Cellular Automata

Background

We discussed cellular Automata in class, describing the components (grid, cell states, and rules.) John Conway's Game of Life [1] is a very simple rule set for a cellular automata. Each cell within the 2-dimensional grid can take on one of two states, typically called "alive" or "dead". A cell changes states based on the states of its eight-connected neighbor cells. The rules for determination of state for the next time quanta are:

1. If a state is alive and has exactly 2 or 3 alive neighbors then it stays alive
2. If a state is alive and it has less than 2 or greater than 3 alive neighbors then it becomes dead
3. If a state is dead and has exactly 3 alive neighbors then it becomes alive

The edges of a cellular automata grid may be handled in one of two ways:

1. Edges are truncated (do not process cells that do not have a full complement of eight neighbors)
2. Edges are wrapped (toroidal model) where the right edge is considered connected to the left edge and the bottom edge is considered connected to the top edge

Running the cellular automata involves two steps:

1. Set the initial state of all cells in the 2D grid
2. Start a timer that updates the entire grid each discrete time quanta

[1] http://en.wikipedia.org/wiki/Conway's_Game_of_Life. Other sources of information are available.

Assignment

Implement a cellular automata. You may use any programming language you like (you do not have to do this in LISP for this assignment.) The features of the system must include:

1. Ability to start the animation timer
2. Ability to stop the animation timer
3. Ability to step the animation timer 1 time quanta then stop (single step)
4. Ability to designate alive cells with the mouse
    a. If a cell is dead, it becomes alive when clicked with the mouse
5. Ability to designate dead cells with the mouse
    a. If a cell is alive, it becomes dead when clicked with the mouse
6. Ability to set all cells to dead (clear the grid)
7. Ability to treat edges as truncated or toroidally wrapped
8. Ability to read alive cell coordinates from a data file
9. Ability to write alive cell coordinates to a data file

10. Ability to visualize the 2D grid
11. Ability to choose from 2 different rule sets
    a. The first rule set must be Conway's Game of Life
    b. The second rule set is one that you invent that is "interesting" and different that Conway's

Figure 1 shows the system that I created. Yours may be similar or different so long as it contains all of the required elements.

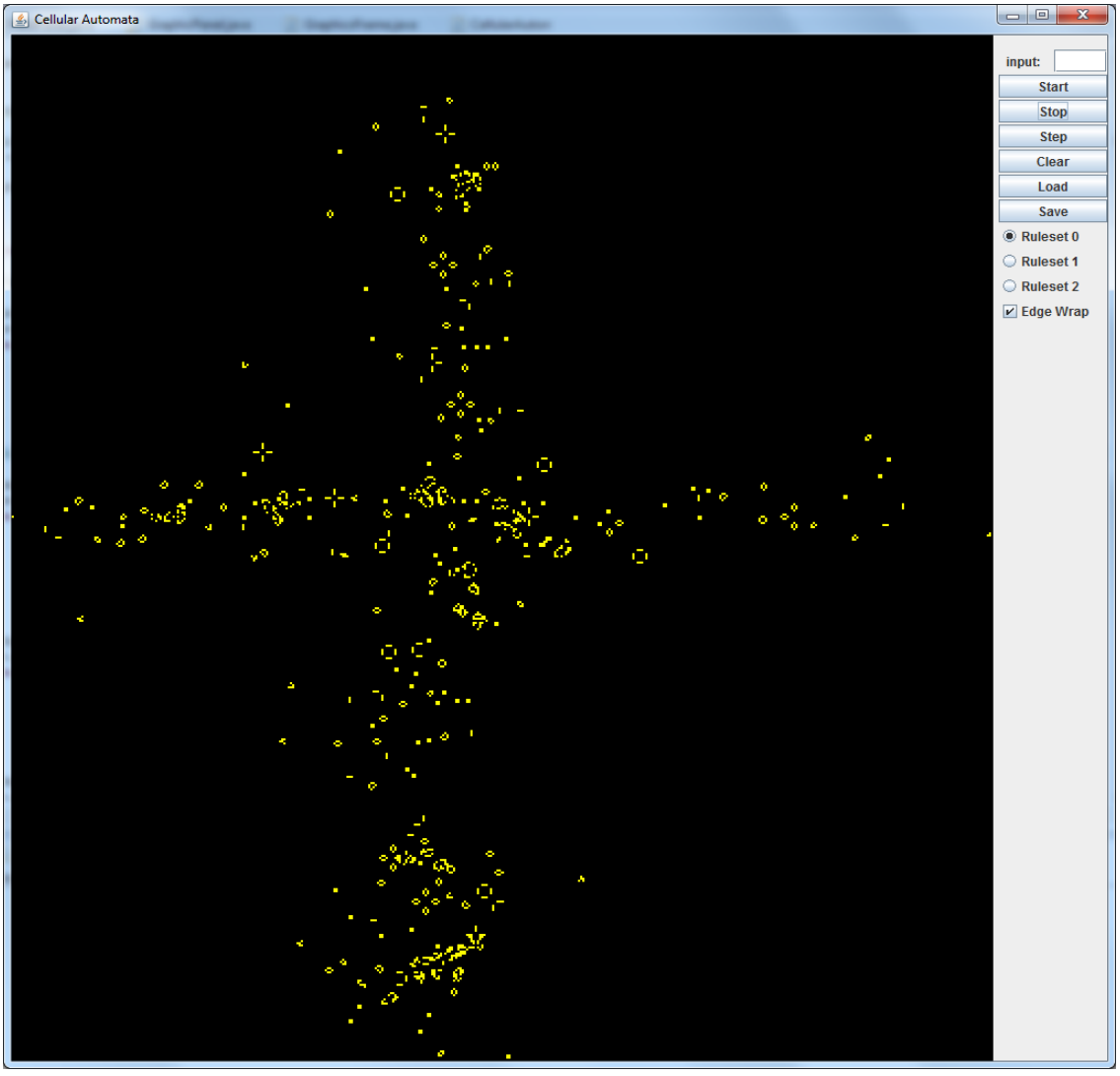

Figure 1. My implementation of a Cellular Automata. All cells were initially "dead". The mouse was used to toggle cells between "dead" and "alive" states. Clicking on a "dead" cell makes it "alive", clicking on an "alive" cell makes it "dead". Buttons are self explanatory. Ruleset 0 is Conway's Game of Life, others are custom creations. (Note that I show 3 rule sets but only two are required.)

Deliverables

1. Your source code file(s)
2. An in-class demonstration of your running system
3. A description of the rule set you created
    a. What are the detail of the rule set (this must provide enough detail so that someone reading it could implement the rules)
    b. Describe why you think it is are “interesting”
4. A description of how you tested your system
    a. Describe how you determined that your features were all properly implemented
5. A brief reflective essay
    a. Describe your degree of success
    b. Describe difficulties you had and how you overcame those difficulties
    c. Describe what you learned from this assignment.