Ex/IT/T/211/2017(S)

B. E. INFO. TECH 2ND YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2017

(2nd year 1st Semester)

OBJECT ORIENTED PROGRAMMING

Time: Three hours

Full Marks: 100

Attempt **any FIVE** questions

1. Define a class "*Complex*" for complex numbers that has two members: (i) a floating point number for real part and (ii) a floating point number for imaginary part. Define constructors so that a string can be initialized by (i) nothing (ii) one floating point number, (iii) two floating point numbers and (iii) another *Complex* object.
   Overload the operators "==" and "+" for the *Complex* class. Also, overload ">>" and "<<" operators for input and output.

   (1+1+1+1) + (4+4+4+4)

2. Consider a base class "Shape" with a pure virtual function "calculateArea". Suppose that there are two derived classes of a shape: (i) Circle and (ii) a "Group" of shapes. Class *Circle* has a member "radius" and it redefines "calculateArea". A *Group* contains a list of pointers to "Shape" Objects. This class also contains a definition of "CalculateArea" which is the sum of areas of all objects in that group.

   (5 + 6 + 9)

3. Write a class "Point". A "Point" class has two members to store its x and y coordinates and an appropriate constructor. A "Point" class has a method "getDistanceFrom" that accepts a "Point" object and returns the distance of the given point from "this" point.
   Write a "SimplePolygon" class in that has an array of "Point" objects. The constructor of this class is passed an array of points. The "SimplePolygon" class has a method called "getPerimeter" that calculates the perimeter of the polygon by calling repeatedly "getDistanceFrom" methods of its point objects..

   10+10

4. Answer the following questions
   (a) Complete the following template class definition

```
template <class T> class List
{
public:
        struct node {
                T * a
                Node * next;
        };
        .......
};
```

A function "count" needs to be written which takes two pointers to "nodes" and counts the number of elements between them. Write the definition of the function "count".

(b) Consider a template class "X" with a template parameter "T". A private variable in the template class "X" is an object "a" of type "T". Consider a class "Y" which has a private member "i" which is an integer. An object "a" of type "Y" is less than another object "b" of type "Y" if the member "i" of "a" is less than that of "b". Similarly, an object "x" of type "X<T>" is less than another object "y" of type "X<T>" if the member "a" of "x" is less than that of "y". Consider the following template function:

```
template <class T> void f( X<T> a, X<T> b){
            if (a < b)cout << "XXX" << endl; else cout << "YYY" << endl;
}
```

Also consider the following main function:

```
main(){
            Y *a = new Y(5);      Y *c = new Y(7);
            X<Y> *b, *d; b  = new X<Y>(*a);   d  = new X<Y>(*c);
            f(*b, *d);
}
```

Complete the definitions of "X" and "Y" so that the entire program works properly.

10+10

5. Suppose that a text file is to be read and a table is to be constructed such that each row in that table contains a letter in the English Alphabet (a-z, A-Z) and the number of times the letter occurs in the text file. This table is then written onto a file. Write a C++ program for this purpose. Define the necessary classes and their member functions and a *main* function.

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6. Answer the following questions
   (a) Which operators can not be overloaded in C++?
   (b) Explain overriding of a method by a suitable example.
   (c) Give an example of the use of a friend method.
   (d) What are the advantages of using "*new*" over "*malloc*"?
   (e) What are the differences between *inline* and *macro*?

3+5+5+3+4

7. Write short notes on the following:
   a) Private Inhreritance and its use
   b) When an inline functions is not expanded
   c) dynamic_cast, type_id operators
   d) Assignment operator overloading with an example

5x4