Assignment A1: Reaction-Diffusion & Swarms

CS 6380
Spring 2020

Assigned: 7 January 2020

Due: RD: 16 January 2020
Due: Swarms: 23 January 2020

For this problem, handin a lab report pdf (include name, date, assignment and class number in pdf) which studies statistics for a the linear reaction-diffusion process. You should handin the report pdf as well as the Matlab code used in the study. The code should conform to the style requested in the class materials.

Write a lab report in the format (please do not deviate from this format!) described in the course materials. Discuss the statistical framework to establish a confidence interval on the means, and the hypothesis test. Please turn in a hardcopy of the report in class before the start of class on January 16, 2020 (reaction-diffusion handin cs6380 A1-1), and January 23, 2020 (flocks handin cs6380 A1-2).

1. Develop a Matlab function which computes the linear reaction-diffusion process described by Turk; use the C programs to create the Matlab code. Run simulations to determine:

- the mean number of stripes produced on 60 cells,
- the mean locations of the stripes, and
- the mean inter-stripe distance.

Use the following header for the reaction-diffusion function.

```
function [a,b] = CS6380_RD_linear(ncells,converge_eps,max_steps,...
   ainit,binit,diff1,diff2,beta_rand,react_speed)
% CS6380 - linear reaction-diffusion process
% On input:
%     ncells (int): number of cells
%     converge_eps (float): convergence threshold
%     max_steps (int): number of simulation steps
%     ainit (float): initial a concentration
%     binit (float): initial b concentration
%     diff1 (float): diffusion constant for a
%     diff2 (float): diffusion constant for b
%     beta_rand (float): variation in concentration
%     react_speed (float): reaction speed
% On output:
%     a (ncells by 1 vector): concentration of variable a
%     b (ncells by 1 vector): concentration of variable b
% Call:
%     [a,b] = CS6380_RD_linear(60,0.0001,1200,4,4,0.25,0.0625,0.05,1);
% Author:
%     <Your name>
%     UU
%     Spring 2020
%
```

2. Develop a flocking simulation function called *CS6380_swarms* based on Swarm_Kells.pdf, and following the given header.

```
function [flock, film] = CS6380_swarm(N, c1, c2, c3, c4, X,...
V, maxV, K, delta, maxT)
% CS6380_swarms - run a boids flocking simulation
% On input:
%     N (int): number of agents
%     c1 (float): repulsion force factor
%     c2 (float): cohesion force factor
%     c3 (float): alignment force factor
%     c4 (float): random force factor
```

```
%     X (float): distribution size
%     V (float): initial velocity distribution size
%     maxV (float): maximum velocity for each agent
%     K (int): no neighbors used for replusion/cohesion/alignment
%     delta (float): time step
%     maxT (int): number of time steps
% On output:
%     flock (maxT by N*3 array): agent positions durng simulation
%     film (movie): recording of the plots for each time step
% Call:
%     [flock, film] = CS6380_swarms(100, 0.3, 0.3, 0.3, 0.3, 3, 3,
%     3, 10, 0.05, 100);
% Author:
%     <Your Name>
%     UU
%     Spring 2020
%
```