1. (10%) Given two examples where you must use the this pointer in a member function.

2. (20%) Make corrections to the following class. For each correction, explain why.
   class X {
   public:
       X();
       X operator = (const X &);
   private:
       X(X);
       ~X();
   ...
   }

3. (30%) Assuming that we want to implement QuickSort for sorting a vector containing integers. The STL function partition (see Lippman, pp. 1167-68) can be used with QuickSort. Implement the following partitioning strategy for use with partition and write the code for calling the function partition: (a) Use the first element of the vector as the partitioning element. Implement this as a C++ function. (b) Use the median of three randomly selected elements in the vector as the partitioning element. Implement this as a function object. (You may assume that class RandomNumber as published on the class web page is available.)

4. (40%) Resource is often limited. Suppose that you have 10 resources of type XResource available to your application, which are shared by 100 clients of type XClient. A client is allowed to get and release an instance only by the following calls:

   XResource *px = XResource::getInstance(this);
   if (px)
       // do something with the obtained resource
   ...
   // done using resource
XResource::releaseInstance(this); // or px-> releaseInstance(this);

Note the client passes a pointer itself in getting and releasing a resource. Design and implement the class XResource. XResource must grant each client no more than 2 instances of the resource.

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