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**Computer science**  
**Higher level**  
**Paper 1**

Monday 20 May 2019 (afternoon)

2 hours 10 minutes

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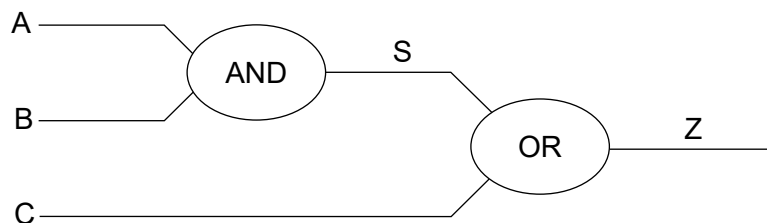
**Instructions to candidates**

- 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 **[100 marks]**.

**Section A**

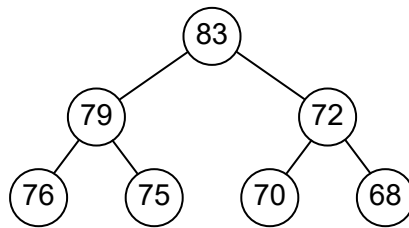
Answer **all** questions.

1. Define the term *peripheral*. [1]
2. Identify **two** features of a graphical user interface (GUI). [2]
3. Outline the purpose of the memory address register (MAR) in the central processing unit (CPU). [2]
4. Outline why single processor computers may not be able to render 3D graphics effectively. [2]
5. (a) Outline **one** advantage of using virtual memory. [2]  
(b) Outline **one** disadvantage of using virtual memory. [2]
6. State the hexadecimal equivalent of the following binary number:  
11011111 [1]
7. Construct the truth table from the following logic circuit. [3]



8. Outline **one** method of collecting information from stakeholders concerning the requirements for a new system. [2]
9. Identify **two** characteristics of a personal area network (PAN). [2]

10. Outline **one** reason why protocols are used in communications between computers. [2]
11. State the output from the binary tree using postorder traversal. [2]



12. Outline why a binary tree would be a good choice of data structure for maintaining an address book. [2]

**Section B**

Answer **all** questions.

**13.** A large mail order company is concerned about the security of its stored data.

- (a) Describe **two** possible causes of data loss. [4]
- (b) Outline **two** backup strategies that may be used to limit data loss. [4]

The company decides to improve its service by introducing a new user interface for its customers and has developed this interface to the point that it needs to be tested by users who are outside of the company.

- (c) Explain why beta testing is used to gather feedback for the new user interface. [3]
- (d) Outline **one** consequence of not involving end-users in the design and testing stages. [2]
- (e) Identify **two** features that could be used to improve the accessibility of the new user interface. [2]

**14.** A company that provides training for teachers plans to set up a training room in its offices with a network of 15 computers. Each computer has 1 TB of storage and 16 GB of random access memory (RAM).

- (a) Identify **two** characteristics of RAM. [2]
- (b) State the purpose of persistent storage on the computers. [1]

In order to minimize costs, the company decided only to install general application software on the training computers.

- (c) Identify **two** types of general application software that would be installed on the training computers. [2]

The company has decided to allow the teachers to use their own devices in its training room by adding wireless networking.

- (d) (i) Outline **one** advantage to the company of implementing this change. [2]
- (ii) Outline **one** disadvantage to the company of implementing this change. [2]
- (e) Describe **one** method of security that may be used on this wireless network. [2]
- (f) Explain why the speed of data transmission on the wireless network in the training room may vary. [4]

15. A school teacher decides to write a program to store class records and marks. Part of this program involves using a sort algorithm. The algorithm shown is a selection sort and to test it, the teacher has set up an array `VALUES[]` with 5 elements of test data.

```
LIMIT = 4

loop COUNTER1 from 0 to LIMIT - 1
MINIMUM = COUNTER1

  loop COUNTER2 from COUNTER1 + 1 to LIMIT
    if VALUES[COUNTER2] < VALUES[MINIMUM] then
      MINIMUM = COUNTER2
    end if
  end loop

  if MINIMUM ≠ COUNTER1 then
    TEMPORARY = VALUES[MINIMUM]
    VALUES[MINIMUM] = VALUES[COUNTER1]
    VALUES[COUNTER1] = TEMPORARY
  end if

end loop
```

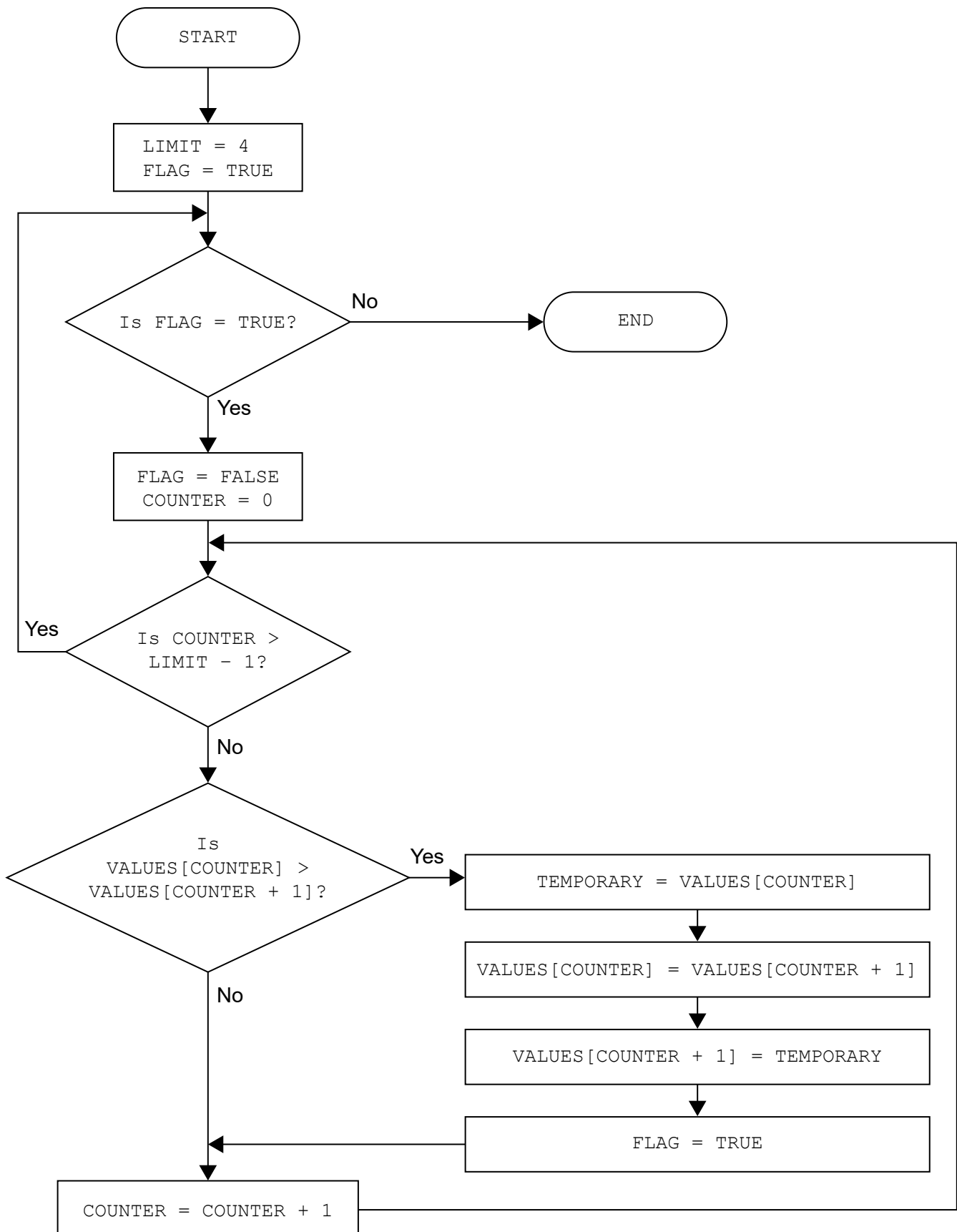
- (a) Copy and complete the table below to trace the algorithm using the data set:  
20, 6, 38, 50, 40

			Array VALUES[]					
COUNTER1	MINIMUM	COUNTER2	[0]	[1]	[2]	[3]	[4]	TEMPORARY
0	0	1	20	6	38	50	40	

[5]

(This question continues on the following page)

(Question 15 continued)



(This question continues on the following page)

**(Question 15 continued)**

- (b) (i) With reference to the algorithm in the flow chart, construct this algorithm in pseudocode so that it performs the same function. [3]
- (ii) State the type of sort in the algorithm constructed in b(i). [1]
- (c) Construct an algorithm fragment to output the data in the array `VALUES [ ]` [2]

The data structure used in this algorithm is a one-dimensional array. The teacher decides to experiment with alternative data structures.

- (d) Explain the difference between a dynamic data structure and a static data structure. [3]
- (e) Identify **one** alternative data structure for storing class marks. [1]

**16.** A mobile phone has been developed with its own dedicated operating system and is to be used as part of a smart home system in Singapore. The smart home system includes a centralized air conditioning system, a burglar alarm and a surveillance system.

- (a) Identify **two** functions of an operating system. [2]
- (b) Explain **one** benefit of using a dedicated operating system on the mobile phone instead of a generic operating system. [3]
- (c) Explain how sensors and microprocessors are used to ensure that the air conditioning system is able to maintain a constant temperature in the smart house. [5]

The developers of the smart home system are considering developing a smart home system that uses a distributed control system to manage the temperature.

- (d) Contrast the use of a distributed air conditioning system with a centralized air conditioning system for maintaining a constant temperature in the smart home. [3]



17. A two-dimensional array `CUSTOMERS[]` is used to store customer details for a mail order company such that each row of the array represents a customer record and each column represents a specific field. The fields currently in use are: `LASTNAME`, `FIRSTNAME`, `ADDRESS1`, `ADDRESS2`, `ADDRESS3`, `CITY`, `POSTCODE`.

The array currently holds 512 records.

- (a) Construct the pseudocode that will find how many customers live in the city of `Cardiff` and display the results. [5]

The company wishes to print a number of mailing labels, such as the one shown below, that will go to all customers called `Jones` who live in `Cardiff`.

```
FIRSTNAME LASTNAME
ADDRESS1
ADDRESS2
ADDRESS3
CITY
POSTCODE
```

- (b) Construct an algorithm that will enable the company to print the mailing labels for all customers called `Jones` who live in `Cardiff`. [5]

A singly linked list has been created including the following surnames; `Bale`, `Cousens`, `Davies`, `Pugh`, `Williams`.

- (c) Explain the steps to insert “`Jones`” into this singly linked list. You may draw a labelled diagram in your answer. [5]
- (d) Outline **one** example of where a circular linked list would be used in preference to a linear linked list. [2]
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