

EVOLUTION AND THE THEORY OF GAMES (Spring 2007)
EXERCISES 11 - 15

11. Show that every 2×2 matrix game with payoff matrix

a,a	b,c
c,b	d,d

with $a \neq c$ or $b \neq d$ has at least one ESS.

12. Extend the Hawk-Dove game with a third strategy called "Retaliator" (R) who plays Dove against Dove but Hawk against Hawk. How does Retaliator play against itself? (There are several possibilities here.) Give the payoff matrix of the Hawk-Dove-Retaliator game and calculate all ESSs.
13. Extend the Hawk-Dove game with a third strategy called "Bully" (B) who plays Hawk against Dove but Dove against Hawk. How does Bully play against itself? (Again, there are multiple possibilities.) Give the payoff matrix of the Hawk-Dove-Bully game and calculate all ESSs.
14. Analyze the Retaliator-Bully game.
15. Animals can invest time and resources into growing "weapons" such as antlers etc. to improve their chances in a pairwise contest for some resource of value V . Suppose that the individual with the biggest investment always wins. Give the payoff function and calculate all ESSs. What is the fundamental difference with the War of Attrition? Think about how a population of individuals with the same fixed level of investment would evolve if most of the time new mutants have about the same level of investment but sometimes a mutant appears with a largely different level of investment.