Source File: `~/2336/37/lab37.(C|CPP|cpp|c++|cc|cxx|cp)`
Input: under control of `main` function
Output: under control of `main` function
Value: 4

A small sudoku puzzle is a grid of 16 boxes, divided into four two-by-two squares. For example,

1	4	2	3
2	3	1	4
3	2	4	1
4	1	3	2

is a valid sudoku game board. When finished, each cell on the board will contain a single integer: 1, 2, 3, or 4. The numbers are placed so that each row, column, and quadrant of the board contains each of the four numbers exactly once. If the board meets this criteria, it is a valid solution. For the above board, we have

1	4	2	3
2	3	1	4
3	2	4	1
4	1	3	2

1	4	2	3
2	3	1	4
3	2	4	1
4	1	3	2

1	4	2	3
2	3	1	4
3	2	4	1
4	1	3	2

The purpose of this assignment is to develop the implementation for the `Sudoku` class. A header file containing the specification is shown in Figure 1, a sample `main` function for testing your implementation is shown in Figure 2, and a sample execution sequence is shown in Figure 3. To use the `Makefile` as distributed in class, add a target of `lab37` to `targets2srcfiles`.

```
1  #ifndef LAB37_H
2  #define LAB37_H
3
4  #include <iostream>
5  #include <d_matrix.h>
6
7  using namespace std;
8
9  class Sudoku
10 {
11   // Overloaded output operator - displays puzzle row-by-row to output
12   // stream out.  The elements in a row should be separated by one
13   // blank space.
14   friend ostream& operator<<(ostream& out, const Sudoku& puzzle);
15
```

Figure 1. `/usr/local/2336/include/lab37.h` (Part 1 of 2)

```
16    // Overloaded input operator - initializes puzzle from input stream
17    // in.  The function should read four four-digit unsigned
18    // integers. The first unsigned integer is used to initialize the
19    // elements of the first row of the puzzle, the second the second,
20    // etc. The least significant digit of the four-digit number is used
21    // to initialize the last element in the row, the next-to-least the
22    // next-to-last, etc.
23    friend istream& operator>>(istream& in, Sudoku& puzzle);
24
25   public:
26    // default constructor - resizes puzzle to have four rows and four
27    // columns
28    Sudoku();
29
30    // Returns true if puzzle represents a valid sudoku game board as
31    // described in the lab handout
32    bool isValid() const;
33
34   private:
35    matrix<uint> gameBoard;
36  };
37
38  #endif
```

Figure 1. `/usr/local/2336/include/lab37.h` (Part 2 of 2)

```
1   #include <iostream>
2   #include <lab37.h>
3
4   using namespace std;
5
6   int main()
7   {
8     Sudoku sudokuPuzzle;
9     uint i, n;
10
11    cin >> dec >> n;
12    for (i = 1; i <= n; ++i)
13    {
14      cin >> sudokuPuzzle;
15      cout << sudokuPuzzle;
16      cout << "Board #" << i << " is ";
17      if (sudokuPuzzle.isValid())
18        cout << "valid" << endl;
19      else
20        cout << "invalid" << endl;
21    }
22
23    return 0;
24  }
```

Figure 2. `/usr/local/2336/src/lab37main.C`

```
newuser@csunix ~> cd 2336
newuser@csunix ~/2336> ./getlab.ksh 37
  * Checking to see if a folder exists for Lab 37. . .No
  * Creating a folder for Lab 37
  * Checking to see if Lab 37 has sample input and output files. . .Yes
  * Copying input and output files for Lab 37
    from folder /usr/local/2336/data/37 to folder ./37
  * Checking to see if /usr/local/2336/src/lab37main.C exists. . .Yes
  * Copying file /usr/local/2336/src/lab37main.C to folder ./37
  * Checking to see if /usr/local/2336/include/lab37.h exists. . .Yes
  * Copying file /usr/local/2336/include/lab37.h to folder ./37
  * Copying file /usr/local/2336/src/Makefile to folder ./37
  * Adding a target of lab37 to targets2srcfiles
  * Touching file ./37/lab37.cpp
  * Edit file ./37/lab37.cpp in Notepad++
newuser@csunix ~/2336> cd 37
newuser@csunix ~/2336/37> ls
01.dat       02.dat       Makefile     lab37.h
01.out       02.out       lab37.cpp    lab37main.C
newuser@csunix ~/2336/37> make lab37
g++ -g -Wall -std=c++11 -c lab37main.C -I/usr/local/2336/include -I.
g++ -g -Wall -std=c++11 -c lab37.cpp -I/usr/local/2336/include -I.
g++ -o lab37 lab37main.o lab37.o -L/usr/local/2336/lib -lm -lbits
```

```
newuser@csunix ~/2336/37> cat 01.dat
4
1423
2314
3241
4132
2134
3421
1214
4321
1234
2341
3412
4123
0423
2315
3246
4732
```

```
newuser@csunix ~/2336/37> cat 01.dat | ./lab37
1 4 2 3
2 3 1 4
3 2 4 1
4 1 3 2
Board #1 is valid
2 1 3 4
3 4 2 1
1 2 1 4
4 3 2 1
Board #2 is invalid
1 2 3 4
2 3 4 1
3 4 1 2
4 1 2 3
Board #3 is invalid
0 4 2 3
2 3 1 5
3 2 4 6
4 7 3 2
Board #4 is invalid
```

```
newuser@csunix ~/2336/37> cat 01.dat | ./lab37 > my.out
newuser@csunix ~/2336/37> diff 01.out my.out
```

Figure 3. Commands to Compile, Link, & Run Lab 37 (Part 1 of 2)

```
newuser@csunix ~/2336/37> cat 02.dat
10
1423
2314
3241
4132
2134
3421
1214
4321
1234
2341
3412
4123
1111
2222
3333
4444
1234
1234
1234
1234
1234
1234
2341
3412
4123
1234
4321
3412
2143
4321
1234
2143
3412
1234
4321
1234
4321
1414
2323
3232
4141
newuser@csunix ~/2336/37> cat 02.dat | ./lab37
1 4 2 3
2 3 1 4
3 2 4 1
4 1 3 2
Board #1 is valid
2 1 3 4
3 4 2 1
1 2 1 4
4 3 2 1
Board #2 is invalid
1 2 3 4
2 3 4 1
3 4 1 2
4 1 2 3
Board #3 is invalid
1 1 1 1
2 2 2 2
3 3 3 3
4 4 4 4
Board #4 is invalid
1 2 3 4
1 2 3 4
1 2 3 4
1 2 3 4
Board #5 is invalid
1 2 3 4
2 3 4 1
3 4 1 2
4 1 2 3
Board #6 is invalid
1 2 3 4
4 3 2 1
3 4 1 2
2 1 4 3
Board #7 is valid
4 3 2 1
1 2 3 4
2 1 4 3
3 4 1 2
Board #8 is valid
1 2 3 4
4 3 2 1
1 2 3 4
4 3 2 1
Board #9 is invalid
1 4 1 4
2 3 2 3
3 2 3 2
4 1 4 1
Board #10 is invalid
```

```
newuser@csunix ~/2336/37> cat 02.dat | ./lab37 > my.out
newuser@csunix ~/2336/37> diff 02.out my.out
newuser@csunix ~/2336/37>
```

Figure 3. Commands to Compile, Link, & Run Lab 37 (Part 1 of 2)