Source File: `~/2336/35/lab35.(C|CPP|cpp|c++|cc|cxx|cp)`
Input: Under control of `main` function
Output: Under control of `main` function
Value: 2

Write a function to determine whether a particular square two-dimensional array is an ***identity matrix*** (1s on the main diagonal and 0s everywhere else).

$$\begin{pmatrix} 1 & 0 & \dots & 0 \\ 0 & 1 & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & 1 \end{pmatrix}$$

A sample `main` function for testing your implementation is shown in Figure 1 and a sample execution sequence is shown in Figure 2. To use the `Makefile` as distributed in class, add a target of `lab35` to `targets2srcfiles`.

```
1  #include <iostream>
2  #include <d_matrix.h>
3
4  using namespace std;
5
6  bool isIdentityMatrix(const matrix<int>& mat);
7  istream& operator>>(istream& in, matrix<int>& mat);
8  ostream& operator<<(ostream& out, const matrix<int>& mat);
9
10 int main()
11 {
12   int n, count = 0;
13   matrix<int> mat;
14
15   while (cin >> n)
16   {
17     mat.resize(n, n);
18     cin >> mat;
19     cout << mat << "Matrix #" << ++count
20          << (isIdentityMatrix(mat) ? " is " : " is not ")
21          << "an identity matrix" << endl;
22   }
23
24   return 0;
25 }
26
```

Figure 1. `/usr/local/2336/src/lab35main.C` (Part 1 of 2)

```
27  istream& operator>>(istream& in, matrix<int>& mat)
28  {
29    int n = mat.rows(), i, j;
30
31    for (i = 0; i < n; ++i)
32      for (j = 0; j < n; ++j)
33        in >> mat[i][j];
34
35    return in;
36  }
37
38  ostream& operator<<(ostream& out, const matrix<int>& mat)
39  {
40    int n = mat.rows(), i, j;
41
42    for (i = 0; i < n; ++i)
43      for (j = 0; j < n; ++j)
44        out << mat[i][j] << (j < n - 1 ? ' ' : '\n');
45
46    return out;
47  }
```

Figure 1. `/usr/local/2336/src/lab35main.C` (Part 2 of 2)

```
1  newuser@csunix ~> cd 2336
2  newuser@csunix ~/2336> ./getlab.ksh 35
3    * Checking to see if a folder exists for Lab 35. . .No
4    * Creating a folder for Lab 35
5    * Checking to see if Lab 35 has sample input and output files. . .Yes
6    * Copying input and output files for Lab 35
7      from folder /usr/local/2336/data/35 to folder ./35
8    * Checking to see if /usr/local/2336/src/lab35main.C exists. . .Yes
9    * Copying file /usr/local/2336/src/lab35main.C to folder ./35
10   * Checking to see if /usr/local/2336/include/lab35.h exists. . .No
11   * Copying file /usr/local/2336/src/Makefile to folder ./35
12   * Adding a target of lab35 to targets2srcfiles
13   * Touching file ./35/lab35.cpp
14   * Edit file ./35/lab35.cpp in Notepad++
15 newuser@csunix ~/2336> cd 35
16 newuser@csunix ~/2336/35> ls
17 01.dat       01.out       Makefile     lab35.cpp    lab35main.C
18 newuser@csunix ~/2336/35> make lab35
19 g++ -g -Wall -std=c++11 -c lab35main.C -I/usr/local/2336/include -I.
20 g++ -g -Wall -std=c++11 -c lab35.cpp -I/usr/local/2336/include -I.
21 g++ -o lab35 lab35main.o lab35.o -L/usr/local/2336/lib -lm -lbits
```

Figure 2. Commands to Compile, Link, & Run Lab 35 (Part 1 of 2)

```
newuser@csunix ~/2336/35> cat 01.dat
3
1 0 0
0 1 0
0 0 1
2
0 1
1 0
4
1 0 0 1
0 1 1 0
0 1 1 0
1 0 0 1
1
1
4
1 0 0 0
0 1 0 0
0 0 1 0
0 0 0 1
2
1 2
3 1
2
1 2
3 4
2
1 -1
-1 1
```

```
newuser@csunix ~/2336/35> cat 01.dat | ./lab35
1 0 0
0 1 0
0 0 1
Matrix #1 is an identity matrix
0 1
1 0
Matrix #2 is not an identity matrix
1 0 0 1
0 1 1 0
0 1 1 0
1 0 0 1
Matrix #3 is not an identity matrix
1
Matrix #4 is an identity matrix
1 0 0 0
0 1 0 0
0 0 1 0
0 0 0 1
Matrix #5 is an identity matrix
1 2
3 1
Matrix #6 is not an identity matrix
1 2
3 4
Matrix #7 is not an identity matrix
1 -1
-1 1
Matrix #8 is not an identity matrix
```

```
newuser@csunix ~/2336/35> cat 01.dat | ./lab35 > my.out
newuser@csunix ~/2336/35> diff 01.out my.out
newuser@csunix ~/2336/35>
```

Figure 2. Commands to Compile, Link, & Run Lab 35 (Part 2 of 2)