Homework 3
CSCI-SHU 210 Data Structures

John Iacono

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1 Warm-up

By matrix, I mean a two dimensional array of numbers.

1. Write a python function to print a matrix in a nice way:

```
N=6
A=[[(i+j) for i in range(N)] for j in range(N)]
printMatrix(A)

   0   1   2   3   4   5
   1   2   3   4   5   6
   2   3   4   5   6   7
   3   4   5   6   7   8
   4   5   6   7   8   9
   5   6   7   8   9  10
```

2. Write a python function add one which works like this:

```
N=6
A=[[(i+j) for i in range(N)] for j in range(N)]
addone(A)
   0   1   2   3   4   5  0
   1   2   3   4   5   6  0
   2   3   4   5   6   7  0
   3   4   5   6   7   8  0
   4   5   6   7   8   9  0
   5   6   7   8   9  10  0
   0   0   0   0   0   0  0
```

3. Write a python function double which works like this:

```
N=6
A=[[(i+j) for i in range(N)] for j in range(N)]
double(A)

   0   1   2   0   1   2
   1   2   3   1   2   3
```

```
2   3   4   2   3   4
0   1   2   0   1   2
1   2   3   1   2   3
2   3   4   2   3   4
```

All of your functions should create normally functional two-dimensional arrays. That is, if you then say A[2][3]=7, only that one element should be 7 and not any of the others!

4. What are the runtimes of your functions.

2 Programming Part

Your task this week is to program Conway's Game of Life. Here is a brief description, for full details please look at the Wikipedia page.

The game of life is simply a two dimensional grid of cells. Each cell is either on or off at a given time. Each cell has eight neighbors (four plus the four diagonal ones). The status of a cell depends on its status and number of neighbors that were on at the previous time. In particular, a cell is on if it was on before and had two or three neighbors or if it was off before and had exactly three neighbors.

You should proceed as follows:

- First, create a grid of cells that are randomly set to on and off and run the game of life
- Add the ability to pause
- Color the cells on differently based on the number of neighbors
- Add the ability to toggle cells on and off
- Add the ability to set all cells to off or to set all cells to random
- Add the ability to speed up / slow down the animation

You should experiment with some of the patterns on the wikipedia page and verify that your code works as expected. This is the basic functionality that will get you a B. For an A, you should do a bit more. Some ideas are:

- Add the ability to make the cells bigger/smaller (so more or less will fit in a window)
- Add the ability to resize the window. In doing so the number of cells should change to fit into the resized window. Do not just have the window stretch
- Add the ability to have it run in fullscreen mode
- Add the ability to zoom in and out
- Make the hexagonal variant (see the wikipedia page)
- Be able to load and save certain configurations
- Something cool I did not think of

If you are confused and want to see a running solution, you are welcome to stop by and visit John or Ben.

3 Reading

Chapter 5

4 Written homework

5. Do problem C-5.19.

5 When and how due

Hand in everything the same way you did for HW2. Due date is Thursday September 25th at 11:55PM. You will go over the HW in personal meetings on Friday the 26th.

6 Help!

Please do not hesitate to contact Ben or John if you have any questions. We are here to help! John will be out of town starting Wednesday after class, but you can email him