Diploma Programme
Programme du diplôme
Programa del Diploma

Computer science
Standard level
Paper 1

Friday 3 November 2017 (afternoon)

1 hour 30 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 **[70 marks]**.

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Section A

Answer **all** questions.

1. Identify **two** essential features of a computer language. [2]

2. Two fundamental operations of a computer are *add* and *retrieve*. State another **two** fundamental operations. [2]

3. In the context of the networked world, state the role of

    (a)   a client. [1]

    (b)   a server. [1]

4. Identify **one** method of inputting data that can improve the accessibility of a computer system for some users. [1]

5. **Copy** and complete the following truth table. [3]

A	B	A NOR B	(A NOR B) OR A
FALSE	FALSE	…	…
…	…	…	…

6. Construct a logic diagram for the Boolean expression

<div align="center">NOT A OR B AND C.</div> [3]

7. Consider the following algorithm, where N is a positive integer.

```
loop for K from 1 to N
  loop for J from 1 to N
    if K = J then
       output K
    end if
  end loop
end loop
```

(a) Determine the number of times the comparison K = J will be performed. [1]

(b) Determine the number of times the statement output K will be executed. [1]

(c) Construct the algorithm which performs the same task using a single while loop, instead of nested for loops. [4]

8. The machine instruction cycle is the process by which a program instruction is fetched, decoded, executed and the results are stored.

(a) State where all instructions and data are stored. [1]

(b) Outline the role of the data bus and address bus in this process. [2]

9. Define the term *bit*. [1]

10. Outline what is meant by beta testing. [2]

Turn over

Section B

Answer **all** questions.

11. An application package used in an office includes a word processor. A secretary uses the word processor to create a text file.

    (a)   Describe how a spellchecker checks whether a word in a text file is correctly spelt or not. [2]

The text file is automatically saved at regular periods while being edited.

    (b)   State **one** advantage of this feature. [1]

    (c)   Identify **two** additional features of a word processing package that could be useful for this office. [2]

    (d)   Outline the purpose of **one** application software package other than a word processing package that could be used in this office**.** [2]

All files created in this office contain information important to the business.

    (e)   Outline the security measures that should be taken to prevent data loss. [2]

The office manager decides to buy and install new software and hardware.

    (f)   Outline **one** problem that may arise from the installation of new hardware and software in the office. [2]

The changeover to the new system can be achieved by either direct changeover or phased conversion.

    (g)   Compare direct changeover and phased conversion. [4]

12. A wireless local area network (WLAN) is used to extend access to a school's wired local area network.

    (a)   Identify **one** hardware component of the WLAN, other than computers.   [1]

The advantages of this WLAN are user-mobility and economical access points.

    (b)   Outline **two** disadvantages of this WLAN.   [4]

    (c)   Identify **three** ways in which the network administrator can reduce the risk of unauthorized access to confidential data.   [3]

The concept of packet data transmission is used within this network.
Figure 1 shows the simplified structure of a data packet.

Figure 1: The structure of a data packet

Header (12 bytes)	**Data** (112 bytes)	**Trailer / Footer** (4 bytes)
• address of sender • address of receiver • protocol • sequence number • …	Actual data to be transmitted (payload)	• transmission codes • error checking codes • control bits • …

    (d)   Define the term *protocol*.   [1]

    (e)   With reference to **Figure 1**, explain how data is transferred by packet switching.   [6]

13. A character array S holds the word "PSEUDOCODE".

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
P	S	E	U	D	O	C	O	D	E

(a) State the index of character "U" in the array S. [1]

(b) Consider the following algorithm. The function len() returns the number of characters in an array (for example, len(S) is 10).

```
K = 0
CL = 0
loop while K < len(S)
   if S[K] = "E" then
      CL = CL + 1
   end if
   K = K + 1
end loop
output CL
```

For this algorithm, **copy** and complete the following trace table. [4]

K	CL	K < len(S)	S[K] = "E"	output
0	0	TRUE	FALSE	...
...	...	...	...	...

A simple method of encoding a message is to use substitutions to produce a cryptogram.

Given a positive integer N and the array UPCASELETTERS containing letters in alphabetical order, a new array SUBSTITUTE is created by shifting the entire contents of UPCASELETTERS to the left, N times. As an element moves off the left of the array, it moves back into the right side of the array.

For example, given the array UPCASELETTERS:

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

When N = 5 the array SUBSTITUTE will be:

[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]
F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E

(c) Construct an algorithm which creates the array SUBSTITUTE. You may assume that a positive integer N and array UPCASELETTERS are given. [5]

(This question continues on the following page)

(Question 13 continued)

This encoding method produces a cryptogram of a sentence by replacing each uppercase letter of the sentence with its substitute. Other characters in the sentence are not changed.

For example, using the arrays shown on page 6:

Input (sentence):   ARS LONGA, VITA BREVIS.
Output (cryptogram):   FWX QTSLF, ANYF GWJANX.

The following algorithm fragment inputs the characters, one by one, from the input sentence, and outputs its cryptogram using the method `encode()`.

```
loop while NOT end-of-input-sentence
    CH = input()
    CRYPTEDCH= encode(CH, UPCASELETTERS, SUBSTITUTE)
    output CRYPTEDCH
end loop
```

The method `encode()` accepts a character `CH` and two arrays `UPCASELETTERS` and `SUBSTITUTE`, as defined above, and returns the corresponding character `CRYPTEDCH` of the character `CH`.

(d)   Explain the steps to construct an algorithm for the method `encode()`.   [5]