

CPS222 - DATA STRUCTURES AND ALGORITHMS

Project #1 - Due Wednesday, February 11, at the start of class

Purpose: To give you experience using C++

Note: This project must be done in teams of 2, with students of similar C++ background working together

Background:

The game of LIFE, invented by mathematician John H. Conway, is intended to model life in a society of organisms. That is, the game follows the development of an initial pattern of organisms as new organisms are born and old organisms die. Using simple rules for birth, death, and survival we model the growth of the "society" of organisms.

Some initial patterns of organisms rapidly die off; others result in new patterns that repeat in a cyclic manner; others change shape and size and may move as a society through their world; others may produce "gliders" that detach themselves from the society and move off on their own. (See *Scientific American*, October, 1970, p. 120 if you are interested in a discussion of the simulation.)

We will play the game on a rectangular board consisting of 900 locations (18 rows by 50 columns). Each location can either be empty (displayed as blank) or contain an organism (displayed as some symbol such as an asterisk) in some stage of life (i.e. surviving, dying, being born). Each location, except those along the edges, has 8 neighboring locations.

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For example, the location in the second row and second column of the partial playing board above (the one pointed to by the arrow) has eight neighboring locations. Three of the eight neighboring locations contain organisms and the other five are empty.

Births and deaths occur in the game according to the following rules.

1. During each cycle of play, an organism is born into any empty location which has exactly three neighboring locations containing organisms.
2. All organisms with fewer than two neighboring organisms die of loneliness.


```

+-----+
| ***   |
|       |
|       |
| ***   |
|       |
|       |
| etc...|
+-----+

```

Test your program with the data given above for 10 generations. Try the same pattern somewhere near the center of the world. Then, experiment with some additional initial configurations. Turn in the test cases you used (just the starting coordinates - not reams of output!)

```
/home/cps222/project1
```

In lieu of a post-project quiz, **each partner individually** must write a brief essay (about one page, double-space typed) on the following topic, and attach it to your project.

What strategies did you discover to facilitate learning something totally new without a lot of support? What can you do the next time you face a similar challenge? (Quitting is not an option :-)

Your project will be evaluated using the following criteria:

- 3

Implementation Notes

1. It will be convenient for the array to have an extra row at the top (row 0) and at the bottom (row 19), together with an extra column at the left (column 0) and at the right (column 51), to represent the border. (These squares will never contain organisms, but will be considered as neighboring squares when testing a cell to see whether it gestates or survives. This avoids having to write special case code for the cells next to the border) The "real" board - which is what you should display - will therefore consist of rows 1 .. 18 and columns 1 .. 50. You might include statements in your program like these:

```
static const int activeRows = 18;
static const int activeCols = 50;
static const int totalRows = activeRows + 2;
static const int totalCols = activeCols + 2;
```

2. Utilize an enumerated data type (enum) to represent the status of any location on the board. That is, you might include statements in your program like these:

```
enum Organism { NONE, GESTATING, LIVING, DYING };
Organism _board[totalRows][totalCols];
```

3. For each iteration of the game, you will need to make two "sweeps" of the board - first to set the state of each cell to NONE, GESTATING, LIVING, or DYING based on its current state and number of neighboring organisms, and the second sweep to set all GESTATING cells to LIVING and DYING cells to NONE.
4. The following code should be used to flush the input buffer after reading input from the user.
 - Immediately after reading all the input values from the user at startup:

```
while (cin.get() != '\n') ;    // NOTE THE SEMICOLON!
```

(This keeps reading characters from standard input until the newline that the user typed to enter the line of input has been read. Failure to do this will result in this newline being interpreted as the first signal to continue after the initial screen is displayed, causing it to disappear immediately.)

5. The following code can be used to clear the screen before the initial board is displayed:

- At toplevel near the start of the file

```
static const char ESC = 27;
```

- Just before displaying the initial board:

```
cout << ESC << "[H" << ESC << "[J" << "Initial:" << endl;
```

6. The following code can be used to position the cursor to the top of the screen, so that each board overwrites the previous one, giving the appearance of animation.

- Just before starting to display the board each time after the first

```
cout << ESC << "[H" << "Generation " << some variable << ":" << endl;
```

7. The following code can be used to prompt the user to press Return after each generation and wait for the user to do so.

- After each board has been displayed:

```
cout << ESC << "[23;1H" << ESC << "[K"
    << "Press RETURN to continue";
while (cin.get() != '\n') ;           // NOTE THE SEMICOLON!
```

(This displays the message "Press RETURN to continue" at the bottom of the screen, and then waits for the newline that the user types.)

Submission:

1. Turn in a printout of your code on the due date.
2. Attach evidence of testing to the code.
3. Be sure a copy of the required essay written individually by each partner is attached to the code.
4. Leave a copy of the working program as `~/cps222/project1.cc` for one of the partners, and an executable version for the professor to test as `~/cps222/project1`. **Please indicate which partner on your written submission!**