Instructions: This homework assignment covers the basics of inheritance in C++. The answers may be determined from the CS 2704 notes and lectures and the assigned reading in Stroustrup, which are online at the course website.

Opscan forms will be passed out in class and collected in class on Tuesday April 3 or Wednesday April 4. Opscans will not be accepted at any other time. Mutilated opscans may be discarded.

1. In OOP, an object of a derived class usually is “larger” (containing more functions and/or more data) than an object of its base class.
   1) True  2) False

2. An inheritance hierarchy defines the “has-a” relationships among a collection of classes.
   1) True  2) False

3. An object of a _________ class can be treated as an object of its corresponding _________ class.
   1) base, derived  2) derived, base  3) Both 1 and 2  4) None of these

4. When an object X of a derived class is assigned, using the default assignment operator, to a variable Y of its corresponding base type:
   1) Y has all the data and function members of the derived class.
   2) Y has only the data and function members of the base class.
   3) an error occurs because this is not an allowed operation.
   4) None of these

5. When an object Y of a base class is assigned, using the default assignment operator, to a variable X of a type derived from Y's class:
   1) X has all the data and function members of the derived class.
   2) X has only the data and function members of the base class.
   3) an error occurs because this is not an allowed operation.
   4) None of these

6. Suppose that X is a class and that F() is a function that is not a member, or a friend, of X or of any class derived from X. Then, as far as F() is concerned, there is no difference between which of the following access specifiers for members of X?
   1) public and private  2) public and protected  3) private and protected  4) public, private and protected  5) None of these

7. Suppose that two classes, X and Y, are derived from a class B. If good OO design criteria have been applied, then the data and function members of B correspond to:
   1) all of the attributes and behaviors of X, and all of the attributes and behaviors of Y.
   2) the attributes and behaviors of X not found in Y, and the attributes and behaviors of Y not found in X.
   3) the attributes and behaviors that are common to both X and Y.
   4) attributes and behaviors that are unrelated to both X and Y.
   5) None of these.
For questions 8 through 13, assume that Foo and Bar are C++ classes, and that the class Bar is derived, using public inheritance, from the class Foo.

8. If X is an object of type Bar, then the member functions of X:
   1) cannot directly access any of the members of class Foo.
   2) can directly access only the public members of class Foo.
   3) can directly access only the public and protected members of class Foo.
   4) can directly access the public, protected, and private members of class Foo.
   5) None of these

9. A programmer who wishes to use inheritance to produce a specialized derived class from the class Foo, does not need access to the source code for the implementation of Foo.
   1) True 2) False

10. Suppose that an object X of type Bar is declared. Then:
    1) no constructor for the base class, Foo, will be executed at all.
    2) a constructor for the base class, Foo, will be executed before any constructor for the derived class, Bar.
    3) a constructor for the base class, Foo, will be executed after any constructor for the derived class, Bar.
    4) a constructor for the base class, Foo, may (or may not) be executed, and that may take place either before or after the execution of a constructor for the derived class, Bar.
    5) constructors for both classes will be executed at the same time.
    6) None of these

11. Suppose that an object X of type Bar is declared. Then when the lifetime of that object ends:
    1) the destructor for the base class, Foo, will not be executed at all.
    2) the destructor for the base class, Foo, will be executed before the destructor for the derived class, Bar.
    3) the destructor for the base class, Foo, will be executed after the destructor for the derived class, Bar.
    4) the destructor for the base class, Foo, may (or may not) be executed, and that may take place either before or after the execution of the destructor for the derived class, Bar.
    5) destructors for both classes will be executed at the same time.
    6) None of these

12. It is illegal to declare an object X of type Bar without first declaring a corresponding object of type Foo.
    1) True 2) False

13. Which of the following is true?
    1) Public members of Foo become public members of Bar.
    2) Public members of Foo become private members of Bar.
    3) Public members of Bar become public members of Foo.
    4) Public members of Bar become private members of Foo.
    5) 2 and 3 only
    6) None of these

14. Which of the following statements about a class inheritance hierarchy is typically true?
    1) Each class is more specialized than the one directly above it.
    2) Each class is less specialized than the one directly above it.
    3) Each class inherits the properties from classes below it.
    4) 1 and 3 only
    5) 2 and 3 only
    6) None of these
For questions 15 and 16, consider the following C++ class declarations:

```cpp
class X {
    private:
        int m;
    public:
        void Func1();
        void Func2();
};

class Y : public X {
    private:
        float f;
    public:
        void Func3();
};
```

15. How many public members (data and function) does an object of class \( Y \) have?

- 0
- 1
- 2
- 3
- 4
- None of these

16. How many data members (considering all access protections) does an object of class \( Y \) have?

- 0
- 1
- 2
- 3
- 4
- None of these

For questions 17 and 18, consider the following C++ class declarations:

```cpp
class X {
    private:
        int M;
        void Func2();
    public:
        X(int iM = 0);
        void Func1();
        ~X();
};

class Y : public X {
    private:
        float F;
    public:
        Y();
        Y(float iF, int iM);
        void Func3();
        ~Y();
};
```

17. Which of the following function(s) may legally be invoked by a user of class \( Y \)?

- \( \text{Func1()} \)
- \( \text{Func2()} \)
- \( \text{Func3()} \)
- All of the above
- 1 and 3 only
- None of these

18. Consider the following constructor implementation for the class \( Y \):

```cpp
Y::Y(float iF, int iM) : X(iM){
    F = iF;
}
```

What is the purpose of the sequence of characters “: \( X(iM) \)?

- To invoke a member function of the class \( Y \).
- To declare a new member function for the class \( Y \).
- To invoke a constructor for a data member an object of the class \( Y \).
- To invoke a constructor for the base level of an object of the class \( Y \).
- Either 3 or 4.
- The syntax is invalid.
- None of these
19. What is the purpose of the C++ language feature known as a constructor member initializer list?

1) To pass parameters from a base class constructor to a derived class constructor.
2) To pass parameters from a derived class constructor to a base class constructor.
3) To construct an object's sub-objects before the rest of the object is constructed.
4) 1 and 3 above
5) 2 and 3 above
6) None of these

20. In the object-oriented design of an airline passenger reservation program, suppose that “airplane seat”, “aisle seat”, and “window seat” have been identified as classes. Focusing specifically on the aisle seat class, how does it relate to the airplane seat class?

1) “aisle seat” exhibits a “has-a” relationship with “airplane seat”.
2) “aisle seat” exhibits a “knows-a” relationship with “airplane seat”.
3) “aisle seat” exhibits an “is-a-kind-of” relationship with “airplane seat”.
4) “aisle seat” and “airplane seat” are independent and unrelated.
5) None of these