[5 pts.] 1. What are the similarities and differences between the record and array data structures?
Similarities:
- they are both static structures
- for both, the individual elements are stored contiguously in memory
- they are both examples of linear lists

Differences:
- array elements must all be the same type (class), record elements may be different types
- array elements are accessed by index (subscript), record elements by name

[5 pts.] 2. How is the concept of a class similar to that of a data structure?
- Both are used to describe the way the data look (type, organization, etc.) and what we can do with them.
- A data structure is an abstract way to describe or define the organizaiton of data operated on by a running program; a class may be used to implement a data structure.

[5 pts.] 3. Class members may be private, public, or protected. Explain these keywords and how you would use them.
- public - members are accessible by functions outside the class.
- private - members are accessible only by functions inside the class. Even descendent classes are denied access.
- protected - only member functions of the class and its descendents have access.

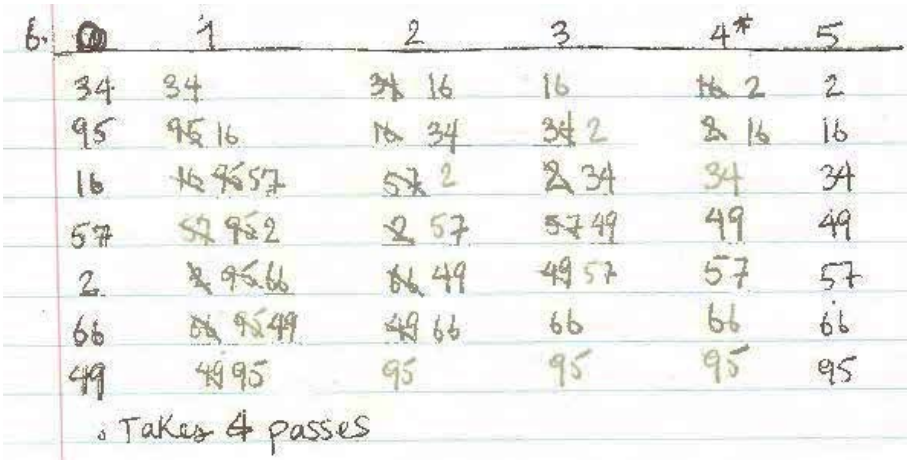
[5 pts.] 4. (a) In what circumstances is it a good idea to use array(s)? (b) When is it not a good idea?
Use arrays when
- data is all of the same type
- you ***must*** keep all the data in memory while the program is running, rather than using and discarding; perhaps because array elements will be accessed more than once
- you will be processing the data in a uniform manner (most likely with **for** loops)
- ideally, you know how large the array has to be when the program is written; this constraint is not a priority

Don't use arrays when
- you are simply reading input data to process it; see if your program can read in data one object (scalar item or record) at a time, process the object, and safely discard it.

[5 pts.] 5. What kind of statements go into a .h (header) file? What goes into a .cpp file?

[10 pts.] 6. Sort the following list in ascending order using the Bubble Sort algorithm. Show all work for each pass, and rewrite the list after each pass.

34 95 16 57 2 66 49



7. The results of a true-false exam are available for input to a test scoring program. The information available for each student consists of (at least) a student ID number and the student's answers to 10 true-false questions.

[30 pts.] (a) Write a complete Student class definition and implementation for this program. Since the Student class may also be used in other programs, be sure to include all relevant attributes and methods. Include a method called scantron() that the program can use to score a single student's exam and return the number of correct answers.

```
//Quick (and incomplete) DRAFT. Please do find my errors. ;)
class Student {
    public:
        Student(){};                  //constructor
        ~Student(){};                 //destructor
        void EnterData();             //to enter data from an input device, like the keyboard or a file
        int scantron (char[10]);      //to score a student's exam
                                      //access (get) functions
                                      //No modifier (set) functions I can't see how they would help here.
        string getID();
        string getFullName();
        int getScore();
    private:                          //attributes for a single student object.
                                      /*Don't include attributes for a group of students or a course,
                                      e.g., courseName, teacher, classAvg, min, max, etc.*/
        string ID; string FullName; char ans[10]; int score;
}

string Student::getID() {return ID;}
string Student::getFullName() {return FullName;}
int Student::getScore() {return score;}
```

```
void Student::EnterData(){
    cin>>ID >>FullName;
    for (int i=0; i<10; i++) cin>> ans[i];
}

int scantron(key[]){
    score = 0;
    for (int i=0; i<10; i++)
        if (ans[i]==key[i]) score++;
    return score;          //could also be a void fn w/o returning score since it is a Student attribute
}
```

[20 pts.] (b) Show how you would have to redesign the Student class you wrote for part (a) so that you could use it in the following program:

Write a program to provide a report of student grades. Each student is given four exams. The final grade of each student is determined by calculating the weighted average of all the exams. Your report should show the average of each student, the class average, and the maximum and minimum grades for the class.

```
class Student{
//At minimum add the following...
    public:
        float calcAvg(float weight[4]);
        float getAvg();
        private:                    //attributes for a single student object.
                                    /*Don't include attributes for a group of students or a course,
                                    e.g., courseName, teacher, classAvg, min, max, etc.*/
        int exam[4]; float avg;
}

//implementation of additional methods goes  here.
/*Note that class average, class max, and class min are found in main() using getAvg() or
calcAvg(weight[]). We might wish to count students when we enter data (as below) but it could just as
well be done in main().*/
void Student::EnterData (int &n){          //changes in red
    cin>>ID >>FullName;
    for (int i=0; i<10; i++) cin>> ans[i];
    n++;
}
```

[10 pts.] (c) Do you think you could design a Student class that could be used efficiently and effectively for both applications? Justify your answer, why or why not.

NOTE: The remaining 5 points will go towards readability and clarity. Try to be neat, please.