Conway's Game of Life

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This Program is about a simulation of cells that die and become alive. The simulation is based on four essential rules:

- Cells with less than two alive neighbours die
- Cells with more than three alive neighbours die
- Cells with two or three alive neighbours stay alive
- Cells with three alive neighbours become alive

John Conway (born 26 December 1937) is an English mathematician

The Code

The code uses a class for the main part. The program, although, is made up of different functions, which keep the program running and updating.

```
from graphics import *
import random

class MainWindow:
    def __init__(self,W,H):
    Win = GraphWin("Game Of Life", W*7, H*7)
    Win.setCoords(0,0,W+1,H+3)
    self.width = W
    self.height = H
    self.window = Win
    self.colors = [color_rgb(0,0,0),color_rgb(0,255,0)]
    self.debug = color_rgb(0,0,255)
    self.Rounds = 0
    Win.getMouse()
```

The script is started out by importing form graphics library and also the random library. Then we code the Main Window.

```
def drawGrid(self,val):
    W = self.width
    H = self.height
    self.GridArray = []
    self.OldArray = []
    self.cellsAlive = 1
    for i in range(W):
     a = []
        for x in range(H):
         life = random.randint(0,val)
            if life == 1:
                Rect = Rectangle(Point(x+1,i+1),
                Point(x+2,i))
                Rect.setFill(self.colors[1])
                Rect.draw(self.window)
                 a.append([i,x,1,Rect])
         else:
        Rect = Rectangle(Point(x+1,i+1),
        Point(x+2,i))
        Rect.setFill(self.colors[0])
        Rect.draw(self.window)
        a.append([i,x,0,Rect])
        self.GridArray.append(a)
        self.T1 = Text(Point(self.width/2,self.height+1),
         "Simulations rounds run: " + str(self.Rounds) +
        " | Cells alive: " + str(self.cellsAlive))
         self.T1.draw(self.window)
```

First a few variables get initialised.

Then a nested for loop is run. The ranges used for the loops are the width and the height of the array.

Then a random value is created. The variable "val" is passed by the function and determines how many cells should be alive when we first start the programme. When the cell is initialized it is drawn. Then i am populating the the arrays. Every cell has its own array. It contains the position, the status and the graphics library object of the cell.

THE UPDATER

```
def isAlive(self):
    CountA = 0
    for i in range(len(self.GridArray)):
        for x in range(len(self.GridArray[i])):
            CountA = CountA+self.GridArray[i][x][2]

    self.cellsAlive = CountA
def startSim(self):
    self.Rounds = 0
    while self.cellsAlive > 0:
    self.T1.setText("Simulations rounds run: " +
    str(self.Rounds) + " | Cells alive: "
    + str(self.cellsAlive))
    self.isAlive()
    self.OldArray = self.GridArray
    self.Rounds = self.Rounds + 1
    for i in range(len(self.GridArray)):
    self.check(self.GridArray[i],
    self.OldArray[i])
```

The isAlive() function updates the self.cellsAlive variable. This is used to run the programm without errors. Finally the startSim() function starts the update function which i will explain later. The while loop runs as long as cells are living. The self.GridArray consists of multiple arrays. Its length is the height of the colony. And then for each of the elements in self.GridArray. But before that i am making a copy of self.GridArray for comaprism and i am naming it self.OldArray. The function self.check() is the update function.

```
def check(self,a,old):
    for i in range(len(a)):
    Count = 0
    Obj = a[i]
    VRow = a[i][0]
    HRow = a[i][1]
    #print VRow,HRow
        for w in range(-1,2):
            for h in range(-1,2):
                if not VRow+w < 0 and not VRow+w >
                self.height-1 and not HRow+h < 0 and not
                HRow+h > self.width-1:
                C = self.OldArray[VRow+w][HRow+h]
            if Obj[3] != C[3]:
            if C[2] == 1:
            Count = Count+1

    Alive = old[i][2]
    if Alive == 1:
    if Count < 2 or Count > 3:
    Obj[3].setFill(self.colors[0])
    Obj[2] = 0
    else:
    if Count == 2 or Count == 3:
    Obj[3].setFill(self.colors[1])
    Obj[2] = 1

    if Alive == 0:
    if Count == 3:
    Obj[3].setFill(self.colors[1])
    Obj[2] = 1
```

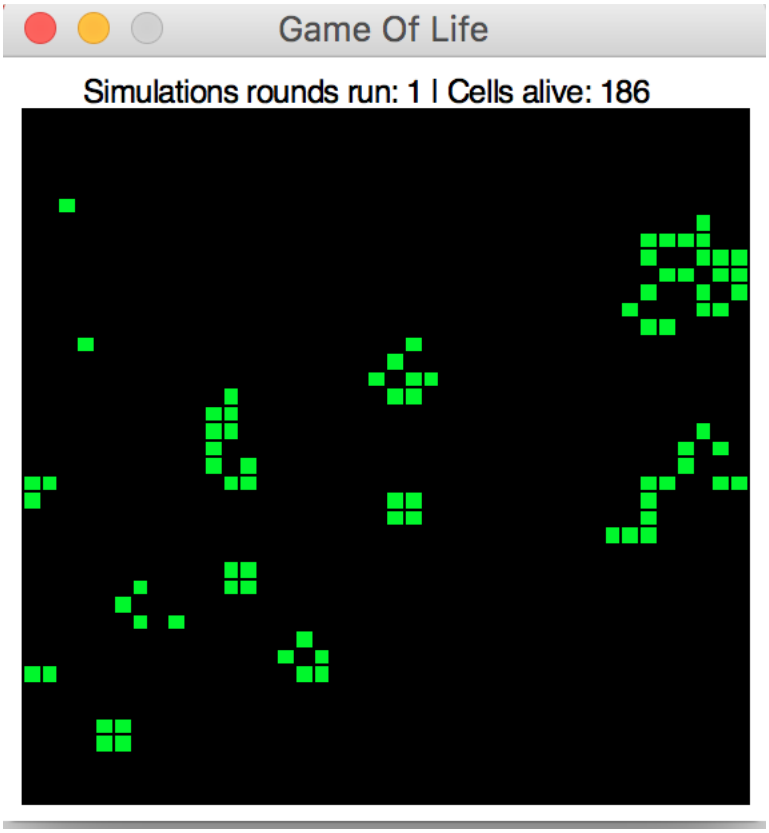
The check function is the most important function in this programm. It checks every cell and changes its status. Because in the startSim() function we pass an array we first need to get every element inside of this array. That we are doing with a for loop. Because we want to count the neighbour cells we set a count value to 0 and the object cell we are cheking is the i element of a. HRow and VRow are the positions of the cell. Then i two for loops form -1 to 2 the programm is checking the sourounding cells. If the calculated coordiates are not outside of our colony and the cell is not our cell we are checking from we are adding its life status to the Count value. After all sourrounding cells are checked we defining the state of the cell according to our rules mentioned at the beginning of this document.

OUTSIDE OF CLASS

```
Start = input("Please state start value")
Window = MainWindow(80,80)
Window.drawGrid(Start)
Window.startSim()
```

The start value is defined by the number you put in at the beginning. It determines the ratio between alive and dead cells. Here we also activate the functions and make the main window and also filling it with rectangles and numbers. Furthermore we start the simulation.

OUTPUT



BIBLIOGRAPHY

"Conway's Game of Life." Wikipedia. Wikimedia Foundation, n.d. Web. 09 Nov. 2015. https://en.wikipedia.org/wiki/Conway27s$_G ame_o f_L i f e$