

Modified Enlarged 24pt
OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Monday 12 June 2023 – Afternoon

A Level Computer Science

H446/01 Computer Systems

Time allowed: 2 hours 30 minutes
plus your additional time allowance

YOU CAN USE:

an HB pencil

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. You can use an HB pencil, but only for graphs and diagrams.

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 140.

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

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

ADVICE

Read each question carefully before you start your answer.

BLANK PAGE

1 A small manufacturing business uses networked computers with closed source application software installed.

(a) A spreadsheet application package is used to calculate employee's wages.

(i) Give ONE benefit of using a spreadsheet application for this task compared to calculating wages manually.

[1]

- (ii) Give TWO other types of application packages that the small business could use, giving an example of a task that the business could use each application for.**

Application 1 _____

Example of task 1 _____

Application 2 _____

Example of task 2 _____

[4]

(iii) Describe a drawback of using closed source software (rather than open source software) for the small business.

[3]

(b) Each computer the business uses has a BIOS.

Tick (✓) ONE box in each row to identify whether each statement in the table is true or false. [3]

Statement	True	False
BIOS stands for Boot Input Output Standard		
The BIOS can be used to alter hardware settings, such as which storage device the computer boots from		
BIOS settings are stored in RAM		

The business uses virtual storage to hold regular backups of all of its data.

(c) Explain why virtual storage is well-suited for storing backups.

[2]

(d) All computers owned by the business are connected together into a Local Area Network (LAN). Various network protocols are used in this network.

(i) Give THREE advantages to the business of connecting computers together in a LAN.

1 _____

2 _____

3 _____

[3]

(ii) Explain what is meant by a network protocol.

[2]

(iii) Give the names of TWO protocols that may be used in a LAN.

1 _____

2 _____

[2]

(iv) Explain why protocol layering is used.

[3]

(e) One computer owned by the business monitors critical-safety features of manufacturing. All input data must be processed within a predictable timescale of a fraction of a second.

(i) State the type of operating system that should be used by this computer.

[1]

(ii) Give the name of THREE other types of operating system, and for each state its purpose.

Type 1 _____

Purpose 1 _____

Type 2 _____

Purpose 2 _____

Type 3 _____

Purpose 3 _____

[6]

When a device such as a keyboard or printer requires attention from the CPU, an interrupt is raised.

(f) Explain how an operating system deals with an interrupt.

[3]

(g)* Memory management is a key function of an operating system. Explain how an operating system can manage the memory available to applications and why doing so is important.

You should include the following in your answer:

the different actions carried out by an operating system to manage memory

how memory that is being managed can be split up

why memory management is important. [9]

[illegible]

[illegible]

- 2 Sundip writes an algorithm to carry out addition and subtraction. The algorithm will use an initially empty stack with the identifier numbers and will take input from the user.**

The action the algorithm takes depends on the value input by the user. These actions are listed in FIG. 2.

FIG. 2

Value input	Action to take
A	Pop two values from the numbers stack Add the two values Push the result back onto the numbers stack
S	Pop two values from the numbers stack Subtract the first popped value from the second Push the result back onto the numbers stack
E	Pop one value from the numbers stack Output this value End program
Any other value	Push the input value to the numbers stack

(a) Complete the pseudocode here to implement Sundip's algorithm. [5]

do

value = input("Enter a value")

if _____ then

num = numbers.pop()

print(num)

elseif value == "A" or _____ then

numone = numbers.pop()

numtwo = numbers.pop()

if value == "A" then

numbers.push _____

```
elseif value == "S" then
    numbers.push(numtwo - numone)
endif

else
    numbers.push(_____)
endif

until value == _____
```

- (b) (i) Complete the diagram to show the state of the stack after each value is entered into the algorithm. The letters will complete an action stated in FIG. 2.

The state of the stack after the first value, 8, has been completed for you. [3]

INPUT 8 7 A 6

8			

- (ii) Complete the table opposite to give the output from this algorithm when the following set of inputs are entered by the user. The letters will complete an action stated in FIG. 2. [3]

Input data (from left to right)	Output
9 3 A E	
10 5 A 8 S E	
25 5 S 2 3 A S E	

**If the user enters 4 2 S A E ,
the algorithm will not work correctly.**

**(iii) Explain what problem this input
data will cause and why the
problem occurs.**

[3]

(c) A stack is one data structure that is available for Sundip to use. She could also use a queue, list, linked list, array or tuple.

(i) Describe ONE difference between a stack and a queue.

[2]

(ii) Describe ONE difference between an array and a list.

[2]

(iii) State HOW a tuple is different to a list.

[1]

(iv) Describe how the SECOND item in a linked list would be accessed using pointer values.

[3]

3 (a) (i) Convert the denary number 189 to hexadecimal.

[1]

(ii) Convert the unsigned binary number 1010101111 to hexadecimal.

[1]

(b) Negative binary values can be represented using either sign and magnitude or two's complement.

(i) Convert the denary number -107 to an 8-bit binary number using sign and magnitude.

[1]

(ii) Convert the denary number -107 to an 8-bit binary number using two's complement.

[1]

(iii) Give ONE advantage of storing values using two's complement instead of sign and magnitude.

[1]

(c) Show how the denary value -15.75 can be represented as a normalised floating point binary number using 8 bits for the mantissa and 4 bits for the exponent.

You must show your working. [4]

(d) The normalised floating point binary number 0100 1110 is stored using 4 bits for the mantissa and 4 bits for the exponent, both in two's complement.

Convert this number to denary.

You must show your working. [3]

-
-
-
- (e) Complete each of the following sentences relating to the storage of floating point binary numbers with an appropriate word. [2]

Increasing the number of bits used for the mantissa increases the

_____ of the number that can be stored.

Increasing the number of bits used for the exponent increases

the _____ of the number that can be stored.

- 4 A team of programmers create a robot that will be used in a factory. The robot will be able to do the work of multiple humans.**

The programmers discuss whether to write the instructions for the robot in assembly language or a high-level language.

- (a) Describe TWO differences between assembly language and high-level languages.**

Difference 1 _____

Difference 2 _____

[4]

(b) The robot uses a multi-core processor. The programmers assume that this means that the robot will execute programs more quickly than using a single core processor.

(i) Give ONE reason why this assumption can sometimes be true.

[1]

(ii) Explain why this assumption is not always true.

[2]

(c)* The robot stores data internally and also communicates with other robots and users via a wireless network which is password protected. All data for these tasks is secured using either encryption or hashing.

Compare the robot's use of encryption and hashing for storing and communicating data.

You should include the following in your answer:

the different types of encryption that could be used and how this would secure data

how hashing could be used to secure data and which data would be suitable

why encryption and hashing are used by the robot for stored data and communications. [9]

[illegible]

[illegible]

(d) The robot provides a web-based interface for users. The home screen webpage for this interface is shown in FIG. 4.

FIG. 4

Robot User Interface	
Robot prime directives	
Serve the company trust	
Protect data	
Uphold standards	
Updates	
Login	
Password	<input type="text"/>
	<input type="submit" value="Submit"/>

(i) Complete this HTML code that will display the webpage shown in FIG. 4. [5]

```
<html>

<head>

    <title>Robot User Interface</title>

</head>

<body>

    <h1>Robot prime directives</h1>

    _____

    <li>Serve the company trust</li>

    <li>Protect data</li>
```


`Uphold standards`

`<a _____ = "updates.html">Updates`

`<p>_____</p>`

`<form action="dologin.php">`

 Password

`<input type = " _____" name="pw">`

`<input type = " _____">`

`</form>`

`</body>`

`</html>`

(ii) Write CSS code that could be used in an external stylesheet to format all text using the <h1> tag as white with a red background.

[3]

The robot's web interface uses images that show the robot in action. These photographs have been taken using a digital camera.

(e) The programmers do not want other people to download and use these images.

(i) State the name of ONE relevant piece of legislation and describe how this would protect these images.

Legislation _____

Description _____

[3]

For other areas of the web interface, the programmers need to use images that they have not created themselves.

(ii) Give TWO ways that they could make sure these images are used legally.

1 _____

2 _____

[2]

BLANK PAGE

(f) Details of all users that have accessed the robot are stored in a database table called TblAccessLog. This table stores the username and user type of each user. When a user accesses the robot, the current date is added to the DateAccessed field for that user.

A selection of the data from this table is shown opposite. Username is the key field.

Username	UserType	DateAccessed
Mrphy003	User	08/05/21, 07/06/21, 08/06/21
Lwis076	Admin	17/04/21, 19/07/21
Bbby412	NotNeeded	01/06/21, 02/07/21, 14/07/21

TblAccessLog

- (i) Write an SQL statement to delete all records from the table `TblAccessLog` for users who have a `UserType` of "NotNeeded".

[2]

- (ii) State TWO requirements for a database to be in First Normal Form (1NF).

1

2

[2]

(iii) Explain why the structure of TblAccessLog means that this database is NOT in First Normal Form (1NF).

[2]

- 5 A doCheck () function takes an integer value as a parameter, carries out a series of calculations and returns an integer value.**

The function is shown opposite.

```
function doCheck(number)

    temp = str(number)

    max = temp.length - 1

    total = 0

    for x = 0 to max

        total = total + int(temp.substring(x,1))

    next x

    return total MOD 10

endfunction
```

- (a) State the value returned from the function when doCheck (3178) is called.**

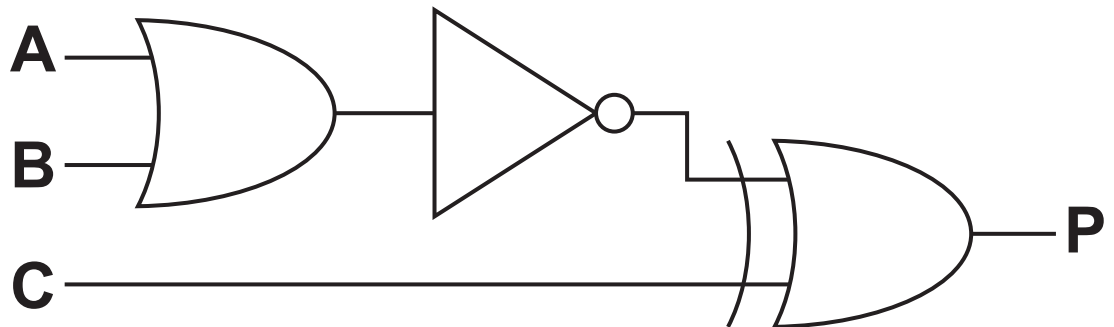
[1]

- (b) Write an algorithm that will:**
allow the user to enter an integer value
pass the value entered into the doCheck () function as a parameter
store both the value input and the value returned from the function in a text file with name "storedvalues.txt"

You should write your algorithm using either pseudocode or program code. [5]

- 6 (a) A computer scientist has created the following logic circuit shown in FIG. 6.

FIG. 6



- (i) Give the Boolean expression that represents the logic circuit shown in FIG. 6. Do not attempt to simplify the expression.

[2]

(ii) Complete the truth table for the logic circuit shown in FIG. 6. [3]

A	B	C	P
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

The following Karnaugh map represents another logic circuit.

		AB			
		00	01	11	10
CD	00	1	1	1	1
	01	1	1	0	0
	11	0	0	0	0
	10	0	0	1	1

(b) Use this Karnaugh map to find the simplified expression for this circuit.

You should highlight the map as appropriate and write the expression here.

[4]

7* The Regulation of Investigatory Powers Act (2000) has been described as both a vital legal tool to ensure the public's safety and an attack on an individual's freedoms.

Evaluate the purpose and use of the Act.

You should include:

the additional powers given under the Act

to whom these powers are given

the perceived benefits and/or drawbacks of the Act. [12]

[illegible]

[illegible]

[illegible]

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).

[illegible]

[illegible]

[illegible]



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