

## Mixed strategies

### Matching pennies

		Player Odd	
		Y	1-Y
Player Even	X	Heads	Tails
	1-X	Heads	1, -1    x-1, 1
		Tails	-1, 1    1, -1

A: Heads

B: Tails

<https://pollev.com/timothymille936>

$$\begin{aligned}
 E(H) &= E(T) \\
 1-2X &= 2X-1 \\
 2 &= 4X \\
 X &= \frac{1}{2} \\
 1-X &= \frac{1}{2}
 \end{aligned}$$

$$E(T) = E(H)$$

Mixed strategies

Indifference:

Odd:

$$\begin{aligned}
 E(H) &= -1X + 1-X \\
 &= 1-2X
 \end{aligned}$$

$$\begin{aligned}
 E(T) &= X + -1(1-X) \\
 &= 2X-1
 \end{aligned}$$

Even:

$$E(H) = 2Y-1$$

$$E(T) = 1-2Y$$

$$\begin{aligned}
 2Y-1 &= 1-2Y \\
 Y &= \frac{1}{2}
 \end{aligned}$$

### Security games

		Adversary	
		Terminal 1	Terminal 2
Defender	X	Terminal 1	5, -3    -1, 1
	1-X	Terminal 2	-5, 5    2, -1

Adversary:

$$\begin{aligned}
 E(T1) &= -3X + 5(1-X) \\
 &= 5-8X \\
 E(T2) &= X + -1(1-X) \\
 &= 2X-1
 \end{aligned}$$

Defender:

$$\begin{aligned}
 E(T1) &= 6Y-1 \\
 E(T2) &= -2Y+2 \\
 E(T1) &= E(T2)
 \end{aligned}$$

$$E(r_2) = x + -1(1-x) = 2x - 1$$

$$E(r_1) = E(r_2)$$

$$5 - 8x = 2x - 1$$

$$6 = 10x$$

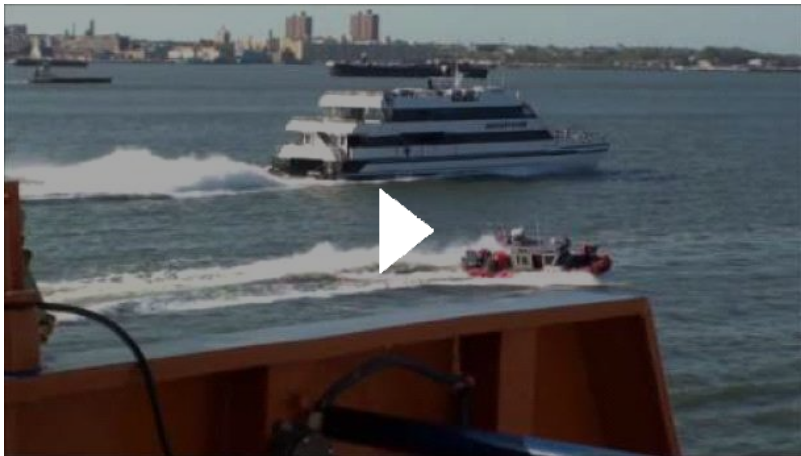
$$x = \frac{6}{10}$$

$$1 - x = \frac{4}{10}$$

Defender  
strategy

$$\left\{ \begin{array}{l} x = \frac{6}{10} \\ 1 - x = \frac{4}{10} \end{array} \right\}$$

[Ferry escort](#)



$$E(l_1) = E(l_2)$$

$$E(r_1) = E(r_2)$$

$$6y - 1 = 2 - 7y$$

$$y = \frac{3}{13}$$

$$1 - y = \frac{10}{13}$$

Adversary  
strategy

[Save the Wildlife, Save the Planet: Protection Assistant for Wildlife Security \(PAWS\)](#)



Pure and mixed equilibria

		Player 2		$E(l) = 1x + 0$ $E(r) = 0 + 3(1-x)$ $E(l) = E(r)$ $4x = 3 - 3x$
		$y$	$1-y$	
		Left	Right	
Player 1	$x$	Up	<span style="border: 1px solid black; padding: 2px;">3, 1</span>	
			0, 0	

Player 1	$x$ Up	$(3, 1)$	$(0, 0)$
	$1-x$ Down	$(0, 0)$	$(1, 3)$

$EU_U = EU_D$   
 $3x = 3 - 3x$   
 $x = 3/4$

One mixed equilibria

1  $(x = 3/4, 1-x = 1/4)$   
 2  $(y = 1/4, 1-y = 3/4)$

Two pure equilibria