SECTION A

*Answer **all** questions in Section A.*

1. State the **four** steps in the machine instruction cycle. *[4 marks]*

2. Outline the function of a computer bus. *[2 marks]*

3. Explain the use of a stack in storing subprogram return addresses. *[2 marks]*

4. State the efficiency of a selection sort in BigO notation. *[1 mark]*

5. A colour is represented in a particular computer using 3 bytes (of 8 bits per byte). For example, red is represented as F00.

(a) Express the 3 byte representation of red in binary. *[1 mark]*

(b) Calculate the number of different colours that can be represented. *[1 mark]*

(c) This machine has a 25-bit word. The word has a single odd parity check bit in the leftmost position (most significant bit). The remaining bits store the colour code. Express the word representation of red in

(i) binary; *[1 mark]*

(ii) hex. *[1 mark]*

6. Outline the function of defragmentation software. *[2 marks]*

7. Outline the purpose of periodic reviews during the system life cycle. *[2 marks]*

8. Sorts such as selection, quick sort and bubble can all be classified as internal sorts. Compare external sorting with internal sorting. *[4 marks]*

9. Outline **two** differences between a compiler and an interpreter. *[4 marks]*

10. Identify **one** application of ROM. *[1 mark]*

11. (a) State the **two** types of computer system documentation. *[2 marks]*

(b) Explain why it is necessary to produce these two types of documentation. *[2 marks]*

12. Outline **one** situation where multi-tasking is necessary. *[2 marks]*

13. Define *handshaking*. *[2 marks]*

14. A manual billing system is being replaced by a computerised one in an office. State **two** ways in which the staff may be affected by this change. *[2 marks]*

15. A printed page is to be transferred into a text document without using a keyboard. The resulting document will then be edited using a word processing software package.

(a) State **one** hardware device that will be required for the transfer. *[1 mark]*

(b) State what further software package is required. *[1 mark]*

16. Outline the need for interrupt priorities. *[2 marks]*

SECTION B

*Answer **four** questions.*

17. A class of students took a test. The names of the students, together with the marks they gained, are stored in a computer file.

For example:

Ana	30
Boris	10
Tim	50

Each record of the file stores one student's name and mark. When these records are read into memory by a computer program which accesses the data alphabetically by student name, they can be stored using

a static data structure
OR
a dynamic data structure.

(a) (i) State a suitable **static** data structure. *[2 marks]*

(ii) Draw a diagram to show how the above data may be stored using **each** data structure. *[4 marks]*

(b) A new development now requires that the names and marks be accessed in two ways:

alphabetically by student name
OR
in descending order of marks.

(i) Identify the most appropriate dynamic data structure for this development. *[1 mark]*

(ii) Use the data given to illustrate your chosen data structure. *[3 marks]*

18. The following algorithm fragment has been designed to analyse temperatures (in ° C) at a tourist resort.

```
1   COUNT ← 0
2   TOTAL ← 0
3   input TEMP
4   while TEMP # 0 do
5      TOTAL ← TOTAL + TEMP
6      COUNT ← COUNT + 1
7      input TEMP
8   endwhile
9   AVERAGE ← TOTAL/COUNT
```

(a) **Copy and complete** the following trace table for the data:

15, 7, 23, 9, 0

Line	COUNT	TOTAL	TEMP	TEMP # 0	AVERAGE
1	0	–	–		–
2		0			–
3			15		–
4				true	–
5					–

[5 marks]

(b) The loop uses zero (0) to terminate the iteration. Suggest a better value, and explain why it is more suitable. *[2 marks]*

(c) Identify the type of error that might occur at line 9 and explain when this would occur. *[3 marks]*

19. Criminal justice agencies (for example, local police forces, drug enforcement agencies) require a lot of information about crimes and people. Rather than using a manual system, information can be computerised and accessed through a criminal justice information system.

(a) Outline **two** disadvantages of computerising a large system. *[4 marks]*

(b) Explain **two** advantages for the criminal justice agency if the system is computerised. *[4 marks]*

(c) Discuss **one** concern members of the public might have about such a system. *[2 marks]*

20. (a) Define the Boolean operator **XOR** by drawing a truth table. *[2 marks]*

(b) A traffic control system uses three sensors to detect the presence of cars or people. Each sensor (P, Q and R) will send a 0 or a 1 along a wire connected to a circuit. The output from the circuit will sound a buzzer (B) indicating that a person can cross the road when safe conditions are detected by the three sensors.

The values of P, Q and R are stored in a 3-bit register, with P as the most significant bit and R as the least significant bit.

(i) Construct the truth table for all possible inputs of P, Q and R. The output buzzer will sound (that is, B=1) for the equivalent decimal values of 0, 3, 4 and 7. *[3 marks]*

(ii) Simplify the Boolean expression for the truth table. *[3 marks]*

(iii) Draw a logic circuit for the system. *[2 marks]*

21. A processor needs to be connected to, and to communicate with, both memory and peripheral devices.

(a) Memory can usually be connected directly to the processor, whilst other peripheral devices cannot, because of differences in operating characteristics.

Outline **four** differences in operating characteristics between the processor and peripheral devices. *[4 marks]*

(b) One task that may be carried out when data is transferred between peripherals and a processor is the conversion from analog to digital (or vice versa).

Explain **one** other task that may have to be performed when data is transferred between peripherals and the processor. *[2 marks]*

(c) A digital system can solve analog problems with the use of analog/digital convertors. Explain the need for the interconversion of data between analog and digital formats. *[4 marks]*