Marine Biology Case Study
Worksheet for Part 1, pp 7-12

1. On pg. 8, coin flipping and possible positions are discussed in the exercises. Fill in the following chart which will help you determine the possible final locations of a fish after a number of clin flips. For example, with 4 flips, a fish could end up at +4, +2, 0, -2, -4 (5 different positions). For the last row (n), write down the expression which will determine the number of different positions.

# flips	possible ending positions	# of different positions
6		
8		
9		
10		
n		

a) What is the difference if n is even or n is odd?

_____

b) (Extending exercise 2) With 6 flips of a coin, one of the possible positions is 4. How many different ways are there of flipping a coin six times which allows you to end up at position 4? _____ Show them.

c) For each of the possible positions with 6 flips, determine the number of different ways to achieve each position. Use the space to the right of the table below to show your work. (There may be more rows in the table than you need).

Position	# of ways

Hint: You might find it easier to fill in the table for 6 flips by analyzing a smaller number of flips, say 4 or 2 flips. This is a good problem solving technique - start with a smaller but similar problem then move to the larger problem - some call this extrapolation.

i) What position(s) is/are least likely to be reached for 6 flips? _____

ii) What position(s) is/are most likely to be reached for 6 flips? _____

iii) If you did n flips (where n is even), how would you answer these two questions? least likely _____ most likely _____

iv) If n is odd, which are least likely _____ most likely _____

2. Questions on the `six-flips.cpp` code on pg 9:
   a) What is `RandGen`? _____
   b) What is `randomVals` (other than a variable)? _____
   c) How many flips will be made? _____
   d) What is `RandInt()`? _____
   e) What are the possible values for `RandInt(2)`? _____
   f) ...for `RandInt(4)`? _____
   g) ...for `RandInt(1)`? _____
   h) ...for `RandInt(0)`? _____

3. Look at `randgen.h` in Appendix B, pages B8 and B9.
   a) How many constructors are there? ___
   b) How many public member functions are there? ____
   c) How many private member functions are there? ____
   d) Explain the difference between `[0..7]` and `[0..7)`

      _____

   e) Give an example of the possible results of a
      i) call to `RandReal()` _____
      ii) call to `RandReal(1.2, 1.3)` _____
      iii) call to `RandInt(7)` _____
      iv) call to `RandInt(2,5)` _____

   f) Assume you used `RandInt(4)` in some code (that is, you used the first RandInt member function). What would be the call to the second `RandInt` member function that would yield the same range of results?

      _____

   g) When you use the function `RandInt`, how does the computer know which one to use?

      _____

   h) When you have two functions with the same name, what is this called?

      _____

i) Write the rule that you would use to construct multiple functions with the same name (which have different purposes)?

_____

j) Write an expression which would generate a random double between and 3 and 8 (including 3 but not including 8). (There are actually two ways of doing this).

_____

4. On pp 9-10 compare the `onedwalk.cpp` program to the `sixflips.cpp` program.

a) What does the variable `position` in `onedwalk.cpp` replace in `sixflips.cpp`?

_____

b) What does the variable `step` in `onedwalk.cpp` replace in `sixflips.cpp`?

_____

c) In `onedwalk.cpp` if `numSteps` is 5, what are the possible final positions which can be displayed?

_____

_____

d) How many different combinations of 5 flips are there which will display a position of 3? _____ Show your work

e) Why do you suppose that there are more ways to get at a position close to 0 than to get at a position further from 0?

_____

_____

5. Answer these questions after you have answered the exercises on pp 11-12.
   a) How would you correct the program code in exercise 2 so that each color is displayed about 1/3 of the time?

   _____

   _____

   b) How would you modify `sixflips.cpp` to count the number of times each possible position is reached?

   _____

   _____

   c) Name an advantage and a disadvantage of the way you thought about this change.

   _____

   _____

   d) Where would you put the statement `cout << position << endl;` so that the position of the fish is displayed each time a coin is flipped?

   _____