Jason Patel

RBE511 HW#5

In this project we simulated the biological process of synchronization of fireflies and other systems. We took an algorithm which approximated the model based on the paper "Synchronization of Pulse-coupled Biological Oscillators" with the following algorithm:

Read the following paper: **Mirollo, R. E., & Strogatz, S. H. (1990). Synchronization of pulse-coupled biological oscillators. SIAM Journal on Applied Mathematics, 50(6), 1645-1662.**

You're going to implement a simple algorithm to achieve global synchronization.

You have 100 agents, whose state is stored in a 10 x 10 grid. The state is binary: whether they are flashing (1) or not (0).

The paper of Mirollo and Strogatz can be summarized with this algorithm:

```
init:
  state = 0
  c = random(0, T)

step:
  c = c + 1
  if(a neighbor flashed)
    c = c + k * c
  if(c >= T)
    state = 1
    c = 0
  else
    state = 0
```

In the above algorithm, `c` is an internal counter; `T` is the maximum value the counter can assume; and `k` is a constant between 0 and 1.

Implement the above algorithm in any language of your choice (i.e. Python is recommended, Matlab is fine), assuming that each agent can see the neighbors on its north, east, south and west. Find a value for `k` that makes the algorithm work. Set `T` to `100` in your simulations.

In the conducted with various values of k, from 0 to 1, the experiments shown synchronization of the lights when t, simulation counter, is between 100 and 200, with 2 distinct patterns arising. In one pattern, a wave forms, hence the wave pattern, and starts at the lower grid and moves upwards It varies from one to many rows in thickness. In some experiments, when the k value is >.5, the second pattern emerges of which almost, or all, of the entire grid appears to blink simultaneously.