



Oxford Cambridge and RSA

Monday 22 May 2023 – Afternoon

AS Level Computer Science

H046/02 Algorithms and problem solving

Time allowed: 1 hour 15 minutes



Do not use:

- a calculator



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

Last name

INSTRUCTIONS

- Use black ink.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION

- The total mark for this paper is **70**.
- The marks for each question are shown in brackets [].
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **16** pages.

ADVICE

- Read each question carefully before you start your answer.

2
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(b) A programmer has partially developed a bubble sort algorithm in pseudocode.

This will partially sort an array of numbers called `numbers` that is passed as a parameter.

```
01 procedure bubbleSort (numbers : byRef)
02     flag = true
03     for x = 0 to numbers.length - 1
04         if numbers[x] > numbers[x + 1] then
05             holdValue = numbers[x]
06             numbers[x] = numbers[x + 1]
07             numbers[x + 1] = holdValue
08         flag = false
09     endif
10 next x
11 endprocedure
```

(i) Explain why the procedure `bubbleSort` accepts the array `numbers` by reference and not by value.

.....
.....
.....
.....
.....
..... [3]

(ii) The programmer has used a `for` loop on line 3 in the procedure `bubbleSort`. A `for` loop is a count controlled loop.

State what is meant by the term 'count controlled loop'.

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

(iii) State the purpose of the variable `holdValue` in the procedure `bubbleSort`.

.....
.....
.....
.....
.....
..... [3]

(iv) The procedure `bubbleSort` will only partially sort the array `numbers` into order.

Describe what the programmer would need to add to the algorithm to enable it to fully sort the numbers into order.

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

(c) (i) The array `numbers` contains 356 numbers to be sorted by the bubble sort algorithm.

State the maximum number of passes a bubble sort would need to complete to sort 356 numbers into order.

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

(ii) State the name of **one** other sorting algorithm.

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

2 Taylor is designing a program for a client who would like to simulate earthquakes on major cities around the world in 3D. The client would like to be able to view any stage of an earthquake such as:

- 1. the build-up of the earthquake
- 2. the earthquake taking place
- 3. the aftershocks of the earthquake.

The client would also like to be able to play the simulation at different speeds. For example, a slow, normal or fast speed.

(a) Give **three** examples of where abstraction can be used in the design of this program.

- 1
-
- 2
-
- 3
-

[3]

(b) The program will need to accept inputs from the user before playing the simulation.

(i) Identify **two** different inputs for this program.

- 1
-
- 2
-

[2]

(ii) One decision point in the program will be to decide if the user inputs are suitable or not.

Identify **two** other example decision points in this program.

- 1
-
- 2
-

[2]

(c) Taylor is deciding which software development methodology to use to write the program. The client has stated that they would like the program as soon as possible and want to be heavily involved during the program creation.

(i) Describe the difference between the spiral model and the waterfall model.

.....
.....
.....
.....
.....
.....
.....
..... [4]

(ii) Give **two** reasons why the waterfall model is not suitable for Taylor.

1
.....
2
..... [2]

(iii) Name **and** describe **one** other model of software development.

Name
Description
..... [2]

5 Layla writes a pseudocode algorithm to:

- input 20 positive numbers into a 0-indexed 1-dimensional array
- output the average (mean) number as a decimal
- output the smallest number
- output the largest number.

The pseudocode algorithm is shown. It contains various errors.

```

01 total = 1
02 smallest = 9999
03 largest = -1
04 for x = 0 to 21
05   dataArray[x] = input("Enter a number")
06   total = total + dataArray[x]
07   if dataArray[x] < largest then
08     largest = dataArray[x]
09   endif
10   if dataArray[x] < smallest then
11     smallest = dataArray[x]
12   endif
13 next x
14 print("Average = " + total * 20)
15 print("Smallest = " + smallest)
16 print("Largest = " + largest)

```

(a) (i) Identify the construct used on lines 01 to 03 in the algorithm.

.....
 [1]

(ii) Identify the construct used on lines 10 to 12 in the algorithm.

.....
 [1]

(b) Identify **two** variables used in this algorithm.

1

2

[2]

(c) The algorithm that Layla has written has many errors.

Identify the line number of **four** different errors and write the corrected line of code.

Error 1 line number

Error 1 correction

Error 2 line number

Error 2 correction

Error 3 line number

Error 3 correction

Error 4 line number

Error 4 correction

[4]

(d) `dataArray` is defined as a local variable within the main program.

(i) State what is meant by a 'local variable'.

.....

..... [1]

(ii) Give **one** benefit and **one** drawback of declaring `dataArray` as a local variable in the main program.

Benefit

.....

Drawback

.....

[2]

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large rectangular area with a vertical solid line on the left side and horizontal dotted lines across the rest of the page, providing space for writing answers.



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