

**Modified Enlarged 24pt**  
**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**Friday 24 May 2019 – Morning**

**AS Level Computer Science**

**H046/02 Algorithms and problem solving**

**Time allowed: 1 hour 15 minutes**  
**plus your additional time allowance**

**DO NOT USE:**  
**a calculator**

**Please write clearly in black ink.**

**Centre number**

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**Candidate number**

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**First name(s)** \_\_\_\_\_

**Last name** \_\_\_\_\_

**READ INSTRUCTIONS OVERLEAF**



# **INSTRUCTIONS**

**Use black ink.**

**Answer ALL the questions.**

**Write your answer to each question in the space provided.**

**Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).**

## **INFORMATION**

**The total mark for this paper is 70.**

**The marks for each question are shown in brackets [ ].**

**Quality of extended responses will be assessed in questions marked with an asterisk (\*).**

<p><b>NO CALCULATOR CAN BE USED FOR THIS PAPER</b></p>
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- 1 Janet is designing a piece of software for a furniture company.**

**The software will allow a user to plan the position of furniture in a room. Users will be able to set the size and shape of a room, and then choose furniture from a library of furniture items. These pieces of furniture will have set sizes and designs and the user will be able to view the room in 3D to see how it looks from a variety of angles.**

- (a) Janet is using computational thinking techniques during the design process.**
- (i) Janet is removing some aspects during the design of the software to simplify it and to make it easier to produce.**

**State the name of the computational thinking technique that Janet is using.**

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**[1]**

- (ii) The computational thinking technique in PART (a)(i) makes it easier to produce the software.**

**Identify ONE additional reason why this technique is necessary.**

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**[1]**

- (iii) Explain, with examples, TWO ways in which Janet will apply the computational thinking technique in PART (a)(i) to this project. [4]**

**1** \_\_\_\_\_

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**2** \_\_\_\_\_

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**(b) Janet is planning the inputs and outputs for the software.**

**(i) Identify TWO inputs that the software will need to take.**

**1** \_\_\_\_\_

**2** \_\_\_\_\_

**[2]**

**(ii) Identify TWO outputs that the software will need to produce.**

**1** \_\_\_\_\_

**2** \_\_\_\_\_

**[2]**

**(c) Janet is going to decompose the problem to produce a set of subprograms.**

**Explain the benefits of using subprograms to produce this software.**

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**[4]**

**(d) The program allows the user to enter dimensions of the room and the furniture. There are preconditions that must be met before the software will draw the room and furniture.**

**Suggest TWO preconditions that must be met before the software will run.**

**1** \_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

**[2]**

**(e)\* Janet is planning the testing strategy for the software.**

**Discuss the different testing methods available to Janet, and make a recommendation for which ones she should use. [9]**

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[illegible]

**2 A procedure is shown in the pseudocode opposite.**

**The arrays that are passed to the procedure store integer values.**

**length returns the total number of elements the array can hold.**

**(a) A decision is made on line 02.**

**(i) Identify the line where the second decision is made.**

\_\_\_\_\_ **[1]**

**(ii) Explain the purpose of the code in lines 02 to 06.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[3]**

```
01 procedure calculateOnce(data[]:byRef,  
    nextData[]:byRef)  
02     if data.length > nextData.length then  
03         loopCount = nextData.length - 1  
04     else  
05         loopCount = Data.length - 1  
06     endif  
11 07     count = 0  
08     while count <= loopCount  
09         data[count] = data[count] +  
            nextData[count]  
10         count = count + 1  
11     endwhile  
12 endprocedure
```

**(b) The procedure has parameters passed by reference.**

**(i) Give the identifiers of the TWO parameters.**

**1** \_\_\_\_\_

**2** \_\_\_\_\_

**[2]**

**(ii) State the effect of the array `data [ ]` being passed by reference and not by value.**

\_\_\_\_\_

\_\_\_\_\_ **[1]**

**(c) The program needs a second procedure, `sortData`. It will be called taking the array `data [ ]` as a parameter by reference.**

**The procedure will then perform a bubble sort on the data in the array.**

**(i) Show each stage of a bubble sort on the following contents of data [ ]: [4]**

95	10	5	33	100	77	45
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[illegible]

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**(ii) Write, using pseudocode, the procedure `sortData`. [8]**

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**(iii) An alternative sorting method is the insertion sort.**

**Show how an insertion sort will sort the data in the following array. [4]**

<b>95</b>	<b>10</b>	<b>5</b>	<b>33</b>	<b>100</b>	<b>77</b>	<b>45</b>
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- 3 The current contents of a queue, colours, implemented in an array is shown in Fig. 3.1.

**FIG. 3.1**

red	yellow	green	blue	grey			
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`front = 0`

`end = 4`

- (a) Describe the purpose of `front` and `end`.

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[2]

**(b) The queue has the subprograms enqueue and dequeue. The subprogram enqueue is used to add items to the queue and the subprogram dequeue removes items from the queue.**

**(i) Use the following diagram to show the queue shown in Fig. 3.1 after the following program statements have run:**

```
enqueue ("orange")  
dequeue ()  
enqueue ("maroon")  
dequeue ()  
dequeue ()
```



**front = \_\_\_\_\_**

**end = \_\_\_\_\_ [4]**

**(ii) enqueue and dequeue are both functions.**

**State the difference between a procedure and a function.**

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**[1]**

**(iii) Describe the steps involved in the enqueue algorithm.**

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**[4]**

**4 A program corrects the grammar in a line of text. The text is read in from a text file.**

**(a) The function, `getText`, needs to:**

**take the file name as a parameter**

**open the file**

**read the line of data in the text file into one string**

**return the string of data.**

**Write the function `getText`. [4]**

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**(b) The procedure, `fullStop`, needs to:**

**ask for a file name as input**

**read the data from the file using the function `getText`**

**replace the first letter after each full stop with a capital letter if it is currently lower case (if the next character is a space, it must check each successive character until it finds a letter)**

**write the edited data back to the text file.**

**You can assume the text file only contains upper and lower case letters, spaces and full stops.**

**Part of the ASCII table has been provided:**

<b>ASCII Value</b>	<b>Character</b>
<b>65</b>	<b>"A"</b>
<b>90</b>	<b>"Z"</b>
<b>97</b>	<b>"a"</b>
<b>122</b>	<b>"z"</b>
<b>32</b>	<b>" " (space)</b>
<b>46</b>	<b>". " (full stop)</b>

**The following functions may be used in your answer:**

**`asc (character)` returns the ASCII value for a single character, e.g. `asc ("A")` would return 65.**

**`upper (character)` returns the single character in upper case, e.g. `upper ("a")` would return "A".**

[illegible]



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**END OF QUESTION PAPER**

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