ET-580 – Classes II - Homework

Reading

1) Chapter 8.1, 8.2 Operator Overloading, Friends and References

Implementation

1. Implement a class:

   a. Implement a *Student* class with the following:
      1. Private nested *GPA* class with the following:
         a. public data member: *grade*
         c. default and one-parameter constructors
         b. *getLetterGrade()* function to return a letter based upon GPA
            >=3.5 A, >=2.5 B, >=1.5 C, >=1 D, all else F
      2. Data members: *name, major, gpa (of type GPA)*
      3. Three-parameter constructor to set all data members
      2. Default constructor to set "*noname*", "*nomajor*", *0.0* using delegation
      4. Accessors for *name*, *major* and *gpa*
      5. Mutators for *name*, *major* and *gpa*
      5. Print function to display a *Student* object (see example)
   b. Instantiate two *Student* objects and print their data (see example)
      Use cout.setf and cout.precision commands to set decimal precision

   Example Output

```
Name: John Williams
Major: Music
GPA: 4.00
Grade: A

Name: Isaac Asimov
Major: English
GPA: 3.33
Grade: B
```

2) N-Queens.

A Queen on a chessboard can attack any piece in the same column, row or diagonal. The N-Queens problem is to place *n* queens on a *n* x *n* chessboard such that no two queens threaten each other.

a) Implement a one-dimensional integer array of Queen positions for an 8x8 board where indices represent rows and the values represent columns.

For example, a "safe" solution would be {3,6,2,7,1,4,0,5}

```
. . . Q . . . .
. . . . . . Q .
. . Q . . . . .
. . . . . . . Q
. Q . . . . . .
. . . . Q . . .
Q . . . . . . .
. . . . . Q . .
```

b) Implement a *print* function to display the board (see output example)

c) Implement an *isSafe* function that:
1) Returns *false* if multiple queens share a column
2) Returns *false* if multiple queens share a diagonal
3) Returns *true* if all queens are safe

d) Program should display if the Queens are safe or not safe.

Example Output

```
Testing: 1 4 2 3 5 7 6 0

. Q . . . . . .
. . . . Q . . .
. . Q . . . . .
. . . Q . . . .
. . . . . Q . .
. . . . . . . Q
. . . . . . Q .
Q . . . . . . .

Queens are not safe!
```