READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions. Answer ALL questions.

2. Write your answers in the spaces provided in this booklet.

3. Do NOT write in the margins.

4. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. Remember to draw a line through your original answer.

5. If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.
SECTION A

COMPUTER ARCHITECTURE AND ORGANIZATION

Answer BOTH questions.

1. (a) The logic circuit in Figure 1 refers to a system of three switches, A, B and C. The combination of switches illustrated below determines whether a bell, X, sounds.

![Logic Circuit Diagram]

Figure 1

In the space below, construct the truth table for the circuit in Figure 1.

[4 marks]
(b) In the space below, construct a truth table for the proposition $P \land Q$.

[4 marks]

(c) What is a program counter?

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[2 marks]
(f) What is a 'multiplexor'. In the space provided below, draw a block diagram to support your answer.

[4 marks]

(g) Why is multiplexing important? Provide a scenario to support your answer.

[4 marks]

Total 25 marks

GO ON TO THE NEXT PAGE
(f) What is a 'multiplexor'? In the space provided below, draw a block diagram to support your answer.

[4 marks]

(g) Why is multiplexing important? Provide a scenario to support your answer.

[4 marks]

Total 25 marks
2. (a) Figure 2 shows the basic hierarchy of computer memory. It requires four examples of specific types of memory for completeness.

```
Memory
   ├── Primary
   │   ├── Non-Volatile
   │   └── Volatile
   └── Secondary
       ├── 3
       └── 4
```

Figure 2

Provide ONE example for EACH of the missing entries labelled 1, 2, 3 and 4.


[4 marks]
(b) Imagine that electricity is available but is not consistently supplied in your community. You have just purchased a cellphone which gives 10 hours of battery power and takes 5 to 7 hours to become fully charged – if not in constant use.

Clearly explain the purpose and core benefit that EACH of the following devices will yield in this scenario.

(i) Surge protector

(ii) Voltage regulator

(iii) UPS

(c) Define the term ‘clock speed’ as it relates to a processor. Give TWO examples of CPU clock speeds using different units of measure.
(d) Describe ONE input device and ONE output device that could be used by a person who is visually impaired.

[4 marks]

(e) Explain the main difference between a supercomputer and a mainframe computer. Provide TWO examples of how EACH type of computer is used.

[5 marks]
(f) There are several types of instructions which can be performed by the processor. Write a set of instructions to perform a mathematical calculation. Include THREE different instructions in your answer.

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[3 marks]

Total 25 marks
SECTION B

PROBLEM SOLVING WITH COMPUTERS

Answer BOTH questions.

3. (a) At a library, a set of data representing outstanding customer balances exist. Each line consists of a customer’s id (integer), followed by the number of books outstanding (integer) and the rate at which fines are charged (character). If the fines rate is P, the customer pays $4.50 for each overdue book. If the fines rate is N, the customer pays $6.50 for each overdue book. The last line contains 9999 only. Assume all data are valid.

Sample Data:

<table>
<thead>
<tr>
<th>ID</th>
<th>Books</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>5</td>
<td>P</td>
</tr>
<tr>
<td>1534</td>
<td>6</td>
<td>N</td>
</tr>
<tr>
<td>2311</td>
<td>10</td>
<td>P</td>
</tr>
<tr>
<td>9999</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the space provided on page 13, write an algorithm to read the data and determine the following:

- The total outstanding fines for each customer
- The total amount of fines paid under each of the categories, N and P
- The total amount of fines paid overall
- The number of customers
- The customer id for the highest fine paid (ignore ties)
(b) Distinguish between ‘bounded iteration’ and ‘unbounded iteration’.

[4 marks]

(c) Write an algorithm to find the sum of all multiples of 7 between 21 and 210 (inclusive).

[6 marks]

Total 25 marks
4. (a) In the space provided on page 17, construct a flowchart to represent the following algorithm.

```
read name
if name = 'enddata'
    print 'No data supplied.'
else
    while name <> 'enddata'
        read amt
        read quan
        sale = amt * quan
        print 'This sale = ', sale
        read name
    endwhile
endif
```
(b) A communications company provides the following rates for telephone calls.

First 20 minutes $1.25 per minute  
Any additional minutes $0.25 per minute

Write an algorithm that reads an integer value representing the amount of minutes for a call and calculates and prints the cost of the call.
(c) A company called ExcelCo sells used video games and wishes to acquire software to track purchases, customer information and the quantities of video games in stock. The company has contracted the services of a software company called SoftwarePlus that writes software applications.

Briefly describe any FOUR stages that SoftwarePlus would generally follow when creating the software for ExcelCo.

[8 marks]

Total 25 marks
5. (a) A certain computer program simulates a simple guessing game. First the program generates a random number between 1 and 10 (inclusive), then the user tries to guess this number by entering an integer. The user continues to enter integers until the number generated and the number guessed are the same. When the numbers are the same the program notifies the user and prints a count of the numbers the user guessed before correctly guessing the random number.

In the space provided on page 21, write a C program which will simulate this guessing game. The following line of code will generate a random number between 1 and 10 (inclusive). You may use the following line of code in your program.

```c
int r = rand() % 10 + 1; // random number generator
```
(b) This question is related to various programming paradigms.

(i) What is a procedural language?

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[1 mark]

(ii) What is an object oriented language?

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[2 marks]

(c) You have been commissioned to assist with the development of an application to keep track of district details for an upcoming general election. The data file, *constituency.txt*, stores the following district details — ID, name, population count and the number of eligible voters. The format for this file is shown in Figure 3 below. Data is terminated by a line containing the characters XX only.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Kingstown</td>
<td>5000</td>
</tr>
<tr>
<td>A2</td>
<td>Port of Spain</td>
<td>9000</td>
</tr>
<tr>
<td>A3</td>
<td>Castries</td>
<td>6000</td>
</tr>
<tr>
<td>B1</td>
<td>St Catherine</td>
<td>3500</td>
</tr>
<tr>
<td>C8</td>
<td>St Joseph</td>
<td>2200</td>
</tr>
<tr>
<td>XX</td>
<td></td>
<td>1500</td>
</tr>
</tbody>
</table>

**Figure 3**

In the space provided on page 23, write C code which will

- read in data from the file
- count the total number of districts recorded
- find the district with the highest number of eligible voters.
6. (a) State THREE ways in which an application for a mobile device may differ from an application for a desktop computer.

(b) What output is produced by the following C code?

```c
#include <stdio.h>

int test (int b, int c, int a) {
    return (c + a);
}

int main ()
{
    int a = 1, b = 2, c = 3;
    while (a <= 10) {
        for (b = c; b <= 7; b = b + 2) {
            a = test(a, b, c);
            printf("a is %d b is %d c is %d\n", a, b, c);
            a++;
            c--;
        } //for
        a = a + 2;
    } //while
    return 0;
} //main
```

[3 marks] [10 marks]

GO ON TO THE NEXT PAGE
(c) (i) Declare in C a structure called BookRec that can store data for a book. A book's data consists of id (integer), quantity in stock (integer) and price (double).

(ii) Write C code to load data into EACH of two books, book1 and book2.

Note: book1 and book2 are of type BookRec.

Obtain the data from the user.

(iii) Write C code to increase the price of book1 by 25%.

[3 marks]
[4 marks]
[2 marks]
(iv) Write C code to interchange the contents of book1 and book2.

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Total 25 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.