Exercises: Evolutionary Game Theory and Cellular Automata

1. (Nash equilibria and ESS's.) Find Nash equilibria and ESS's for each of the following payoff matrices.

(a)

	S	H
S	1	0
H	0	1

(b)

	S	H
S	1	0
H	0	0

(c)

	S	H
S	0	-1
H	1	-20

   (d) Interpret the results of the previous exercises. What can you say about Nash equilibria, ESS's and their relation?

2. (ESSs and Replicator Dynamics 1.) Consider the pairwise contest with actions A and B and payoff matrix.

	A	B
A	3	0
B	0	1

   (a) What are the ESSs of this game?

   (b) Denote by x the fraction of the population using A.

      i. Compute the expected payoff of (a player with) strategy A, of strategy B, and the total expected payoff of a player.

      ii. Give the replicator dynamics equation for this game.

      iii. Find the fixed points.

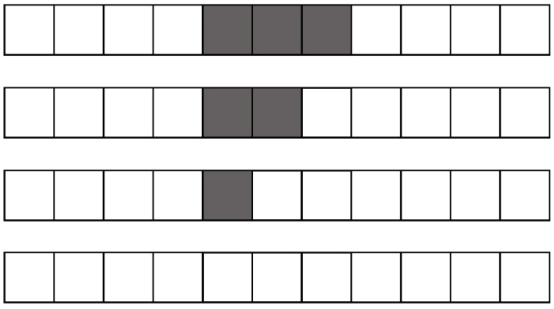
      iv. Which fixed points are evolutionary end points? (Motivate your answer)

3. (ESSs and Replicator Dynamics 2.) Show that, for the Hawk-Dove game, the replicator dynamics yields the same result as the ESS, that is, $p = V/C$.

4. (Experimenting with existing software.) Consider the NetLogo model available at `http://ccl.northwestern.edu/netlogo/models/community/GameTheory`.

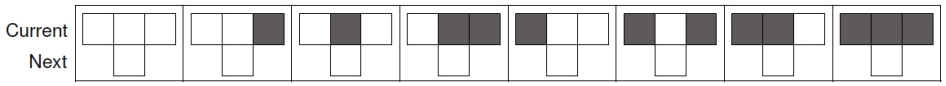
   (a) Run the model following the steps described in the ##HOW TO USE IT section. Try to justify the results obtained using the different settings described in the section.

   (b) Discuss briefly your experience with the use of such software (pro's and con's).



5. Consider the following sequence of states from a 1-D CA:

   Use the format in the scheme below (that is, specify the row 'New') to describe two sets of rules able to generate this sequence of states.



6. Download and run the Game of Life simulator from: `http://www.bitstorm.org/gameoflife/` Select "Small Exploder" from the menu, click start and wait until a stable state is reached. Explain why this state remains static.