MATH 2121 **Mathematical Modeling and Simulation** **Spring 2024**

Problem Set 3

(Out Tue 02/06/2024, Due Tue 02/20/2024)

Submissions are to be done by emailing to the course instructor: all requested Matlab files, plus a single file (PDF preferred), called `yourfamilyname_pset3.pdf` that contains all requested explanations.

Problem 3

(a) Combine the two Matlab files `temple_abm_butterfly_animation.m` and `temple_abm_bacteria_run_and_tumble_and_eat.m` from the course website `http://math.temple.edu/~seibold/teaching/2024_2121/` to obtain a the following agent-based model. Butterflies conduct hill-topping, one after another, as in the example butterfly code. Moreover, each butterfly continuously lowers the ground below its position (similarly to the example bacteria code). Choose the magnitude of the ground reduction so large that each butterfly carves a visible, but not too deep, channel. Now let many butterflies conduct hill-topping (one after another, with the landscape constantly being modified). Let their paths end when they reached a hill top (as in the code `temple_abm_butterfly_corridor_width.m`). Submit your program under the filename `yourfamilyname_problem3a.m`

(b) Run your code from part (a) with 500 butterflies, and plot their paths and end points of their paths. Then remove (i.e., set to zero) the lowering of the ground, and re-run your code. Again, plot the paths and end points. Describe and explain the differences between the two cases.