# Marine Biology Case Study
# Worksheet for Part 2, pp 19-28

1. On page 19 we are told that the driver program `fishsim.cpp` runs the simulation. Look at `fishsim.cpp` in Appendix C, page 13 and answer these questions.

   a. Which statement do you suppose places the fish into the pond in their starting locations?

   _____

   b. What do you suppose the statement `Simulation sim` actually does?

   _____

   c. Explain the meaning (use) of each of these:

   `step` _____
   `numSteps` _____
   `sim.Step()` _____

   d. Since the statement `cin >> numSteps` obtains the input from the user, what do you suppose is the purpose of `getline(cin, s)`?

   _____

   e. Write the modification(s) required in the `for` loop which would show the state of the fish in the pond only in the odd-numbered steps.

   f. At the top of page 20, the authors indicate that apvector and apmatrix classes will be used. Why don't we see either of these used in the code for `fishsim.cpp`?

   _____

2. In the second paragraph on page 23 the author briefly mentions the files `display.h` and `simulate.h` shown in appendix B. Study these two files.
   a. Since neither of these classes have private member variables, why did the author include a constructor for each (are they necessary? something for the future?)

   _____

b. In display.cpp the environment is passed as a const-ref parameter. What would occur if the environment were passed by value? What problem could this cause?

_____

c. In `simulate.h` notice the public member function `Run()`. It certainly looks like we could substitute the `Run()` function for the `for` loop in `fishsim.cpp`. Make this change in a copy of `fishsim.cpp` and on the line below indicate the difference between running the simulation for 3 steps with the original version and with your revised version.

_____

3. Based on the description of the input text file of fish (pg 23),
   a. write the contents of a fish.dat file for a 2 x 3 pond with the fish positions indicated by "o" in the diagram below.

```
o o .
. o .
```

   b. Does the order of the lines make a difference? Explain your answer.

_____

4. Based on the description on the top of page 24, fill in the vector below with the fish located in the above example.

```
  0  |  1  |  2  |  3  |  4  |  5
-----+-----+-----+-----+-----+-----+
     |     |     |     |     |
```

5. When you ran `fishsim.cpp` earlier, each fish was denoted by a capital letter. If the sample environment shown in the description on the top of pg 24 were displayed, it is not necessarily true that the fish "0" would be labeled A, fish "1" would be labeled B and so forth. Why might they be denoted by other letters in the range A-Z?

_____

6. To allow you to use different fish files (such as those suggested in the following exercises), you should comment out the line

```
ifstream input("fish.dat");
```

and enter these lines at the beginning of `fishsim.cpp`

```
apstring filename;
cout << "Enter your fish datafile: ";
cin >> filename;
ifstream input(filename.c_str());
```

Compile your revised `fishsim.cpp` to make sure it works (you will find it easiest to put your fish datafiles in the same folder as your project file).

7. Create a fish data file named `fish24.dat` which contains the 4 lines you wrote for question 3 above and run the simulation.
   a. In the space below sketch the display you see just before the word “initialized”

   b. Change the order of the last 2 lines of `fish24.dat` and run the simulation. Sketch the display you see just before the word “initialized”

   c. Explain why the 2 displays show the letters in different positions.

   _____

   d. Do you suppose the fish are moved (processed) based on the letters or on the positions?

   _____

8. In the space below, write a fish datafile (name it `fish25a.dat`) which will initially display the fish as shown after the second paragraph on page 25. (Run the simulation with your new datafile several times to help you understand how fish move).

9. In the second last paragraph on page 25, the author states “Some other sequence is possible as well.” Write at least 2 other sequences that are possible (we can think of at least 4 others).

   _____

10. Create two fish in a 5x1 environment in the space below. Using this information, create the file `fish25b.dat` and run the simulation. What do you notice about the behavior of the fish?

_____

11. Based on the discussion on pages 25 and 26, we will ask you to write some sample fish data files. When you run the simulation with each, compare the fish movement with the author's observations and note your observations.

    a. Write the fish datafile (name it `fish26a.dat`) which will initially display the fish as shown after the first paragraph.

    b. Write the fish datafile (name it `fish26b.dat`) which will initially display the fish as shown after the second paragraph.

    c. Write the fish datafile (name it `fish26c.dat`) which will initially display the fish as shown after the fifth paragraph.

    d. Write the fish datafile (name it `fish26d.dat`) based on the situation from part c (just above) as a 5 x 1 environment as described in the paragraph starting with the words "Running the test...". Confirm the author's statement that the "uppermost fish move first."

    e. Write the fish datafile (name it `fish26e.dat`) as described at the bottom of this page. Before you run this file in the simulation, write down what you think will be the result after the first step.