ECE 3340 – Programming Assignment 2
Solving Linear Systems Using Scaled Partial Pivoting

In this assignment, you will implement a stable algorithm for solving linear systems.

The problem
Your application will take a file name as a command-line argument. The associated file will be a standard text file describing a linear system as an augmented matrix.

A text file containing:

```
1    0    1    3
2    3    -2   5
-4   1    1    8
```

represents the linear system:

$$\begin{bmatrix} 1 & 0 & 1 \\ 2 & 3 & -2 \\ -4 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \\ 8 \end{bmatrix}$$

You will solve this system using two methods:

1) Gaussian elimination
2) Gaussian elimination with scaled partial pivoting

Hint: You can implement (1) by removing one line of code from (2). You only have to implement one algorithm with a conditional statement that switches between (1) and (2).

Implement this algorithm using 32-bit precision for all floating point values!

Input Format
The text file used as input has column values separated by spaces and tabs ('\t'). Rows are separated by a carriage return and line feed ('\n'). There are several options for loading the data. My code uses the `std::ifstream` class to interface with the file, the `getline()` function to read data, and the `strtok()` function to split up columns into individual strings.

Output Format
Output the values of $\boldsymbol{x}$ such that each component $x_1 \cdots x_n$ is separated by white space. Output the results for Gaussian elimination first and scaled partial pivoting second. The following is an example of a valid output format for 3 equations and 3 unknowns:

```
Gaussian elimination: x0 = -.211   x1 = 3.95   x2 = 3.21
Scaled partial pivoting: x0 = -.211   x1 = 3.95   x2 = 3.21
```

Turning in your code
Same as programming assignment 1.

Examples
Available on the course website.

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Rubric

Name_____

input format		**_____ / 20**
read correct data from the file	_____ / 15	
comments	_____ / 5	
output format		**_____ / 5**
Scaled Partial Pivoting		**_____ / 45**
correct implementation of scaling	_____ / 10	
correct implementation of pivoting	_____ / 10	
correct implementation of elimination	_____ / 15	
code commented	_____ / 10	
Gaussian Elimination		**_____ / 10**
Back Substitution		**_____ / 20**
correct implementation	_____ / 10	
code commented	_____ / 10	
Total		**_____ / 100**