Marine Biology Case Study
Worksheet for Part 2, pp 29-35

1. On page 29 there is a list of revisions the biologists might ask for. Can you think of at least one other change which they might consider asking for (think about what fish do and what happens to fish)?

   _____

2. On page 30, the list of files and classes shows one file per class. The author states "As one might expect, each file defines at most one class."

   a. Other than file naming, why is it so desirable to have one class per file?

      _____

   b. Why is it desirable to create a `.h` file and a `.cpp` file for each class instead of just one file for all of this information (you see it both ways in books) ?

      _____

3. After the second paragraph on page 31 the author shows two of the private state variables. However if you look at `environment.h` in appendix B, you'll notice another state variable `int myFishCreated`. Can you think of a reason to need or want both `myFishCreated` and `myFishCount` as private variables?

   _____

4. No size (rows and columns) is specified in the private variable `apmatrix<Fish> myWorld`. When is `myWorld` given a size (you might want to look at `environment.cpp` in Appendix C)?

   _____

5. The author talks about storing a collection of integers explicitly then says "or to make certain operations more efficient." Can you name one operation that is more efficient by storing the integers the second way?

   _____

6. After the two Stop and Consider questions at the top of page 32, the author talks about "hybrid structures" where there is a need to define what an "undefined" element would look like. For example, say you were attempting to store 24-hour representations of times in a vector and a time is made up of three elements, hours, minutes and seconds. How might you define an "undefined" time?

_____

7. In the next paragraph, the author talks about three functions in the Environment class which are available to clients. Consult `environ.h` in Appendix B and list the other functions that are also available to a client of this class.

_____

8. The author discusses an important statement in `AddFish`. Here the constructor is used to create a fish and then assign it to a row-column position in `myWorld`. This is a different way to use a constructor. Write another way of coding this.

_____

9. An object of type `Position` such as `pos` contains a row and column pair. Why can't the statement `myWorld[pos]=Fish(myFishCreated, pos)` work?

_____

10. Look at `Environment::AddFish` in Appendix C. The code checks to make sure a fish isn't added where one already exists.
    a. Where is the fish to be added checked to make sure the new fish's position is in range?

    _____

    b. Look at the order of the last 3 statements. Can these 3 statement appear in another order? If so, write at least one different order; if not, tell why they must be in the exact order shown.

    _____

11. In the last paragraph on page 32 the author mentions `IsUndefined()` and says "we consult the `fish.h` file for more information". Write the expression in the code just above the paragraph which makes a reference to a fish.

_____

12. Look at `fish.cpp` in appendix C. Where is the "emptyFish" object defined and what is the ID for an "emptyFish"?

_____

13. The first paragraph on page 33 has the statement "(Not surprisingly, fish apparently have unique IDs)".

    a. What form do the fish IDs take? _____

    b. In which class function and where in that class function do fish get assigned unique ID numbers?

    _____

    c. What guarantees that the IDs for fish will always be unique?

    _____

    d. When a fish is displayed, the ID number appears as a letter. In what class function does this change take place?

    _____

14. In the paragraph after the code, a reference is made to the missing `!=` operator in the `Position` class. In the space below, write the code to implement this operator (it would appear in the `position.cpp` file).

15. What do you suppose is returned as the `Position` if the statement `emptyFish.Location()` is executed?

    _____

16. In the first paragraph on page 34, the author talks about a large environment and the need for a "correspondingly large matrix." How might you consider storing fish in such a large environment to avoid using large amounts of storage?

    _____

17. Look at the code below the second paragraph which processes the fish top to bottom left to right. How would you change the code to process the fish in a different order, say, processing each fish left to right top to bottom?

    _____

18. If you changed the processing as suggested in the previous question, what would be the position stored for the first fish, the second fish, the third fish and the fourth fish?

    first fish: _____ second fish: _____ third fish: _____ fourth fish: _____

19. Determine the total number of ways of processing fish using different variations of row and column combinations. You might want to list them down. The first two are noted.

    T-B L-R, L-R T-B,_____

20. In the code at the bottom of page 34 and the top of page 35, what statement places all of the fish into the apvector?

    _____

21. On page 35, what type is `fishList[k]` ? _____

22. About halfway down the page is a statement indicating how an `Environment` object initializes itself. Where specifically do the empty cells get defined as "containing" empty fish (looking at the file `environment.cpp` will help here)?

    _____

23. In bit further on in 2a, what statement in `Simulate::Step` asks the `Environment` for all fish in some order?

    _____

24. In reference to 2c, neither `Simulate::Step` nor `Simulate::Run` call the `Display` class. Write a reason why the `Display` class was not called here.

    _____