

CSci 1113: Introduction to C/C++  
Programming for Scientists and Engineers  
Homework 10  
Spring 2018

**Due Date: Thursday, May 3, 2018 before 11:55pm.**

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

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 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.

The rules of Battleship are as follows. Each player first sets up ships on their board in secret. Each player then guesses a coordinate (letter and number combination) to bombard on the enemies board. If a ship is hit in this bombardment, the player must say “Hit”. If all parts of a ship are hit, then the player must say “You sank my [name of ship]”. If no ship was hit, the player responds “miss”. This process continues until one player has sunk all of the opponent's ships. Here is a website about the rules if mine are inadequate:

<http://boardgames.about.com/od/battleship/a/Rules-of-Battleship.htm>. The pieces and lengths of pieces for Battleship are:

Aircraft carrier = length 5  
Battleship = length 4  
Submarine = length 3  
Cruiser = length 3  
Destroyer = length 2

There is a lot of code here. Familiarize yourself with it some before programming (at the very least, you should look at main() and the names of all the functions in the classes). The navigator (left side of geany) can be quite useful to bounce around between methods. Your coding program can probably use Ctrl+f to search for parts of code as well.

You can run the program as it is, and it should play the game Battleship for just one ship (the length 3 submarine) on a 10x10 board. For testing purposes, you could remove the randomization so you don't need to guess the whole board.



```
H ~ ~ ~ ~ ~ ~ ~ ~ ~
I ~ ~ ~ ~ ~ ~ ~ ~ ~
J ~ ~ ~ ~ ~ ~ ~ ~ ~
```

What coordinate do you want to place the aircraft carrier (length 5) at?

c3

What direction do you want the piece to go? (up, down, left or right)

right

```
      1  2  3  4  5  6  7  8  9 10
A ~ ~ ~ ~ ~ ~ ~ ~ ~
B ~ ~ ~ ~ ~ ~ ~ ~ ~
C ~ ~ A A A A ~ ~ ~
D ~ ~ ~ ~ ~ ~ ~ ~ ~
E ~ ~ ~ ~ ~ ~ ~ ~ ~
F ~ ~ ~ ~ ~ ~ ~ ~ ~
G ~ ~ ~ ~ ~ ~ ~ ~ ~
H ~ ~ ~ ~ ~ ~ ~ ~ ~
I ~ ~ ~ ~ ~ ~ ~ ~ ~
J ~ ~ ~ ~ ~ ~ ~ ~ ~
```

Which coordinate would you like to bombard?

**[Game continues on...]**

When you are done, name the source code file <username>\_10A.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\_10A.cpp. Then submit your program using the Homework\_10A submission link in Moodle. It is important that you follow the file naming conventions very carefully. For example, note your username should be all in lowercase, you should not include “@umn.edu”, the file name should contain an underscore (not a dash), the ‘A’ in the “10A” part is upper case, the extension is .cpp, etc. Following rigorous naming conventions is something computer programmers often must do in “real life” programming, and so submitting your program with the correct name is part of doing this assignment correctly.

**Problem B: Multiple ships (20 points)**

For this part, you need to make your program work for 5 pieces (both you and the computer). **We will only test your code for submarines, so submit this part separately from part A.** The program should work as before, except you need to place 5 pieces and sink all 5 of the opponents pieces to win. [Hint: It will be **much easier** to use arrays and loops to do this.] Ensure you can place/hit all 5 ships and win when all 5 of their ships are sunk.

Example 1 (user input is underlined, **not showing right board**):

```
Welcome to Battleship v23.1
      1  2  3  4  5  6  7  8  9 10
A ~ ~ ~ ~ ~ ~ ~ ~ ~
B ~ ~ ~ ~ ~ ~ ~ ~ ~
```

```

C ~ ~ ~ ~ ~ ~ ~ ~ ~
D ~ ~ ~ ~ ~ ~ ~ ~ ~
E ~ ~ ~ ~ ~ ~ ~ ~ ~
F ~ ~ ~ ~ ~ ~ ~ ~ ~
G ~ ~ ~ ~ ~ ~ ~ ~ ~
H ~ ~ ~ ~ ~ ~ ~ ~ ~
I ~ ~ ~ ~ ~ ~ ~ ~ ~
J ~ ~ ~ ~ ~ ~ ~ ~ ~

```

What coordinate do you want to place the submarine (length 3) at?

a1

What direction do you want the piece to go? (up, down, left or right)

right

```

      1  2  3  4  5  6  7  8  9 10
A  S  S  S  ~  ~  ~  ~  ~  ~
B  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
C  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
D  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
E  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
F  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
G  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
H  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
I  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
J  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

```

What coordinate do you want to place the submarine (length 3) at?

c2

What direction do you want the piece to go? (up, down, left or right)

up

Please enter a valid position and direction

```

      1  2  3  4  5  6  7  8  9 10
A  S  S  S  ~  ~  ~  ~  ~  ~
B  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
C  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
D  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
E  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
F  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
G  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
H  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
I  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
J  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

```

What coordinate do you want to place the submarine (length 3) at?

c3

What direction do you want the piece to go? (up, down, left or right)

right

```

      1  2  3  4  5  6  7  8  9 10

```

```

A  S  S  S  ~  ~  ~  ~  ~  ~  ~
B  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
C  ~  ~  S  S  S  ~  ~  ~  ~  ~
D  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
E  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
F  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
G  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
H  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
I  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
J  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

```

What coordinate do you want to place the submarine (length 3) at?

d1

What direction do you want the piece to go? (up, down, left or right)

right

```

      1  2  3  4  5  6  7  8  9 10
A  S  S  S  ~  ~  ~  ~  ~  ~  ~
B  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
C  ~  ~  S  S  S  ~  ~  ~  ~  ~
D  S  S  S  ~  ~  ~  ~  ~  ~  ~
E  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
F  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
G  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
H  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
I  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
J  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

```

What coordinate do you want to place the submarine (length 3) at?

e1

What direction do you want the piece to go? (up, down, left or right)

right

```

      1  2  3  4  5  6  7  8  9 10
A  S  S  S  ~  ~  ~  ~  ~  ~  ~
B  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
C  ~  ~  S  S  S  ~  ~  ~  ~  ~
D  S  S  S  ~  ~  ~  ~  ~  ~  ~
E  S  S  S  ~  ~  ~  ~  ~  ~  ~
F  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
G  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
H  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
I  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~
J  ~  ~  ~  ~  ~  ~  ~  ~  ~  ~

```

What coordinate do you want to place the submarine (length 3) at?

f3

What direction do you want the piece to go? (up, down, left or right)

left

	1	2	3	4	5	6	7	8	9	10
A	S	S	S	~	~	~	~	~	~	~
B	~	~	~	~	~	~	~	~	~	~
C	~	~	S	S	S	~	~	~	~	~
D	S	S	S	~	~	~	~	~	~	~
E	S	S	S	~	~	~	~	~	~	~
F	S	S	S	~	~	~	~	~	~	~
G	~	~	~	~	~	~	~	~	~	~
H	~	~	~	~	~	~	~	~	~	~
I	~	~	~	~	~	~	~	~	~	~
J	~	~	~	~	~	~	~	~	~	~

Which coordinate would you like to bombard?

**[Game continues on...]**

When you are done, name the source code file <username>\_10B.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\_10B.cpp. Then submit your program using the Homework\_10B submission link in Moodle. It is important that you follow the file naming conventions very carefully. For example, note your username should be all in lowercase, you should not include “@umn.edu”, the file name should contain an underscore (not a dash), the ‘B’ in the “10B” part is upper case, the extension is .cpp, etc. Following rigorous naming conventions is something computer programmers often must do in “real life” programming, and so submitting your program with the correct name is part of doing this assignment correctly.