

CSci 1113: Introduction to C/C++  
Programming for Scientists and Engineers  
Homework 6  
Spring 2018

**Due Date: Thursday, March 29, 2018 before 11:55pm.**

**Instructions:** This is an individual homework assignment. There are two problems worth 20 points each. Solve the problem below by yourself (unlike the labs, where you work collaboratively), and submit the solution as a C++ source code file. Here are a few more important details:

1. Unlike the computer lab exercises, this is not a collaborative assignment.
2. Because all homework assignments are submitted and tested electronically, the following are important:
  - You follow any naming conventions mentioned in the homework instructions.
  - You submit the correct file(s) through Moodle by the due deadline.
  - You follow the example input and output formats exactly given in each problem description.
  - **Regardless of how or where you develop your solutions, your programs compile and execute on cselabs computers running the Linux operating system.**
3. You should test your program on other test cases (that you make up) as well. Making up good test cases is a valuable programming skill, and is part of ensuring your code solution is correct.

**General comments:**

Both parts of this homework you are expected to use recursion.

**Problem A: SumAllToN (20 points)**

I did an example of this the first time we used nested loops. The user will enter a single number, then display the sum from 1 to all numbers between 1 and the number entered (inclusive).

You **CANNOT** use any loops anywhere in making this program.

Example 1 (user input is underlined):

Sum to what?

4

$$1 = 1$$

$$1 + 2 = 3$$

$$1 + 2 + 3 = 6$$

$$1 + 2 + 3 + 4 = 10$$

Example 2 (user input is underlined):

Sum to what?

6

$$1 = 1$$

$$1 + 2 = 3$$

1 + 2 + 3 = 6  
1 + 2 + 3 + 4 = 10  
1 + 2 + 3 + 4 + 5 = 15  
1 + 2 + 3 + 4 + 5 + 6 = 21

When you are done, name the source code file <username>\_6A.cpp. Here you replace <username> with your U of M email address; for example, if your email address is smithx1234@umn.edu, your file should be named smithx1234\_6A.cpp. Then submit your program using the HW 6 Problem A submission link in Moodle.

**Problem B: N-Queens (20 points)**

First ask the user to enter what size board they want (you can assume it will be less than 100), then how many queens you want to place on this board. (This problem is actually fairly popular and is called the “N-Queens” problem, but I would suggest not googling for code as you should not be taking large portions of code from online.) The queens need to be in positions where each queen cannot immediately take another queen (i.e. not in any increment of 45 degrees from another). If it is not possible to put all the queens requested on the board, simply say “impossible” and don’t show anything else.

You **must use the following format to show the board:**

1. character 'Q' for a queen
2. character '.' (period) for an immediately capture-able square
3. character '-' (hyphen) for an open space
4. Use no additional markers other than the above when showing the grid.
5. The word “impossible” must appear if no valid configuration exists.

Hint: This is quite similar to the “sudokuSolver.cpp” that we did in class, so I would suggest starting with that code and modify it.

Example 1 (user input is underlined):

What size board do you want?  
3  
How many queens do you want to place?  
3  
Impossible.

Example 2 (user input is underlined):

What size board do you want?  
4  
How many queens do you want to place?  
4  
.Q..  
...Q  
Q...

..Q.

Example 3 (user input is underlined):

What size board do you want?

4

How many queens do you want to place?

5

Impossible.

Example 4 (user input is underlined):

What size board do you want?

8

How many queens do you want to place?

7

Q.....

..Q.....

....Q...

.Q.....

.....Q

.....

...Q....

.....Q.

Example 5 (user input is underlined):

What size board do you want?

8

How many queens do you want to place?

4

Q.....

..Q.....

....Q...

.Q.....

...-...-

.....

...-.-..

...-.-..

When you are done, name the source code file <username>\_6B.cpp. Here you replace <username> with your U of M email address; for example, if your email address is smithx1234@umn.edu, your file should be named smithx1234\_6B.cpp. Then submit your program using the HW 6 Problem B submission link in Moodle.