Section A

Answer **all** questions.

1. Outline the function of a web browser.   [2]

2. Identify **two** applications of queues in computing.   [2]

3. Outline **one** reason for using Unicode to represent data in a computer system. [2]

4. Sensors that take readings of the levels of different pollutants have been installed at a number of sites along a river. Each reading is sent to a central computer, where it is processed and analysed.

    (a) Define the term *interrupt*.   [1]

    (b) Describe how polling could be used in this situation.   [3]

5. Construct a truth table for the logic expression   [4]

    (A NAND B) NOR C

6. Outline what is meant by a collection.   [2]

7. Distinguish between random access memory (RAM) and read-only memory (ROM).   [2]

8. Consider the following binary tree, in which each node stores a number greater than all the numbers in the node's left subtree and less than those in its right subtree.

6

3   8

5   7   9

4
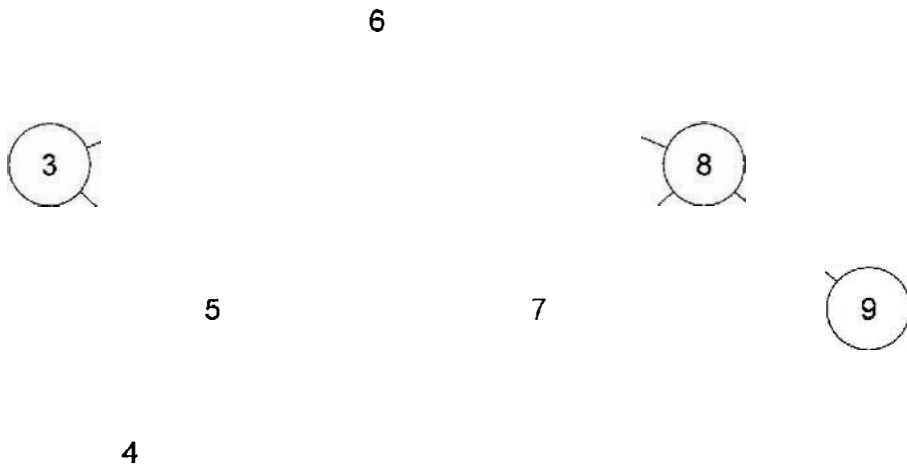
(a) Identify the leaf nodes in this binary tree. [1]

(b) State the result of the preorder traversal. [1]

(c) Sketch the resulting binary tree after the deletion of the root node. [3]

9. Outline **one** disadvantage of the use of virtual memory. [2]

Turn over

Section B

Answer **all** questions.

10. An organization needs to improve its current computer systems. The systems are legacy systems with a large number of end users.

    (a) Identify **two** issues concerning the roles of end users that must be considered in relation to the new system. [2]

    (b) Outline the meaning of the term "legacy system". [2]

    (c) Identify **one** method of gathering requirements from end users. [1]

The organization needs to use existing data in the new system.

    (d) Explain **one** problem that may occur during data migration. [3]

A decision needs to be made on whether to use parallel running or a direct changeover method of implementation.

    (e) Explain **one** advantage of using parallel running instead of a direct changeover. [3]

    (f) End users will require training in the use of the new system.

        (i) Identify **one** method of training for end users. [1]

        (ii) Evaluate the advantages and disadvantages for the end user of the method of training identified in (f)(i). [3]

11. Many organizations use a virtual private network (VPN) to enable employees working remotely to access files that are held on the organization's server.

    (a) State **two** technologies that are required to provide a virtual private network (VPN). [2]

    (b) Identify **two** factors that may affect the speed of data transmission. [2]

    (c) Explain why data compression would be used when data is transmitted. [3]

A large amount of sensitive data is stored online and needs to be protected.

    (d) Outline how encryption is used to protect data. [2]

    (e) Describe the role of a firewall. [2]

Employees are increasingly working from home.

    (f) Discuss the social impacts of this changed work pattern on employees. [4]

12. Smart control systems can manage the temperature within a house.

    (a)   Outline the steps involving the sensor, processor and output transducer to manage the temperature in the house. [5]

    (b)   Describe the role of feedback in this control system. [2]

    (c)   The smart control system is managed by an operating system.

        (i)   Describe **one** function of an operating system. [2]

        (ii)   Outline **one** reason why a dedicated operating system would be used. [2]

    (d)   Compare and contrast a centralized control system with a distributed control system for managing the temperature of a house. [4]

Turn over

13. Consider the following recursive method:

```
func(X)
    if X>1
        then
            return func(X-1) + func(X-2)
        else
            return X
    end if
end func
```

(a)   Determine the value of `func(5)` (*show all your working*).   [4]

(b)   Outline **two** disadvantages of recursive methods.   [4]

A stack is a data structure that is used in the implementation of a recursive method.

(c)   Outline the purpose of the stack access method `isEmpty()`.   [2]

The stack `TOWNS` holds several town names, and the name "Cardiff" is on the **top of the** `TOWNS` stack (see **Figure 1a**).

An algorithm is needed that will reverse the contents of the `TOWNS` stack. The **name "Geneva"** should be on top of the `TOWNS` stack after reversing its contents (see **Figure 1b)**.

Figure 1: Example data held on the TOWNS stack before
and after execution of the requested algorithm

a. The content in the `TOWNS` stack
before it is reversed

Cardiff
Washington DC
The Hague
Singapore
Geneva

b. The content in the `TOWNS` stack
after it is reversed

Geneva
Singapore
The Hague
Washington DC
Cardiff

(d)   Construct an algorithm that will reverse the `TOWNS` stack **using an empty queue.**
        You may assume that the `TOWNS` stack is inputted and a new empty queue named
        `TEMP` is initialized.

        You must use stack access methods **and** queue access methods in **your** response.   [5]

14. A program is developed to simulate the roll of dice in a game.

Three dice are thrown, with faces that have numbers from 1 to 6.

The dice are thrown seven times, and the data are stored in a two-dimensional array called DICEDIAL (see **Figure 2**).

Figure 2: The example data stored in the DICEDIAL array

	[0]	[1]	[2]
[0]	4	2	2
[1]	4	4	4
[2]	5	2	3
[3]	6	5	5
[4]	5	5	6
[5]	1	1	4
[6]	3	2	1

(a)   Construct an algorithm in pseudocode to calculate the sum of all values stored in the
      DICEDIAL array.   [3]

The sub-program DuplicateNum(DICEDIAL,R) checks whether there are repeated
numbers in row R. If the numbers are not repeated, it returns 0, otherwise it returns the
repeated number.

The DuplicateNum() sub-program will produce the following from the values used in **Figure 2**:

DuplicateNum(DICEDIAL,0) returns 2

DuplicateNum (DICEDIAL,1) returns 4

DuplicateNum(DICEDIAL,2) returns 0

(b)   Construct an algorithm in pseudocode for the sub-program DuplicateNum(DICEDIAL,R). [4]

The sub-program highestRT(DICEDIAL) accepts the DICEDIAL array and outputs the
highest row total and the indexes of all the rows with that total.

From the example data given in **Figure 2**, highestRT(DICEDIAL) would output that the
highest row total is **16**, and it occurs in the rows with indexes **3** and **4**.

(c)   Construct an algorithm in pseudocode for the sub-program highestRT(DICEDIAL).   [8]