

Homework

① simulate rock paper scissors w/ M
when playing

	R	P	S
R gets	0	-a	1
P gets	1	0	-a
S gets	-a	1	0

as follows:

Let $x = \text{Rock}$, $y = \text{Paper}$, $z = \text{Scissors}$
Note $z = 1 - x - y$

(a) What is rock's average payoff?
What is scissors, paper's average payoff

call these f_x, f_y, f_z

Let $\phi = x f_x + y f_y + z f_z$ be the
average fitness of all

$$(b) \quad \dot{x} = x (f_x - \phi)$$

$$\dot{y} = y (f_y - \phi)$$

Substitute $z = 1 - x - y$

This is a two-dimensional system

(c) Start with $x = .2, y = .3$ } you may
+ solve equations for: } have
 $a = 1, a = .9, a = 1.1$ } to solve for
a while

(d) sketch the solution in the x-y phase plane. I will provide an XPP file if you want to use it.

② Let's consider the Hawk-Dove game again

	Hawk	Dove	Mixed
Hawk	$\frac{b-c}{2}$	b	$p \left(\frac{b-c}{2} \right) + (1-p)b$
Dove	0	$\frac{b}{2}$	\star
Mixed	$p \left(\frac{b-c}{2} \right) + (1-p)0$	\star	\star

The mixed strategy is as follows. With probability p , it takes the Hawk strategy & with prob $1-p$ it takes the dove strategy

So, for example when ~~mixed~~ plays Hawk it receives $p \cdot \frac{b-c}{2} + (1-p)b$.

When mixed plays Hawk, it receives

$$p \left(\frac{b-c}{2} \right) + (1-p)0$$

\uparrow \uparrow
 playing playing
 as hawk as dove

Try to fill in the rest of these values.

Note mixed vs mixed is tricky

There are 4 scenarios that you have to keep track of. For example

mixed playing as Hawk vs

mixed playing as Dove occurs at a rate $2p(1-p)$ (or $2(1-p)$)

There because the first can be dove, second hawk or hawk/dove.
