Games

① Rock - Paper - Scissors

2 players each choose Rock, Paper or Scissors
winner chosen based on choices

② Prisoners' Dilemma

2 players each choose to Confess or not
sentences are determined by choices

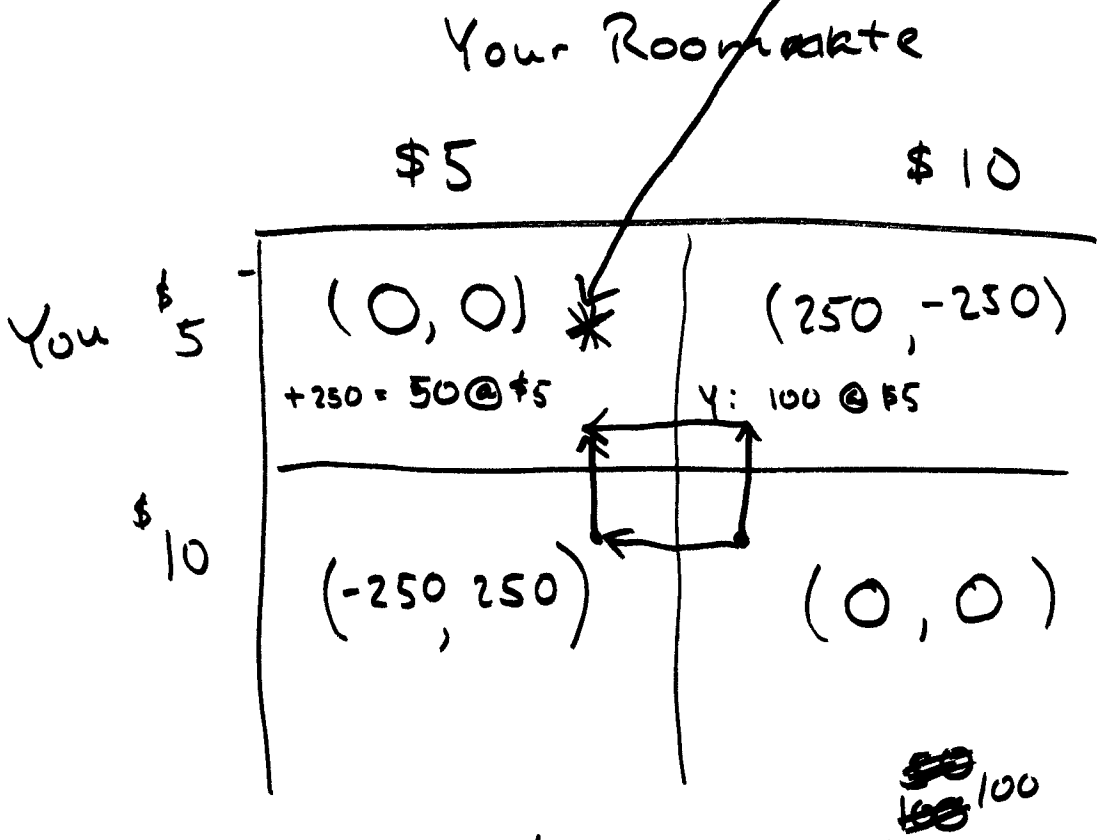
③ Selling Roses

2 players each choosing to sell roses for $5 or $10. Profit is determined by choice

Mathematical Games - 2 (or more) "players" each making a choice of "moves". Every combination of moves has a "payoff."

Selling Roses

Nash Equilibrium



- Each spend $250 to get roses
- At $5, 100 roses will be sold
  -- $10 50 . . . — — —

⟷ means Roommate changed moves

↕ means You changed moves

* Nash Equilibrium. Neither Player can improve payoff by ~~a~~ d using a different strategy.

Prisoner's Dilemma

Roommate

You \ Roommate	Confess	Not
Confess	(-5, -5) ← 5 yr sentence each	(0, -10) ← Probation for You, 10 yrs for Ro
Not	(-10, 0) ←	(-1, -1) ← 1 yr sentence on lighter crime.

PD S R

	(-5, -5)	(0, -10)
	(-10, 0)	(-1, -1)

Not Zero Sum

Y \	0	250
	~~(0, 0)~~	~~(-250, 250)~~
	-250	0
	~~(250, -250)~~	~~(0, 0)~~

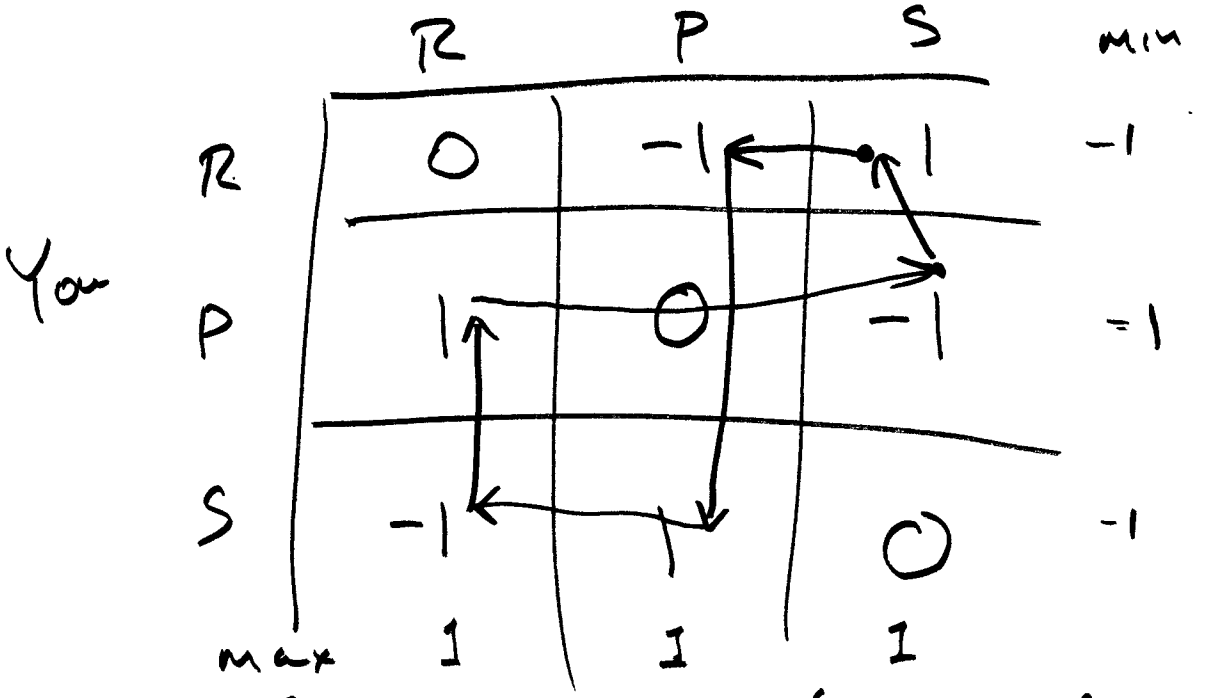
Zero sum game

Sum of payoffs = 0

Payoffs are equal but opposite

Rock Paper Scissors - A Zero Sum Game

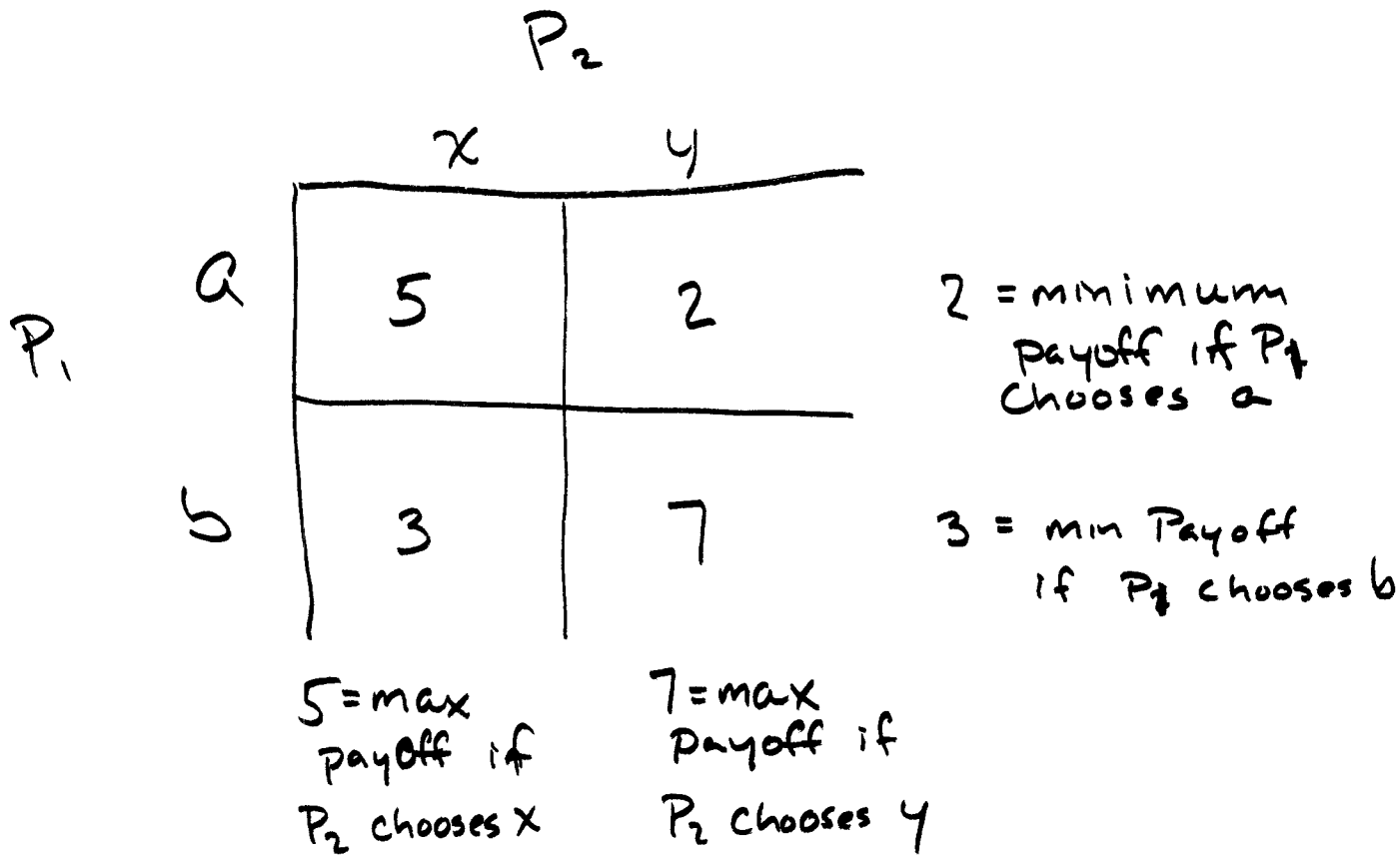
Roommate

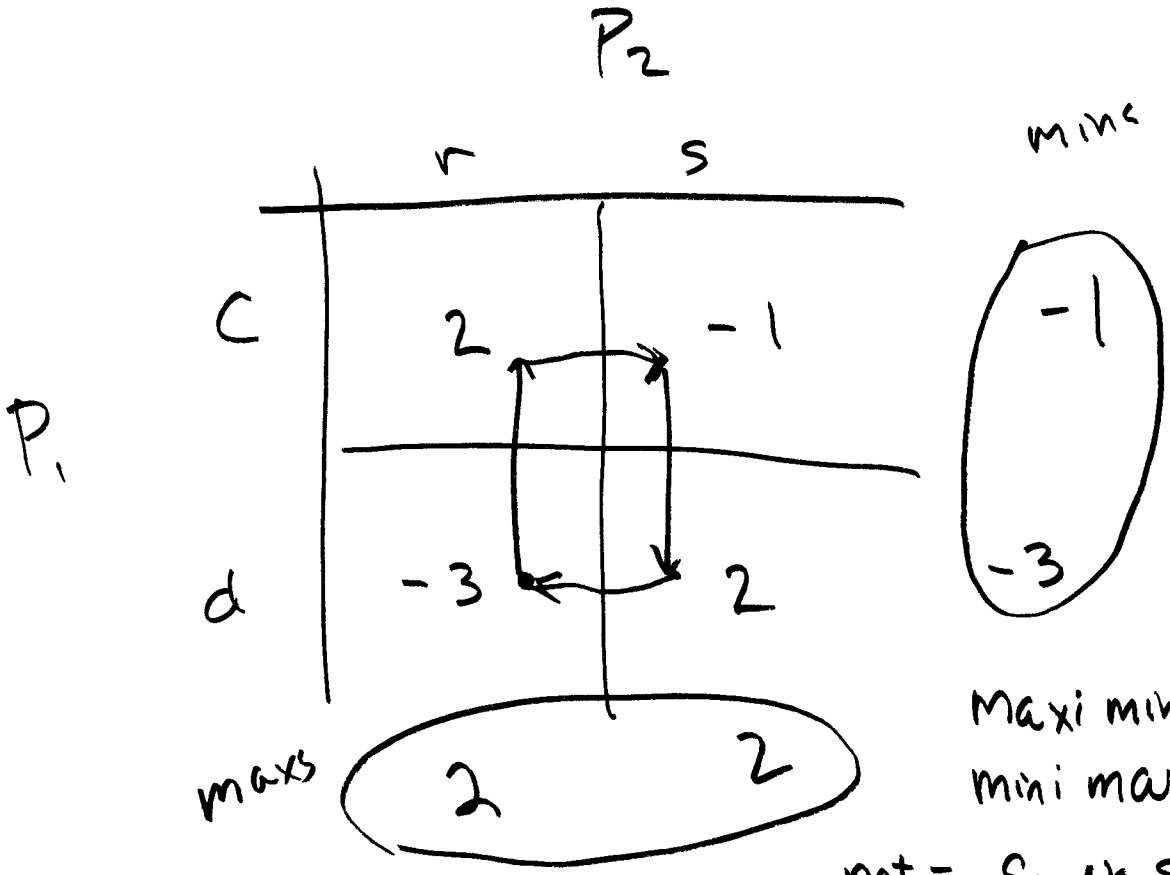


No fixed strategy (choice of moves) can not be improved on by one player or another.

maximin = -1
minimax = 1
} No saddle point.

Nash Equilibrium If there is no saddle point, the N.E. is in a mixed strategy. (random)

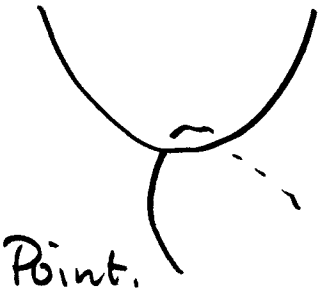

P2
x
y
P1
a
b
5
2
3
7
2 = minimum payoff if P1 chooses a
3 = min Payoff if P1 chooses b
5 = max payoff if P2 chooses x
7 = max payoff if P2 chooses y


P2
r
s
mini
P1
c
d
2
-1
-3
2
-1
-3
maxs
2
2
Maxi min = -1
mini max = 2
not = So no saddle point

	m	n	mins
e	(2)	3	2 * max
f	-1	4	-1

maximin

	maxs
minimax	2 * 4



2 = "saddle point"

= Nash Equilibrium Point.

where minimax = maximin