Answer ALL of Part I and TWO questions from Part II

The use of Electronic Calculators is NOT permitted

PART I
1.
An Air Traffic Management (ATM) system divides the available airspace into control zones. Each of these zones holds a list of aircrafts currently flying in the zone. The information kept about each flight includes:

- Flight Identifier
- Aircraft type
- Origin
- Destination

a) Design a C++ class called FlightInfo. The class should hold information about individual aircrafts and provide an interface to manipulate the information. Objects of the class should assign and copy corrctly.

[6 marks]

b) Design and show the implementation in C++ of a class called ATMcontrol. The class should hold information about flights in a given ATM control area as a set of FlightInfo objectes. It should allow the following operations:

   i)   add FlightInfo object to set
   ii) delete FlightInfo object from set.
   iii) find FlightInfo object in set from Flight Identifier

The class should not allow the same FlightInfo object to appear twice in the set.

Make sure all design decisions are properly commented

[30 marks]

c) Provide a test plan - including test programs - for the ATMcontrol class. Make sure the plan tests all operations.

[6 marks]

d) Discuss in detail the performance implications of handling very large sets of FlightInfo objects and outline any changes you would make to the class to operate on such sets.

[8 marks]

[Total 50 marks]

PART II

2.
Describe the following C++ features:
       Declaration
       Dynamic variables
       Templates
       Inline functions
       Friend

[5 marks each]

[Total 25 marks]

3.
a) Write a function to sort the elements of an integer array. The function should have the
    following parameters

- The array holding the data
- Number of elements in the array
- Flag indicating ascending or descending sort.

The function should return the pointer to an array holding the sorted data. It must not alter
the original array.

[15 marks]

b) How can the function be tested?

[5 marks]

c) Discuss the efficiency of your function.

[5 marks]

 [Total 25 marks]

4.

a) How is array indexing done using pointer arithmetic?

[7 marks]

b) Explain the concept of explicit type conversion and how it is implemented in C++.

[6 marks]

c) Explain the use of void* pointers in C++

[6 marks]

d) Why is the following function incorrect?

```
int f( int *a, int n )
{
      int i;
      for( i=0; i<n; i++ )
            if( a[i] = 0 ) break;
      if( i < n/2 ) return( 0 );
      else return( 1 );
}
```

[6 marks]

[Total 25 marks]