I. Give a brief (1-2 sentences) definition for each of the following terms (4 pts. each):

- Protected data member
- Class hierarchy
- Inheritance
- Struct
- Memory leak
- Pointer dereferencing
- Deep copy

II. Provide short but adequate answers for the following (6 pts. each):

- Discuss the possible consequences for a running program that has memory leaks and dangling pointers.
• Given a choice between using an array and using a linked list to manage a list of elements, discuss which you believe would be better and why (you may use coding difficulty, performance implications, code readability and debugging, and flexibility as your justification).

• Discuss or draw the internal representations of a base class object and a derived class object.

• Describe a situation in which making a shallow copy of an object is a dangerous action.

III. Answer the following in two sentences or less (4 pts. each):

• When is it a good idea to use inheritance?

• You have a class that has pointers in its private data section. You have already written a copy constructor for the class. What other two functions should you write?
• You have decided that making a protected section in your class is too dangerous. What responsibility, with respect to your private data elements, do you have for classes that will derive from yours?

• Describe the result if a compiler called the following copy constructor:

   ```cpp
class myClass {
   public:
       myClass(const myClass m);
   …
   };
```

• What is the second of two actions that the delete operator will perform when called?

• When you were writing your linked list code, why would it have been incorrect to just call delete on your “first” pointer?

• Why are input and output operators (>> and <<) usually not overloaded as class member functions?

• Given the following code, what kind of output would you expect to see?

   ```cpp
   int x = 12;
   int* iPtr = &x;
   cout << iPtr;
   ```
IV. Code writing (4 pts. each):

- Declare a constant pointer that can point to fraction objects and make it point at a dynamically created fraction object.

- Write a struct definition for type person that contains a string to hold a first name, a string to hold a last name, an int to hold an ID number, and a char to hold a gender.

- Write the first two lines you should place in an include file called bicycle.h.

- Write the full copy constructor definition (including the function header) for a class called elevator whose private data consists of:

  ```
  int weightLimit;
  int currentWeight;
  int currentFloor;
  string* manufacturer;
  ```