Assignment 3  
Which way am I going?  
Due: Sunday, January 31, 2016 11:59pm

Grading: EVERY assignment in this course is graded by demoing your work for 10 minutes with a TA. You are required to meet with a TA within one week after the due date to demo. You are penalized for failure to see a TA within the week or missing a scheduled appointment. In either case, if you are within 1 day (24 hours) of the deadline, you lose 10 points. If you are within 7 days (1 week) of the deadline, then you lose 25 points, anything outside of a week from the deadline to demo is an automatic 50 point deduction. Your job is to convince the TA that your program works correctly, i.e. show your TA how to use/break your program😊

During your time in programming, you will undoubtedly run into a situation where you will need to go through information more than once or need to perform the same task over and over. The way we as programmers accomplish this is through the use of loops and functions.

(50 pts) Implementation: Problem Statement
You work for a company that is building the next big rover for planetary exploration. Your job is to write the code that will guide the rover from its current location to its destination.

We will be simulating this on a 4 x 4 grid. Your program must ask the user for the starting position of the rover and the destination. Then you will use these to find the path the rover needs to take, as well as printing the path move by move to the user while keeping track of where the rover has been. Hint: You can use a variable for each grid location to do this.

In this scenario, the rover can only move up, down, left, or right. Your program must be able to run multiple times without closing, as well as print error messages for when the user makes an invalid input. Here are errors you must catch:
- User tries to start or end the rover off the grid.
- User enters characters or floating point numbers for integers.
- Any other errors you might encounter with input for running again.

You will use the following function declaration to find the path:

    void find_path(int xStart, int yStart, int xEnd, int yEnd);

You are also required to create your own print function for the grid. You may create other functions if you would like, but you cannot define any global variables.

Use the following grid as an example of how the coordinates will be assigned to the grid locations:

<table>
<thead>
<tr>
<th></th>
<th>0,0</th>
<th>0,1</th>
<th>0,2</th>
<th>0,3</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>(3,3)</td>
<td>(2,3)</td>
<td>(1,3)</td>
<td>(0,3)</td>
</tr>
<tr>
<td>2</td>
<td>(3,2)</td>
<td>(2,2)</td>
<td>(1,2)</td>
<td>(0,2)</td>
</tr>
<tr>
<td>1</td>
<td>(3,1)</td>
<td>(2,1)</td>
<td>(1,1)</td>
<td>(0,1)</td>
</tr>
<tr>
<td>0</td>
<td>(3,0)</td>
<td>(2,0)</td>
<td>(1,0)</td>
<td>(0,0)</td>
</tr>
</tbody>
</table>
(-10 pts) **Warning:** You are not allowed to use global variables in any assignment in CS 161. There isn’t any practical purpose for them in this course. Keep this in mind as you design your program with the `find_path` and `print_grid` functions.

(20 pts) **Design**
You will design a solution for the problem statement as well as answer the following questions for each function that you write.

- What is being passed into this function?
- What is being returned?
- What must be true **before** this function can be called?
- What will always be true **after** this function is called?

Your design can be in the form of a flow chart, pseudocode, or both. **DESIGN BEFORE YOU CODE.** While there is no way that we can check that you actually did, it will make writing the code take much less time.

(20pts) **Testing**
Fill out this testing table for your program (the first row is an example and you must test more than one).

<table>
<thead>
<tr>
<th>Inputted Values</th>
<th>Expected Output</th>
<th>Actual met Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start at (100, 25)</td>
<td>Error message, out of range</td>
<td>yes</td>
</tr>
</tbody>
</table>

(10pts) **Program Style/Comments**
In your implementation make sure that you include a program header, as well as function headers for each function. In addition, be sure to use proper indentation and spacing. Below is an example of a function header. For more information look at the style guidelines.

```c*
/***************************************************************************/
Function: find_path
Description: finds the path from the starting positon to the ending position as well as prints the path to the screen
Parameters: xStart, yStart, xEnd, yEnd
Return: None
Pre-Conditions: all parameters are valid integers
Post-Conditions: no change to the parameters and the path will have been printed to the screen
/***************************************************************************/
```

**NOTE:** This is the function header for the `find_path` function. You may not get user input from inside of this function. Also see how the questions from the design fit into this header (wink wink).
Electronically submit your C++ program (.cpp file, not your executable!!!) and pdf, by the assignment due date, using TEACH.

https://secure.engr.oregonstate.edu:8000/teach.php?type=want_auth

**NOTE:** The easiest way to upload your program from ENGR to TEACH is to map a network drive to your home directory on ENGR. Mac or Windows, See:

http://engineering.oregonstate.edu/computing/fileaccess/

If you are doing this off campus, pay attention to the off-campus directions!!!!

Example output: