OCR
Oxford Cambridge and RSA

Tuesday 13 October 2020 – 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 | | | | | | Candidate number | | | | |

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 **20** pages.

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions.

1 Sally is a classroom teacher. She would like a program to be able to organise where students will sit in her classroom.

A plan of her classroom is shown **in Fig. 1**.

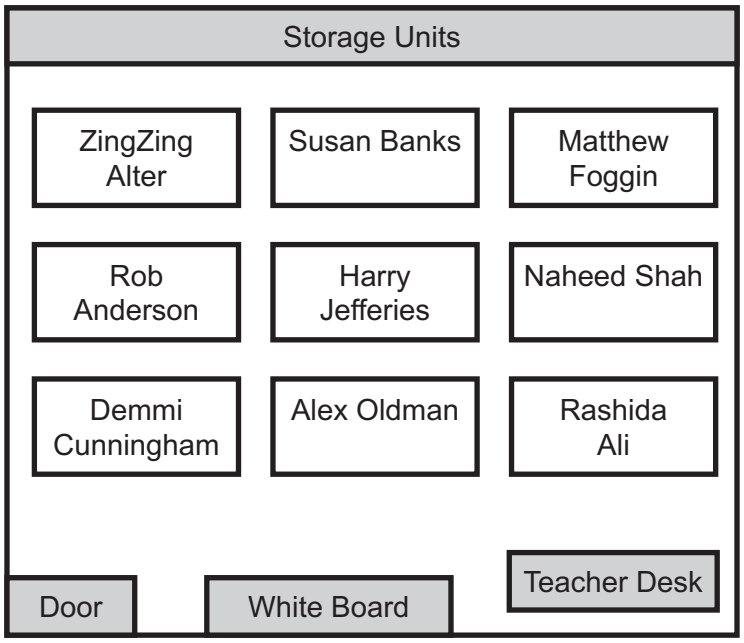

Fig. 1

(a) (i) State **three** ways that Sally has made use of abstraction in Fig. 1.

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[3]

(ii) Explain **two** benefits to Sally of using abstraction before creating the programming code.

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[4]

(b) Sally would like to increase the security of her program by adding a password to enter the program. She has created the procedure, `checkPassword`, to do this.

```
01 procedure checkPassword()
02    correctPassword = "ComputerScience12"
03    check = false
04    while check == false
05       enteredPassword = input("Enter Password")
06       if enteredPassword == correctPassword then
07          check = true
08       endif
09    endwhile
10 endprocedure
```

(i) Identify the programming construct used on lines 06 to 08 in the procedure `checkPassword`.

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

(ii) Sally has used a `while` loop on line 04 of the procedure `checkPassword`.

Explain why Sally has used a `while` loop instead of a `for` loop.

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

(iii) Sally could have used a `do until` loop instead of a `while` loop.

Rewrite lines 04 to 09 of the procedure `checkPassword` using a `do until` loop instead of a `while` loop.

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

(c) Sally will make use of an Integrated Development Environment (IDE) to create her program code.

(i) Describe **three** features that are commonly found in IDEs that will help Sally write her program code.

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[6]

(ii) Sally uses a Rapid Application Development (RAD) approach when creating her program.

Describe **two** benefits of using RAD.

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[4]

(iii) Sally will make use of an appropriate test strategy to test her programming code.

Compare **one** difference between black box testing and white box testing.

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

2 Poppy would like to use a bubble sort to sort 250 000 numbers into order from lowest to highest.

Currently the first five numbers before they have been sorted are:

195 584	167 147	158 187	160 125	184 236

Currently the last five numbers before they have been sorted are:

1058	19 558	1915	20 215	15

(a)* Discuss how a bubble sort works and how efficient it will be when sorting these 250 000 items into order from lowest to highest.

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..... **[9]**

(b) State the number of comparisons that will need to be made in the first pass of the bubble sort.

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

(c) Bubble sorts make use of two different loops when sorting items into order.

Describe the **two** loops used and their purpose.

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2 .....

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[4]

(d) State the name of **one** other sorting algorithm that Poppy could have used.

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

3 Oscar owns a taxi company. He would like a program to handle taxi bookings from customers.

(a) When a customer makes a booking, they are placed into a queue data structure until a taxi driver is available.

(i) Explain why Oscar uses a queue data structure rather than a stack data structure.

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

(ii) Oscar has written a procedure, `enqueue`, to be able to add a customer number to the queue. The queue is not circular.

```
01  procedure enqueue(custNumber)
02     maxElements = 10
03     if (tail + 1) > maxElements then
04        print ("Error, queue is full")
05     else
06        head = head + 1
07        queue[head] = custNumber
08     endif
09  endprocedure
```

State the name of the parameter used in the procedure `enqueue`.

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

(iii) The procedure `enqueue` contains an error on line 06 and line 07.

Rewrite lines 06 and 07 of the procedure `enqueue` so that the queue works correctly.

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(iv) Identify the logical condition in the procedure `enqueue` that affects whether a new Item can be added to the queue.

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

(b) Some of Oscar's customers are rated as gold. Customers who are rated as gold are given priority when they make a taxi booking. Some customers rated as gold are shown here.

Arshad	Betty	Dave	Freddie	Harry	Jimmy	Kanwal	Lynn	Siad	Tommy	Will

When a customer makes a booking, Oscar will make use of a binary search to check if they are gold rated.

Oscar would like to know if 'Tommy' is gold rated.

(i) State the **three** values that will be set as the midpoints and then checked against 'Tommy' on each iteration of the binary search.

Show your working here.

Midpoint 1 .....

Midpoint 2 .....

Midpoint 3 .....

[3]

(ii) Oscar has 75 000 customers stored in his program.

Describe the benefit to Oscar of using binary searches in his program.

Benefit .....

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

(iii) State **one** other search algorithm that Oscar could have used.

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

(iv) State the pre-condition which has been met which meant that Oscar did not need to use the search algorithm you stated in question **3(b)(iii)**.

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

4 Daisy is a computer technician. She is responsible for making sure all new employees are given a username to access the computer network.

The rules that are followed when creating a new username are as follows:

Step 1: The employee's first name is entered (e.g. Roger)

Step 2: The employee's surname is entered (e.g. Banks)

Step 3: A username is then made up from:

- Their whole surname (e.g. Banks)
- The first letter of their first name (e.g. R)
- A number 1

For example: BanksR1

Step 4: The username is then checked against existing usernames. This is done by calling a function `existingUsers`. This will return `true` if the username is unique and `false` if the username already exists.

Step 5: If the username is unique then "Username is Unique" should be printed. If the username already exists then the number at the end of the username should increase by one (e.g. BanksR2).

Step 6: Steps 4 and 5 should be repeated until the username is unique.

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Write a procedure called `createUsername` that meets the rules of Daisy's program.

You should write your procedure using pseudocode or program code.

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..... **[9]**

5 Given the following procedure:

```
procedure maths(number)
    a = (number DIV 10) * 10
    b = a + 10
    if (number - a) >= (b - number) then
        print(b)
    else
        print(a)
    endif
endprocedure
```

(a) State the value printed by the procedure `maths` if `number=27` ..... **[1]**

(b) State the value printed by the procedure `maths` if `number=14` ..... **[1]**

(c) State the value printed by the procedure `maths` if `number=10` ..... **[1]**

(d) State the purpose of the procedure `maths`.

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

END OF QUESTION PAPER

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).