Note: Answer Five Questions (10 marks for each question)

Q1) Answer the following (choose five only):
   a- What is the polymorphism? Explain the early binding and late binding?
   b- Using examples show how many types of constructors the program in OOP could have?
   c- What is Static Data Member? Show an example.
   d- What are the benefits of reusability?
   e- What is the meaning of ambiguity? Is there any relation between it and the overriding, show using examples.
   f- How can we initialize constant members in a class? Give an example.

Q2) A- Write a class to represent a rectangle, with a function to calculate the area, and a friend function to duplicate the width and height of the rectangle.

   B- Write a class to represent a string of characters, with overloaded constructor function, the first function with no parameter, the second function with an array of characters as a parameter, and the third function contains an integer parameter to be converted to a string.

Q3) A- . Show the output of the following program:
   ```
   #include <iostream>
   class A {
       public:
       int f() { return 1; }
       virtual int g() { return 2; }
   };
   class B: public A {
       public:
       int f() { return 3; }
       int g() { return 4; }
   };
   class C: public A {
       public:
       int g() { return 5; }
   };
   int main() {
       A *pa;
       A a;
       B b;
       C c;
       pa = &a; cout << pa->f() << endl; cout << pa->g() << endl;
       pa = &b; cout << pa->f() + pa->g() << endl;
       pa = &c; cout << pa->f() << endl; cout << pa->g() << endl;
       return 0;
   }
   ```

   B- Write a complete OOP program to represent a class of string has the following function:
      1- Check number of the vowel letters in a string, and return a counter to main function
      2- A display function.
Q4) A- Define an array of objects with initial values as given in the following table:

<table>
<thead>
<tr>
<th>Country</th>
<th>Capital</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iraq</td>
<td>Baghdad</td>
<td>24,775,987</td>
</tr>
<tr>
<td>Egypt</td>
<td>Cairo</td>
<td>50,435,434</td>
</tr>
<tr>
<td>Yemen</td>
<td>Sana’a</td>
<td>28,905,224</td>
</tr>
</tbody>
</table>

B- Write a program to illustrate how to define and declare a class template for reading two data items using special function (constructor) and to find the multiplication of the given two data items.

Q5) Implement a class which is named time. Each object of this class represent a specific time of the day. Store the hours, minutes, and second as an integer number. Use constructor to input the data and then member functions named (advance) used to update the time and (reset) function used to accurate the time. The last function is (normalize) which is used to arrange the time.

Q6) A- Write an OOP program that contain an overload functions for the operators (>, +). (> ) to check if the first cube is bigger than second one (its bigger if its x, y, z is greater than the x, y, and z of the second one) and the second function (+) to add x, y, z to the x, y, and z of the second one) add a statements in the main program to check the functions.

B- Write class Point, where each point represented by two integer numbers (X, Y), with a suitable constructor and a function to print the point, then derive class circle, where each circle represented by the central point and radius, with a suitable constructor and a function to compute the area of the circle. Note that the access visibility is protected.

GOOD LUCK