MATH 2121 **Mathematical Modeling and Simulation** **Spring 2025**

Problem Set 4

(Out Tue 02/18/2025, Due Thu 02/27/2025)

Submissions are to be done by sending an email with subject `MATH 2121: Problem set 4` to the course instructor, containing: all requested Matlab files (called `yourfamilyname_problem4X.m`), plus a single file (PDF preferred), called `yourfamilyname_pset4.pdf`, that contains all requested explanations.

Problem 4

(a) Modify the Matlab file `temple_abm_population_migrate_mate_and_age.m` from the course website `http://faculty.cst.temple.edu/~seibold/teaching/2025_2121/` in the following way:
(i) increase the speed of the agents to 0.02;
(ii) place initially 500 agents uniformly in the left half domain, $(x, y) \in [0, 5] \times [0, 10]$;
(iii) change the code so that offspring-producing cells are ones that contain 7, 8, 9, or 10 agents; and
(iv) let (in each step) an offspring-producing cell produce a new agent with probability 1/4.
Run your code multiple times and explain your observations. Submit your program under the filename `yourfamilyname_problem4a.m` .

(b) Now modify your program (and submit as `yourfamilyname_problem4b.m`) by changing the probability of a cell producing a new agent to 1/5. You should observe a notable change in the effective behavior of the model/simulation. Explain what happens and why.

(c) Leave the probability of a cell producing a new agent at 1/5, but now let a cell be offspring-producing if it contains 7, 8, 9, 10, 11, 12, 13, 14, or 15 agents. Submit as `yourfamilyname_problem5b.m`. Describe and explain the model's behavior.