

**AS LEVEL**

**Examiners' report**

# **COMPUTER SCIENCE**

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**H046**

For first teaching in 2015

**H046/02 Summer 2022 series**

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## Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

### Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our [website](#).

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## Paper 2 series overview

Paper 2 focuses on algorithms and problem solving. It tests candidates' computational thinking ability to analyse and solve problems. Candidates are expected to be able to write algorithms fluently in either pseudocode or program code and to be able to trace algorithms.

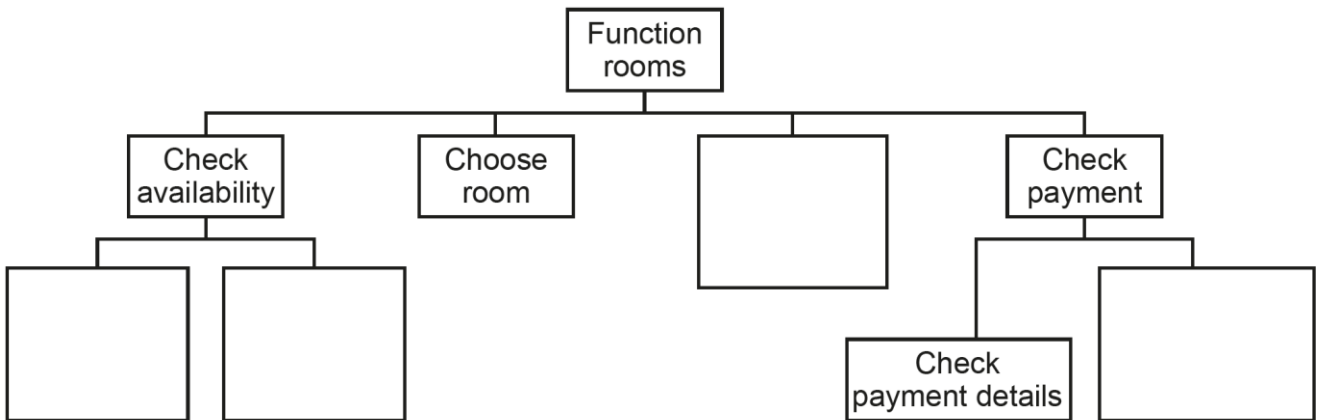
<b>Candidates who did well on this paper generally did the following:</b>	<b>Candidates who did less well on this paper generally did the following:</b>
<ul style="list-style-type: none"><li>• demonstrated good factual knowledge of definitions of terms on the specification</li><li>• demonstrated an ability to trace algorithms carefully to determine their output and purpose</li><li>• demonstrated an ability to analyse questions and respond with appropriately detailed responses for the number of marks available</li><li>• demonstrated an ability to trace and discuss standard algorithms such as the linear search and bubble sort</li><li>• demonstrated an ability to write pseudocode to solve a problem.</li></ul>	<ul style="list-style-type: none"><li>• showed some factual knowledge but were less able to show application</li><li>• produced responses to 'explain' questions that identified a point but lacked an expansion in terms of explanation of the point</li><li>• struggled to trace the logic of algorithms presented to them</li><li>• showed an inability to write pseudocode or program code.</li></ul>

### Question 1 (a)

1 Ruhail owns ten different function rooms which can be hired by different business customers to hold meetings. He would like a program to manage the booking process of each room.

Customers should be able to enter the date they want to hire a function room, and then a list of available rooms will be displayed. Customers can then select which room they want to hire. Customers can then enter their payment details which are then checked and then a confirmation email is sent to the customer.

(a) Complete the structure diagram below to show the different component parts of the problem.



[4]

Candidates needed to apply computational thinking skills to identify the components of the problem presented in the stem of the question and to determine the order of the steps required. Many candidates responded in context and generally answered well, but a significant number either repeated the points they made or repeated steps already given in the diagram.

### Question 1 (b)

(b) Ruhail will make use of an Integrated Development Environment (IDE).

State the purpose of an IDE.

.....

..... [1]

Most candidates showed good recall of knowledge stating that an IDE was used to develop code.

### Question 1 (c)

(c) State **two** different programming constructs and give an example of how Ruhail could use each construct when creating his program code.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

Most candidates had factual knowledge of the specification point that lists sequence, iteration and branching as types of programming construct. However, many candidates found it more difficult to demonstrate computational thinking skills to logically break down the problem given in the stem of the question to give relevant examples.

Several candidates did confuse programming constructs with either computational thinking concepts such as abstraction and decomposition or with other elements of programming such as procedures, functions or classes.

### Question 1 (d)

(d) Ruhail will test his program code to make sure that it works correctly.

State **two** test strategies that Ruhail could use.

1 .....

.....

2 .....

.....

[2]

Most candidates responded well with good factual recall of testing strategies. Some candidates did confuse testing strategies with types of test data that could be used within a test strategy or described validation checks that could be performed on input values.

### Question 1 (e)

(e) Ruhail will make use of a software development life cycle methodology.

State **two** software development methodologies that Ruhail could consider using.

1 .....

.....

2 .....

.....

[2]

Most candidates showed accurate factual recall to identify appropriate software development methodologies. Where Rapid Application Development was selected many candidates gave the acronym RAD which was accepted, but candidates should, in general, be careful to expand all acronyms when they are first given within an answer.

### Question 1 (f)

(f) Ruhail has been told to make use of reusable components when creating his program code.

Explain **two** benefits of using reusable components when writing program code.

1 .....

.....

.....

.....

.....

2 .....

.....

.....

.....

[4]

Many candidates did not give a clear explanation for a point made, and there were a number of 'cheaper' or 'quicker' type responses that had no qualification for what was being alluded to as 'cheaper' or 'quicker'.

## Exemplar 1

- 1 ~~Allows you to divide different~~ Allows you to use  
 Components in confidence, as once they have been tested, you know  
 they are error free. Can be tested individually.
- 2 Reduces the number of programmers <sup>working on a project</sup>, as you will be  
 using other programmers' expertise <sup>using their</sup> with pre-made components.  
 This also reduce the development time as not every component  
 needs to be developed from scratch.

A response that shows a clear point being made with a detailed explanatory expansion for both benefits.





### Question 2 (a) (ii)

- (ii) As well as the procedure `checkDetails`, Logan would like to use additional procedures to expand his program.

The program will be expanded to:

- allow customers to be able to register an account by setting up a username and password
- allow registered users to be able to log-in with their registration details
- allow customers, once logged in, to be able to add items that are in stock to their online shopping basket.

State **two** other procedures that Logan could write to meet these requirements, and for each one, state a suitable name and purpose.

**Procedure 1:**

Procedure Name: .....

Purpose: .....

.....

**Procedure 2:**

Procedure Name: .....

Purpose: .....

.....

[4]

Candidates needed to apply computational thinking and show procedural identification. Most scored full marks and identified suitable procedures such as checking login details or adding items to shopping basket with clear descriptions.

Question 2 (a) (iii)

- (iii) When setting up the additional procedures in his program, Logan will use a mixture of parameter passing by reference and by value.

State the difference between parameter passing by reference and parameter passing by value.

.....

.....

.....

..... [2]

More candidates were able to produce accurate definitions of passing by value and passing by reference than in previous series.

Question 2 (b)\*

- (b)\* Logan will work in a team with five other programmers and together they will create the programming code for the program.

Discuss how modularity can be used to allow the team of programmers to work effectively together on the same program at the same time.

.....

.....

.....

.....

..... [9]

Candidates continue to struggle with the banded response question on the paper and most responses did not have a clear structure.

These questions always require candidates to show knowledge by defining the terms being used, applying knowledge to the specific context given in the question, and then weighing the merits or drawbacks in an evaluation.

Few candidates could develop the concept of modularity to the level of interfaces and the need for agreed standards for function calls and return values. Most responses focused on the basics of the use of functions and procedures but did not demonstrate how different modules might be integrated.

### Question 3 (a)

3 Trudi would like to sort an array of numbers into order.

The numbers before they have been sorted can be seen here.

89	25	75	37	45
----	----	----	----	----

(a) Trudi will use a bubble sort to put these numbers into order from smallest to largest.

Show the first pass of the bubble sort. You should clearly show each comparison made.

.....

.....

.....

.....

..... [4]

There were a number of responses that included clear diagrams illustrating the first pass of a bubble sort on the given data. Very few candidates confused bubble sort with other types of sorting algorithm so most achieved full marks for this question.

### Question 3 (b) (i)

**(b)** Trudi has written a procedure, `bubbleSort`.

```

01 procedure bubbleSort(numbers)
02     do
03         sorted = true
04         for count = 0 to numbers.length -2
05             if numbers[count] > numbers[count+1] then
06                 temp = numbers[count+1]
07                 numbers[count+1] = numbers[count]
08                 numbers[count] = temp
09                 sorted = false
10             endif
11         next count
12     until sorted == true
13 endprocedure

```

**(i)** Identify a line in the procedure `bubbleSort` where a decision is taken.

.....  
..... [1]

Most candidates had little difficulty identifying line 05 as the obvious response, but some candidates did choose the decision taking place at the end of the `do..until` loop in line 12.

### Question 3 (b) (ii)

**(ii)** Identify the name of the parameter used in the procedure `bubbleSort`.

.....  
..... [1]

Nearly all candidates correctly identified `numbers` as the correct parameter name.

### Question 3 (b) (iii)

(iii) Describe the purpose of the `temp` variable in the procedure `bubbleSort`.

.....

.....

.....

..... [2]

Candidates found it difficult to articulate a response that broke the purpose of the `temp` variable down in lines 06 to 08 into logical steps with reasons. Many candidates identified it as a temporary store, but few could explain that it allowed the contents of the two array positions to be swapped without erroneously overwriting either value.

### Question 3 (b) (iv)

(iv) Describe the purpose of the `sorted` variable in the procedure `bubbleSort`.

.....

.....

.....

..... [2]

Many responses to this question were generalised answers that stated that the `sorted` variable determined whether the data was sorted or not. This could be an indication that candidates did not have practical experience of implementing a bubble sort with a swap flag. Most candidates did not appreciate the function of the variable during each pass of the bubble sort. Candidates need to be well versed in the different ways of implementing a bubble sort.

### Question 4 (a)

4 Given the following procedure:

```
01 procedure generate(number)
02     a = 0
03     while number > 0
04         if number MOD 2 == 0 then
05             a = a + 2
06             print(a)
07             number = number - 2
08         else
09             a = a + 1
10             print(a)
11             number = number - 1
12         endif
13     endwhile
14 endprocedure
```

(a) Explain why = is used on line 11 of the procedure generate instead of ==.

.....

.....

.....

..... [2]

Most candidates were correctly able to distinguish between assignment and equality.

### Question 4 (b)

(b) State the values printed by the procedure `generate` when `number = 8`.

.....  
..... [1]

In many cases candidates gave the response 2 and did not iterate through the loop until the initial loop condition was false.

### Question 4 (c)

(c) State the values printed by the procedure `generate` when `number = 7`.

.....  
..... [1]

Candidates who answered the previous part of the question generally went on to score full credit for a second trace of the algorithm with a different calling argument value.

### Question 4 (d)

(d) Describe the purpose of the `MOD` operator on line 04 of the procedure `generate`.

.....  
.....  
.....  
..... [2]

Candidates who successfully identified that a remainder was calculated found it harder to determine that its purpose was to see if the number was even or odd.

### Misconception



Some candidates think that a modulo division calculation resulting in 0 means that there is no remainder. Where the result of modulo division is 0 it means that the remainder is 0.





### Question 5 (b)

(b) A function `findFirst`, is used to find the first available appointment.

Write the function `findFirst` that will find the first available appointment and return the booking slot number. If no appointments are available then the function should return "-1".

You should write your function using pseudocode or program code.

.....

.....

.....

.....

.....

..... [7]

A number of candidates started by defining a procedure rather than defining a function. Indentation was not always consistent with the constructs being used. Candidates seemed to have difficulty with referencing two dimensional structures. Algorithms that require two dimensional data frequently appear on this paper and candidates need to have extensive practical programming experience solving problems using these structures.

## Exemplar 2

```

appointments = [array]
function FindFirst():
    length = array appointments.length()
    available = -1
    index = 0

    found = False

    while found == False AND index < length
        if appointments[2] == "" then
        if appointments[index, 2] == "" then
            print
            available =
            return appointments[index, 0]
            found = True
        else
            index = index + 1
        endif
    endwhile
    return available
end function

```

[7]

A well-structured pseudocode response that uses indentation and variable naming well. The logic of the loop to check each item in sequence for an empty entry is clear, as is the indexing into the 2-Dimensional table structure.



### Question 5 (c)

- (c) When an available time slot has been found then a valid customerID must be entered to confirm the booking.

This is checked by another function called `checkCustomerID`. This will return `true` if the customerID is valid or `false` if the customerID is not valid.

State why a function would be used instead of a procedure for this purpose.

.....  
..... [1]

Nearly all candidates successfully identified the factual knowledge that a function returns a value.

### Question 6 (a)

6 Kylie buys used games consoles and then sells them to make a profit. She sells her products in multiples of £5 such as £30, £55 and £95. Kylie only accepts £50, £20, £10 and £5 notes from her customers.

Kylie has written an algorithm which will calculate the amount of change needed by stating how many £20, £10 and £5 notes are needed.

The program should output the minimum number of notes required. For example if £35 change is required then it should output 1 x £20 and 1 x £10 and 1 x £5.

```

01 total = input("Enter total price of goods")
02 paid = input("Enter amount paid")
03 global change = paid - total
04 calculateChange()
05
06 procedure calculateChange()
07     twenty = 0
08     ten = 0
09     five = 0
10     while change >= 20 //Calculates number of £20 notes needed
11         twenty = twenty + 1
12         change = change - 20
13     endwhile
14     while change >= 10 //Calculates number of £10 notes needed
15         ten = ten + 1
16         change = change - 10
17     endwhile
18     while change >= 5 //Calculates number of £5 notes needed
19         five = five + 1
20         change = change - 5
21     endwhile
22     print("The amount of change you need is £" + str(change))
23     print("Total £20 Notes:" + str(twenty))
24     print("Total £10 Notes:" + str(ten))
25     print("Total £5 Notes:" + str(five))
26 endprocedure

```

(a) Describe how calculateChange() on line 04 is used differently to calculateChange() on line 06.

.....

.....

.....

..... [2]

Many candidates responded correctly and could identify the difference between a procedure call and a procedure declaration.

### Question 6 (b)

(b) When line 22 is run, it will always print:

The amount of change you need is £0

Explain why this error occurs when line 22 is run.

.....

.....

.....

..... [2]

Many candidates identified that the procedure would reduce the `change` to 0 but few identified that it was because `change` was a global variable which meant that the initial value was being decreased to zero or that line 22 would need to be moved to before line 10 to resolve the error.

### Question 6 (c)

(c) Explain why Kylie has used `str` on lines 22 to 25 in her algorithm.

.....

.....

.....

.....

.....

..... [3]

Most candidates identified that the values needed to be converted from integer to string otherwise an error would be generated because they could not be concatenated. Fewer identified the process as type casting.

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