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Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Higher level
Paper 1

Friday 8 November 2019 (afternoon)

2 hours 10 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer all questions.
- The maximum mark for this examination paper is **[100 marks]**.

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Section A

Answer **all** questions.

1. Describe **one** way offsite storage can be used to prevent data loss. [2]

2. Explain the purpose of cache memory. [3]

3. Colours are represented by a computer as a combination of the three primary colours: red, green and blue.

Numerical values are used to represent the different shades of each primary colour. These values range from 0 to 255 in decimal, or 00 to FF in hexadecimal.

(a) State why hexadecimal numbers are frequently used in computing. [1]

(b) State the number of bits used to represent a non-primary colour, such as yellow. [1]

(c) State the maximum number of colours that can be represented in a computer pixel. [1]

4. Copy and complete the following truth table where:

X = A XOR B
Y = A NOR C
Z = X OR NOT Y

A	B	C	X	Y	Z
0	0	0			

[4]

5. Sketch a double linked list that holds the following sequence of names: Anne, Lana, Mary. [3]

6. Explain why abstraction is required in the design of algorithms. [3]

7. Outline what is meant by *virtual memory*. [2]

8. Construct a trace table for the following algorithm.

```
K = 1
N = 1
M = 2
loop while K < 5
   output(N,M)
   K = K + 1
   N = N + 2
   M = M * 2
end loop
```

[5]

Section B

Answer **all** questions.

9. An organization is implementing a new computer system.

(a) Identify **two** organizational issues related to the implementation of the new system. [2]

The management considered phased conversion and direct changeover as methods of implementation.

(b) Evaluate these **two** methods of implementation. [5]

(c) (i) State **one** type of testing that involves users. [1]

(ii) Identify **three** consequences of inadequate testing. [3]

(d) Discuss the social and ethical issues associated with the introduction of a new computer system. [4]

10. (a) Outline **two** advantages of a school using a computer network. [4]

(b) Describe the purpose of the following hardware components of a network:

(i) Router [2]

(ii) Network interface card (NIC) [2]

(c) Outline why protocols are necessary. [2]

(d) Define the term *data encryption*. [1]

(e) Evaluate the use of trusted media access control (MAC) addresses as **one** method of network security. [4]

11. A washing machine manufacturer has created its website to be viewed on standard desktop computers as well as mobile devices. The mobile browsing experience differs from desktop browsing.

(a) (i) Define the term *screen resolution*. [1]

(ii) Describe **two** issues resulting from the website being viewed on various devices, such as desktops and smartphones. [4]

Different devices such as desktop computers and mobile devices have different operating systems.

(b) Explain the role of the operating system (OS) in terms of managing the hardware resources. [4]

A washing machine uses a control system.

The microprocessor controls the washing machine and its actions. To complete the wash and rinse process the user selects the program, loads the washing machine and pushes the start button.

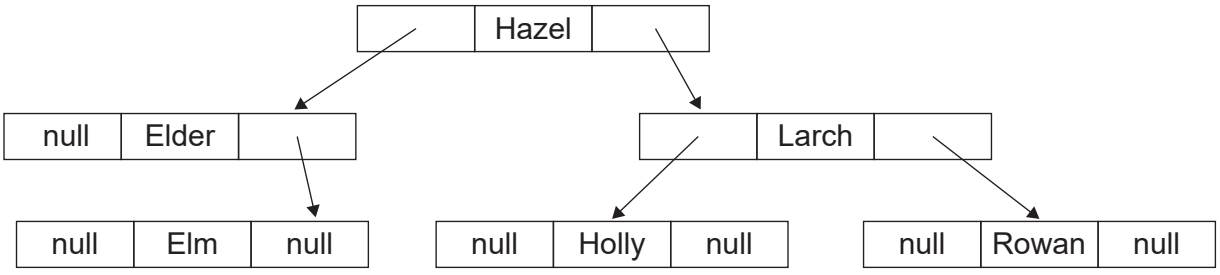
(c) Describe the interaction between the sensors, microprocessors and output transducers in this situation. [6]

12. (a) State **two** applications of stacks. [2]

(b) Explain the use of a one-dimensional array as a static stack. Your answer should include brief outlines of the push and pop operations and the tests for empty and full stacks. [6]

Consider the following binary tree.

An inorder traversal of this binary tree will produce a list of names sorted in ascending order.



(c) (i) State the result of postorder traversal. [1]

(ii) Draw the binary tree after deleting the root node. [3]

(d) Compare the use of static and dynamic data structures. [3]

13. The following matrix has non-zero elements on the diagonal, on the super-diagonal (the first diagonal above the main diagonal) and on the sub-diagonal (the first diagonal below the main diagonal). All the rest of the elements are zeros.

The following two-dimensional array named `MAT` of dimensions 6 × 6 is an example of such a matrix.

MAT

	[0]	[1]	[2]	[3]	[4]	[5]
[0]	**7**	**7**	0	0	0	0
[1]	**1**	**2**	**1**	0	0	0
[2]	0	**9**	**–3**	**5**	0	0
[3]	0	0	**–5**	**6**	**4**	0
[4]	0	0	0	**7**	**7**	**2**
[5]	0	0	0	0	**5**	**1**

(a) State the value of `MAT`[3][4]. [1]

Method `isValidMatrix(N,A)` accepts an integer `N` and a two-dimensional array `A` of dimensions `N`x`N`. It returns `True` if all elements below the subdiagonal and all elements above the superdiagonal are zeros and all elements on three diagonals are non-zeroes; otherwise it returns `False`.

For example, `isValidMatrix(6,MAT)` returns `True` for the matrix `MAT` given above.

(b) Construct an efficient algorithm for the method `isValidMatrix()`. [8]

Given the following recursive method `mystery()` with two formal parameters:
`A` (a two-dimensional array) and `R` (an integer).

```
mystery(A,R)
   if R > 0 then
      return A[R][R-1] + mystery(A,R-1)
   else
      return 0
   end if
end mystery
```

(c) Determine the value of variable `X` after execution of the following method call:

```
X = mystery(MAT,5)
```

where `MAT` is the two-dimensional array given. You must show your working. [4]

(d) Deduce the purpose of the method `mystery(A,R)`. [2]