

**Computer science**  
**Standard level**  
**Paper 1**

Friday 3 November 2017 (afternoon)

1 hour 30 minutes

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**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]**.

### 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]

<b>A</b>	<b>B</b>	<b>A NOR B</b>	<b>(A NOR B) OR A</b>
FALSE	FALSE	...	...
...	...	...	...

6. Construct a logic diagram for the Boolean expression  
NOT A OR B AND C. [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]

## 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)
<ul style="list-style-type: none"><li>• address of sender</li><li>• address of receiver</li><li>• protocol</li><li>• sequence number</li><li>• ...</li></ul>	Actual data to be transmitted (payload)	<ul style="list-style-type: none"><li>• transmission codes</li><li>• error checking codes</li><li>• control bits</li><li>• ...</li></ul>

- (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]

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