & counter & "guesses.") TO DISPLAY
```

Write a program to implement the logic in the pseudocode.

Open **Q02a** in the code editor.

You **must** use the structure give 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.

## Mark scheme

Award 1 mark for each of:

1. set counter to 1 and guess to 0 (1)
2. set answer to random value between 1 and 10 (1)
3. request input of and accept an integer value for guess (1)
4. create a while loop with a correct condition (1)
5. increment the counter (1)
6. use if else selection to determine and display appropriate output message for incorrect guesses (1)
7. request input of and accept another integer value for a guess inside the loop (1)
8. display correct guess and count of guesses (1)
9. compiling without syntax errors (1)
10. coding meets all requirements of question (1)

Candidates are required to open the file Q02a in the code editor.

Amended code should be saved as Q02aFINISHED.

Logic of algorithm must be followed as set out.

Alternatives must address each point.

Do not penalise candidates who attempt more than the stated requirements.

## Exemplar response A

```
# Q02a

from random import *

# Initialise variables
counter = 1
answer = random = (9) +1
guess = 0

# Print prompt and take guess from user
guess = int(input("Enter a number from 1 to 10: "))

# Create WHILE loop to check if guess is correct
while int(guess) != int(answer):
    counter = counter + 1
    if int(guess) > int(answer):
        print(str(guess) + " was too high. Try again.")
    else:
        print(str(guess) + " was too low. Try again.")
        guess = input("Guess again: ")

# Report the correct answer to the user and indicate the number of guesses
print("You guessed " + str(guess) + " in " + str(counter) + " guesses")
```

### Examiner's comments:

#### This response was given 7 marks.

It is expected that candidates will be taught how to convert the pseudocode given in Appendix 5 of the specification into one of the three available programming languages. The task here was to translate pseudocode into the programming code of their choice. This candidate used the Python language.

The mark point 2, 7 and 10 were not awarded:

Mark point 2: the candidate has not generated a random number with the correct syntax.

The value assigned to the variable 'answer' in this code is the constant value 10 [(9) +1] and not a random number.

Mark point 7: the candidate has produced code that has not requested an integer input when the guess is incorrect.

Mark point 10: the program does not produce the expected output in that the only value available for 'answer' is 10.

## Exemplar response B

```
11 static void Main(string[] args)
12 { // Initialise variables
13     int counter = 1;
14     Random Rnd = new Random();
15     int answer = Rnd.Next(1, 10);
16     int guess = 0;
17     // Print prompt and take guess from user
18     Console.WriteLine("Enter a number from 1 to 10");
19     guess = Convert.ToInt32(Console.ReadLine());
20
21     // Create WHILE loop to check if guess is correct
22     while(guess != answer)
23     {
24         counter = counter + 1;
25
26         if(guess > answer)
27         {
28             Console.WriteLine(guess + " was too high. Try again.");
29         }
30         else
31         {
32             Console.WriteLine(guess + "Was too low. Try again.");
33         }
34         Console.WriteLine("Guess again:");
35         guess = Convert.ToInt32(Console.ReadLine());
36     }
37
38     // Report the correct answer to the user and indicate the number of guesses
39     Console.WriteLine("You guessed" + guess + "in" + counter + "guesses.");
40     Console.ReadLine();
41
42 }
```

### Examiner's comments:

**This response was given 9 marks.**

The candidate has used C# to encode the pseudocode in this example.

The candidate has produced a working solution. Mark point 10 was not gained because in running the program, the display of the result has no spacing when the correct guess is made. It is important to check that the code not only works correctly but also displays any results in an effective way.

## Question 2(b)(iii)

(iii) State the data type for the variable <b>distance</b> . Justify your answer.
Data type
Justification

### Mark scheme

Real (1) Because real x integer = real (1)	Accept double / float Accept 'because it could be a number with decimal places'
---	--

### Exemplar response A

Data type float
Justification It is a number with decimal places, returns 24.0 when "distance" is printed.

### Examiner's comments:

**This response was given 2 marks.**

The candidate has given an answer which is acceptable but not strictly correct. 'Float' is not a data type (as identified in the specification) but is defined within programming languages. The 'number with decimal places' was also accepted. A better response would have been that when a real number is multiplied by an integer the result is a real number.

## Exemplar response B

Data type
real
Justification
It has decimals

### Examiner's comments:

**This response was given 2 marks.**

The candidate has identified the correct data type. Credit was also given for the justification. A better response would have referred to the definition that a real variable is obtained when an integer is multiplied by an integer.

## Question 2(c)(v)

(v) State the value returned by the subprogram when the input values are **educational, 3, 6**

### Mark scheme

Response starts with 'c' (1)

Response has six letters in sequence from 'educational' (1)

Marks can be awarded from Q2(c)(vi)

### Exemplar response A

(v) State the value returned by the subprogram when the input values are **educational, 3, 6**

cati

#### Examiner's comments:

**This response was given 1 mark.**

The candidate gained 1 mark for identifying that the value started with the letter 'c'. The candidate does not gain the second mark as the response has only given the characters from the fourth to seventh positions (values 3 – 6 in the code).

### Exemplar response B

(v) State the value returned by the subprogram when the input values are **educational, 3, 6**

cation

#### Examiner's comments:

**This response was given 2 marks.**

The candidate gains both marks for a correct response.

## Question 2(c)(vi)

(vi) State the purpose of the subprogram.

### Mark scheme

<ol style="list-style-type: none"><li>Returns substring / crops a string (1)</li><li>Located between the two input values / with number of characters identified in the last parameter (characters) and starting at the second parameter (startPos) (1)</li></ol>	<p>Award two marks for: It produces a substring of the message starting at position startPos with length characters Award up to 2 marks for a correct interpretation of the code (e.g. 'obtain a newMessage' - is worth 1) Accept a correct generic explanation of what a subprogram does for 1 mark</p>
---	--

### Exemplar response A

(vi) State the purpose of the subprogram. (2)

To cut off letters of the word user has entered. E.g. For the input of Educational, 3, 6 the output becomes 'cation'.

### Examiner's comments:

**This response was given 1 mark.**

One mark was awarded for the words 'to cut off letters of the word user has entered' as being equivalent to 'crop a string'. No further credit could be awarded for part (vi) as the candidate has not explained how the cropping has been enacted.

If the candidate had not been awarded full marks for a response in 2(c)(v) (see above), then the 2 marks could be awarded for that item from the response 'cation' in this item.

## Exemplar response B

To give you a slice of an entered string. Based on the numbers you input, the starting index of a char and the length of the slice <sup>are</sup> ~~is~~ determined.

### Examiner's comments:

**This response was given 2 marks.**

This response gains both marks for identifying that the subprogram slices (= crops) a string based on the entered values for the starting position and length of the slice.

## Question 3(a)

(a) **Email.txt** contains a list of email addresses.

Open **Q03a** in the code editor.

Write a program to implement these requirements.

The code must:

- check each email address to ensure it contains the '@' symbol.
- write email addresses that do not contain the '@' symbol to an **Error.txt** file.

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

Do not add further functionality.

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

## Mark scheme

Award 1 mark each for:

1. File opened for input (1)
2. File opened for output (1)
3. Loop for processing data (1)
4. Check for '@' symbol (1)
5. Write invalid address to output file (1)
6. Close files (1)

Amended code should be saved as Q03aFINISHED.

Do not penalise candidates who attempt more than the stated requirements.

## Exemplar response A

```
1 # Q03a
2
3 # Open the file and input data
4 file = open("Email.txt", "r")
5 file.open("Email.txt", "r")
6
7 # Open output file
8 outputFile = open("Error.txt" , "w")
9
10 # Find errors and write to output file
11 for email in range(len(Email)):
12     if email != "@":
13         outputFile.write(email)
14
15 # Close files
16 file.close()
17 outputFile.close()
18
```

### Examiner's comments:

**This response was given 5 marks.**

This candidate has used Python for the coding response.

Marks were awarded for the clip as follows:

- Mark point 1: awarded for code on line 4. Line 5 was ignored – though it generates an error condition
- Mark point 2: awarded for code on line 8
- Mark point 3 was not awarded as the candidate has not looped through the list of emails. (Also, the code on line 11 causes an error condition as the variable 'Email' is not defined.)
- Mark point 4: awarded for code on line 12 for an attempt to check whether the character was the '@' symbol
- Mark point 5: was awarded for correct code on line 13 to write to the output file
- Mark point 6: was awarded for the code on lines 16 & 17 for correct syntax for closing the files.

## Exemplar response B

```
9  {
10 public static void main(String[] args) throws IOException
11 // you may amend the throws FileNotFoundException if you wish
12 {
13     // Open the input file
14     FileReader fReader = new FileReader("Email.txt");
15     BufferedReader bReader = new BufferedReader(fReader);
16     // Open the output file
17     FileWriter fWriter = new FileWriter("Error.txt", true);
18     BufferedWriter bWriter = new BufferedWriter(fWriter);
19     // Find errors and write to output file
20     String line = "";
21     while((line = bReader.readLine()) != null)
22     {
23         if(!(line.contains("@")))
24         {
25             bWriter.write(line);
26             bWriter.write("\n");
27         }
28     }
29     // Close files
30     bReader.close();
31     fReader.close();
32     bWriter.close();
33     fWriter.close();
34 }
35 }
```

### Examiner's comments:

**This response was given 6 marks.**

This candidate has responded using Java.

Marks were awarded for the clip as follows:

- Mark point 1: for code on line 14
- Mark point 2: for code on line 17
- Mark point 3: for code on line 21
- Mark point 4: for code on line 23
- Mark point 5: for code on line 25
- Mark point 6: for code on lines 30 to 33.

Whilst some of the coding was not necessary, not all of it was incorrect and the program worked without errors.

## Question 3(b)

(b) Explain **one** drawback of using the merge sort algorithm to sort large data sets.

(2)

### Mark scheme

More memory/storage required (1)  
Because not sorted in place / not efficient / many steps /  
division of data set / is recursive (1)

### Exemplar response A

(2)  
The bigger the data, the more splits must be done before each merge, which is just inefficient in larger quantities.

#### Examiner's comments:

**This response was given 1 mark.**

This response identified that there must be many splits (=steps) and inefficiency but these are the same marking points and there is no reference to the memory storage needs of the merge sort algorithm.

### Exemplar response B

Merge sort algorithms need to store and process the split arrays. Thus, as the data set becomes larger the memory requirement and time increases making it inefficient.

#### Examiner's comments:

**This response was given 2 marks.**

This response identified that merge sort algorithms have a large memory requirement due to storing the many split arrays. It commented on the inefficiency of the process.

## Question 3(c)

Open **Q03c** in the code editor.

Write a program to display the square and cube of a number between 1 and 50 entered by a user.

The code must:

- ask the user to enter a number between 1 and 50 inclusive
- display the number, the square of the number and the cube of the number, with appropriate labels
- stop when a number outside the range 1 to 50 is entered.

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

## Mark scheme

Award 1 mark for each section of code that:

1. Asks for input of a number and stores it in a variable with a meaningful name (1)
2. Checks number is between 1 and 50 (1)
3. Calculates square and cube of number (1)
4. Displays suitable labels e.g. 'Number', 'Square' and 'Cube' and relevant values (1)

For the whole code:

5. Compiles and runs without logical or syntax errors (1)
6. Efficient in terms of computation, storage and selection of programming constructs (1)

Amended code should be saved as Q03cFINISHED.

Allow follow through for mark point 4 when square and cube are incorrectly calculated.

Credit alternative coding which produces same results.

Accept use of exponent operators:

C#	e.g. <code>Math.Pow(2, 3) = 8</code>
Java	e.g. <code>Math.pow(2, 3) = 8</code>
Python	e.g. <code>2**3 = 8</code> .

## Exemplar response A

```
1 # Q03c
2
3 # Write your code below this line
4 number=input("Enter a number between 1 and 50: ")
5 square=(int(number)/2)
6 cube=(int(number)/3)
7 if int(number)>50:
8     print("Out of range")
9 else:
10    print("your original number is",number,"and its square number is",
11         square,"along with its cube been",cube)
```

### Examiner's comments:

**This response was given 3 marks.**

This response used Python. Marks for the code were awarded as follows:

Mark point 1: code on line 4

Mark point 2: not awarded as the input value is not checked for being between 1 and 50

Mark point 3: not awarded as the calculations are incorrect (i.e. not the square and cube of the input value but a half and a third)

Mark point 4: awarded for code to print out the results of their code (follow through for incorrect values produced)

Mark point 5: code produces logical errors (i.e. unexpected results)

Mark point 6: was awarded for efficiency and use of constructs in coding.

## Exemplar response B

```
5 {
6     public static void main(String[] args)
7     {
8         Scanner scan = new Scanner(System.in);
9         System.out.println("Please enter a number between 1 and 50 inclusive:");
10        int number = Integer.parseInt(scan.nextLine());
11        if(check(number))
12        {
13            int square = power(number,2);
14            int cube = power(number,3);
15            System.out.println("The square of " + number + " is " + square + " and the cube of
16            " + number + " is " + cube);
17        }
18        else
19        {
20            System.out.println("That was not a valid number");
21        }
22    }
23    private static boolean check(int number)
24    {
25        if(number >= 1 & number <= 50)
26        {
27            return true;
28        }
29        return false;
30    }
31    private static int power(int number,int power)
32    {
33        int result = number;
34        for(int i = 1;i<power;i++)
35        {
36            result = number * result;
37        }
38        return result;
39    }
40 }
41 }
```

### Examiner's comments:

**This response was given 6 marks.**

This response has used Java. Marks for the code were awarded as follows:

- Mark point 1: awarded for the code on line 10
- Mark point 2: awarded for the code in the subroutine in lines 23 to 29
- Mark point 3: awarded for the code in the subroutine in lines 32 to 39
- Mark point 4: awarded for the code on line 15
- Mark point 5: awarded because there were no errors in the code
- Mark point 6: awarded because the code is effective and uses good programming constructs. The use of subroutines was not required but shows good awareness of possible expansion of the code to easily produce other powers of the value.

## Question 4(c)

(c) Figure 2 shows another grid.

C	O	M	A	B	D	L	N	Q
P	U	T	F	G	H	V	W	X
E	R	S	I	J	K	Y	Z	

Figure 2

State whether this set of symbols meets the requirements of a Pigpen cipher.

Justify your answer.

(3)

State

Justification

### Mark scheme

One mark for correct decision:

Yes (1)

Up to two marks for the correct justifications:

Each/every letter has a symbol / is represented (1)

The symbol is a single/unique representation (1)

Award marks independently

### Exemplar response A

State	Yes
Justification	This is because all the letters of the alphabet are displayed so one can make any combination with them. The Pigpen cipher doesn't necessarily have to be in a certain order.

### Examiner's comments:

**This response was given 2 marks.**

This response indicated that the set of symbols met the requirements. The explanation is partly correct because all the letters are displayed but it did not clearly point out that all the symbols are unique for each letter.

### Exemplar response B

State

Yes

Justification

Every letter receives its own unique symbol to represent it, as well as there being no clashes in symbol ownership as well.

**Examiner's comments:**

**This response was given 3 marks.**

The response correctly indicated that the set of symbols met the requirements of the Pigpen cipher. It also indicated that every letter is present and that the symbols are unique.

## Question 5

Ria is a school librarian.

She wants a program to analyse pupil use of the library.

She wants to encourage reading by awarding gold, silver and bronze medals to the three pupils who have read the most books.

Test data has been included in the code.

Open **Q05** in the code editor.

Write a program to calculate and display:

- the total number and average number of books pupils have read
- the IDs of pupils who have read fewer than ten books
- the details of the gold, silver and bronze medal winners.

**Your program should function correctly even if the number of pupils in the file is changed.**

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

## Mark scheme

The mark scheme is made up of two sections. The first section is points marked with marking points specific to the question asked in that series. The second section is a levels-based mark scheme covering an overview of the response. For this series the points-based marks were:

Designated marks: <ol style="list-style-type: none"><li>1. Initialise variables for at least two of total number of books, count of pupils and average</li><li>2. Initialise variables for gold, silver and bronze / sort array in order of books read</li><li>3. Create loop for identifying (and printing) those borrowing fewer than 10 books</li><li>4. Print out appropriate details (must include pupil ID)</li><li>5. Print out total of books borrowed</li><li>6. Print out average number of books borrowed</li><li>7. Identification of gold medal winner</li><li>8. Identification of silver medal winner</li><li>9. Identification of bronze medal winner</li><li>10. Details of at least one of gold, silver and bronze medal winner printed (minimum last name or first name)</li><li>11. Details of all three medal winners (first name and last name)</li></ol>	Award marks independently  Award marks for reasonable attempt to meet requirement.
--	--

The overview section of the mark scheme awards up to 9 marks for coding that matches the descriptors in this table.

Mark Band 0	Mark Band 1	Mark Band 2	Mark Band 3
0	1 – 3	4 – 6	7 – 9
No rewardable content	Little attempt to decompose the problem into component parts	Some attempt to decompose the problem into component parts	The problem has been decomposed into component parts
	Some parts of the logic are clear and appropriate to the problem	Most parts of the logic are clear and mostly appropriate to the problem	The logic is clear and appropriate to the problem
	Some appropriate use and manipulation of data types, variables, data structures and program constructs	The use and manipulation of data types, variables and data structures and program constructs is mostly appropriate	The use and manipulation of data types, variables and data structures and program constructs is appropriate
	Parts of the code are clear and readable	Code is mostly clear and readable	Code is clear and readable
	Finished program will not be flexible enough with other data sets or input	Finished program will function with some but not all other data sets or input	Finished program could be used with other data sets or input
	The program meets some of the given requirements	The program meets most of the given requirements	The program fully meets the given requirements

Note: some spacing in the candidates' responses have been amended to fit the coding into this document.

## Exemplar response A

```

38      int average=0; int count; int total = 0;
39      for (count = 0; count<=19; count++)
40      {total = Convert.ToInt32(libraryRecord[count, 3]) + total;} //calculating the total of books read
41      //outputting the number of books which has been read between the pupils
42      Console.WriteLine("Between all the pupils " + total + " books has been read.");
43      for (count=0; count <= 19; count++)
44      {average = total / 19;} //calculating average of books read per person
45      Console.WriteLine("The average books read per pupil is " + average); //outputting the average books being read per person
46      Console.WriteLine("Here are all the pupils IDs who has read less than 10 books");
47      for(count=0; count<=19; count++)
48      { //finding pupils who has read less than 10 books and outputting the pupils IDs who has read less than 10 books
49          if(10 > Convert.ToInt32(libraryRecord[count, 3])) {Console.WriteLine(libraryRecord[count, 0]);}
50      }
51      int goldMedal = Convert.ToInt32(libraryRecord[0, 3]); //declaration of gold medal
52      string goldMedalFirstName = libraryRecord[0, 1]; //declaration of gold medal first name
53      string goldMedalLastName = libraryRecord[0, 2];
54      string goldMedalIDs = libraryRecord[0, 0];
55      for(count=0; count <= 19; count++)
56      { //finding the person who has read the most amount of books
57          if(goldMedal < Convert.ToInt32(libraryRecord[count, 3])){
58              goldMedal = Convert.ToInt32(libraryRecord[count, 3]);
59              goldMedalIDs = libraryRecord[count, 0];
60              goldMedalFirstName = libraryRecord[count, 1];
61              goldMedalLastName = libraryRecord[count, 2]; } }
62      Console.WriteLine(goldMedalFirstName + " " + goldMedalLastName + " who's IDs is " + goldMedalIDs + " has won the gold award.");
63      //outputting the person's details who has won the gold award
64      Console.WriteLine();
65      int silverMedal = Convert.ToInt32(libraryRecord[0, 3]); //declaration of silver medal
66      string silverMedalFirstName = libraryRecord[0, 1];
67      string silverMedalLastName = libraryRecord[0, 2];
68      string silverMedalIDs = libraryRecord[0, 0];
69      for(count=0; count <= 19; count++)
70      { //calculating the silver medal winner
71          if(silverMedal < Convert.ToInt32(libraryRecord[count,3]) && silverMedal != goldMedal){
72              silverMedal = Convert.ToInt32(libraryRecord[count, 3]);
73              silverMedalFirstName = libraryRecord[count, 1];
74              silverMedalLastName = libraryRecord[count, 2];
75              silverMedalIDs = libraryRecord[count, 0];
76              Console.WriteLine(silverMedalFirstName + " " + silverMedalLastName + " who's IDs is " + silverMedalIDs + " has won a silver medal.");
77              //outputting the silver medal's details
78          } }
79      int bronzeMedal = Convert.ToInt32(libraryRecord[0, 3]); //declaration of bronze medal
80      string bronzeMedalFirstName = libraryRecord[0, 1];
81      string bronzeMedalLastName = libraryRecord[0, 2];
82      string bronzeMedalIDs = libraryRecord[0, 0];
83      for(count=0; count <= 19; count++)
84      { //calculating the person who won the bronze medal
85          if (bronzeMedal < Convert.ToInt32(libraryRecord[count, 3]) && bronzeMedal != silverMedal && bronzeMedal != goldMedal)
86          {
87              bronzeMedal = Convert.ToInt32(libraryRecord[count, 3]);
88              bronzeMedalFirstName = libraryRecord[count, 1];
89              bronzeMedalLastName = libraryRecord[count, 2];
90              bronzeMedalIDs = libraryRecord[count, 0];
91              Console.WriteLine(bronzeMedalFirstName + " " + bronzeMedalLastName + " who's ID's is " + bronzeMedalIDs + " has won the bronze medal.");
92              //outputting the person who won bronze medal
93          } }
94      Console.ReadLine(); //ALLOWING THE INFORMATION TO BE DISPLAYED ON THE SCREEN

```

## Examiner's comments:

### This response was given 15 marks.

This response is produced C#.

9 marks were awarded from the points-based section and 6 marks from the overview section.

The points-based marks (mark points [MP] 1 to 11) were awarded as follows:

- MP1: awarded for line 38 – variables declared for total and average
- MP2: awarded for lines 51, 65 and 78 – variables for gold, silver and bronze
- MP3: awarded for lines 47 to 50 – loop for identifying readers of fewer than 10 books
- MP4: awarded for line 49 – for printing out the pupil ID of readers of fewer than 10 books
- MP5: awarded for line 42 – for printing the total books read
- MP6: awarded for line 45 – for printing the average number of books read. Benefit of doubt given for incorrect calculation (i.e. dividing by 19 not 20)
- MP7: awarded for lines 56 to 61 – correct identification of gold medal winner
- MP8: not awarded – incorrect calculation of silver medal winner
- MP9: not awarded – incorrect calculation of bronze medal winner
- MP10: awarded for line 62 – printing out the gold medal winner details
- MP11: awarded for lines 62, 76 & 90 – printing out the details of the three medal winners. Follow through was given for incorrect identification of silver and bronze.

This response was judged to be in Mark Band 2 of the levels-based section of the mark scheme. There were some elements of Mark Band 3. It had decomposed the problem into component parts and the logic of the code was relatively clear. However, it was noted that the code was not usable with other data sets as some loops had fixed constraints. There were also some logical errors in the code and the code did not fulfil all the requirements of the task. Overall, it was felt that the response is at the top end of the level 2 band and so 6 marks were awarded from this section.

To gain more marks in the levels-based section of the mark scheme, the response should have used the length of the array to make the code extendable and ensured that the code worked as intended.

Spelling errors in the code were not penalised as these did not affect the syntax of the programming.

## Exemplar response B

```
28 int totalBooksRead = 0; int averageRead = 0; int counter = 0; int numOfNonReaders = 0;
29 String bronzeWinner = ""; String silverWinner = ""; String goldWinner = "";
30 int bWinner = 0; int sWinner = 0; int gWinner = 0;
31 for(int i = 0; i < libraryRecord.length; i++)
32 {
33     if(counter == 0)
34     {
35         totalBooksRead = Integer.parseInt(libraryRecord[i][3]);
36     }
37     else
38     {
39         totalBooksRead = totalBooksRead + Integer.parseInt(libraryRecord[i][3]);
40     }
41     counter++;
42 }
43 System.out.println("The total number of books read is: " + totalBooksRead);
44 for(int i = 0; i < libraryRecord.length; i++)
45 {
46     averageRead = totalBooksRead / counter;
47     counter++;
48 }
49 System.out.println("The average number of books read is: " + averageRead);
50 for(int i = 0; i < libraryRecord.length; i++)
51 {
52     if(Integer.parseInt(libraryRecord[i][3]) < 10)
53     {
54         System.out.println(libraryRecord[i][1] + " " + libraryRecord[i][2] + " has not read more than ten books");
55     }
56 }
57 for(int i = 0; i < libraryRecord.length; i++)
58 {
59     bronzeWinner = libraryRecord[i][3];
60     silverWinner = libraryRecord[i][3];
61     goldWinner = libraryRecord[i][3];
62     if(goldWinner != libraryRecord[i][3] && silverWinner != libraryRecord[i][3])
63     {
64         bronzeWinner = libraryRecord[i][0] + " " + libraryRecord[i][1] + " " + libraryRecord[i][2] + " has read a total of " + libraryRecord[i][3];
65     }
66     else if(Integer.parseInt(libraryRecord[i][3]) > bWinner && libraryRecord[i][3] != goldWinner)
67     {
68         silverWinner = libraryRecord[i][0] + " " + libraryRecord[i][1] + " " + libraryRecord[i][2] + " has read a total of " + libraryRecord[i][3];
69     }
70     else if(Integer.parseInt(libraryRecord[i][3]) > sWinner)
71     {
72         goldWinner = libraryRecord[i][0] + " " + libraryRecord[i][1] + " " + libraryRecord[i][2] + " has read a total of " + libraryRecord[i][3];
73     }
74     counter++;
75 }
76 System.out.println("The gold winner is: " + goldWinner);
77 System.out.println("The silver winner is: " + silverWinner);
78 System.out.println("The bronze winner is: " + bronzeWinner);
79 }
80 }
```

## Examiner's comments:

### This response was given 11 marks.

The response was produced in Java.

6 marks were awarded from the points-based section and 5 marks from the levels-based section.

The points-based marks (mark points [MP] 1 to 11) were awarded as follows:

- MP1: awarded for line 28 – variables declared for total and average
- MP2: awarded for lines 29 and 30 – variables for gold, silver and bronze
- MP3: awarded for lines 50 to 56 – loop for identifying readers of fewer than 10 books
- MP4: not awarded as for printing out did not include the pupil ID
- MP5: awarded for line 43 – for printing the total books read
- MP6: awarded for line 49 – for printing the average number of books read
- MP7: not awarded as code does not identify gold medal winner
- MP8: not awarded as code does not identify silver medal winner
- MP9: not awarded as code does not identify bronze medal winner
- MP10: awarded for line 62 – printing out the gold medal winner details – follow through for printing out what candidate had created as gold medal winner
- MP11: not awarded as printing out does not include the necessary details of the three medal winners.

The response was judged to be within Mark Band 2 of the levels-based section of the mark scheme. It had decomposed the problem into component parts and the logic of the code was relatively clear. The code would be usable with other data sets. Some of the work matched some of the criteria for Mark Band 3. However, it was judged that the errors in the logic of the code and the failures in meeting some of the requirements moved the work down into Mark Band 2. Some of the looping structures were unnecessary (e.g. lines 44 to 48). It was decided that a mark in the middle of this mark band was most appropriate, so 5 marks were awarded in this section.

To gain more marks in this section, the response should have included more efficient code. The code did not fulfil all the requirements of the task and that there were some logical errors in the code. For example, the average calculation produced the incorrect value and the identification of the medal winners were incorrect.

## Exemplar response C

```
28 #Initializing Variables
29 total = 0
30 i = 0
31 gold = 0
32 silver = 0
33 bronze = 0
34 #Calculating the total and average
35 for i in range(0,20):
36     total = total + libraryRecord[i][3]
37 average = total/20
38 #Searching for less than 10 books read then finding IDs of those people.
39 for i in range(0,20):
40     if libraryRecord[i][3] < 10:
41         print ("The ID's of the student who have read less than 10 books are:")
42         print (libraryRecord[i][0])
43 #Calculating medalists
44 for i in range (0,20):
45     if (libraryRecord[i][3] > gold):
46         gold = libraryRecord[i][3]
47         index1 = i
48 for i in range (0,20):
49     if libraryRecord[i][3] > silver and libraryRecord[i][3]<gold:
50         silver = libraryRecord[i][3]
51         index2 = i
52 for i in range (0,20):
53     if libraryRecord[i][3] > bronze and libraryRecord[i][3]<silver:
54         bronze = libraryRecord[i][3]
55         index3 = i
56 #printing Results
57 goldMedalist= libraryRecord[index1]
58 silverMedalist= libraryRecord[index2]
59 bronzeMedalist= libraryRecord[index3]
60 print(goldMedalist)
61 print(silverMedalist)
62 print(bronzeMedalist)
63 print ("The total number of books read was",total)
64 print ("The average number of book read per pupil was", average)
```

### **Examiner's comments:**

#### **This response was given 18 marks.**

This response was produced in Python.

11 marks were awarded from the points-based section and 7 marks from the levels-based section.

The points-based marks (mark points [MP] 1 to 11) were awarded as follows:

- MP1: awarded for line 29 & 37 – variables declared for total and average
- MP2: awarded for lines 31 to 33 – variables for gold, silver and bronze
- MP3: awarded for lines 39 to 42 – loop for identifying readers of fewer than 10 books
- MP4: awarded for line 42 for printing out the pupil ID
- MP5: awarded for line 63 – for printing the total books read
- MP6: awarded for line 64 – for printing the average number of books read
- MP7: awarded for lines 44 to 47 – code to identify gold medal winner
- MP8: awarded for lines 48 to 51 – code to identify silver medal winner
- MP9: awarded for lines 52 to 55 – code to identify bronze medal winner
- MP10: awarded for line 60 – printing out the gold medal winner details
- MP11: awarded for lines 60 to 62 – printing out the necessary details of the medal winners.

The work was considered to fit within Mark Band 3 of the levels-based section of the mark scheme. It had decomposed the problem into component parts and the logic of the code was clear. It used and manipulated variables and programming constructs. All requirements specified in the question paper were met.

To gain more marks in this section the candidate could have written code that would be usable with other data sets. For example, the number of pupils identified in the code was fixed at 20. The candidate could have used the length parameter of the array to extend the code. It was also considered that the loops in lines 44 to 55 could have been combined to increase the efficiency of the code.

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