

# Games and Computation Homework #12:

## Nash and Correlated Equilibria

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Answer these questions within the HW #12 Moodle quiz:

### Strictly Dominated Strategy Elimination

Does the elimination of a row/column strategy that is strictly dominated by a pure row/column strategy possibly eliminate a Nash equilibrium? \_\_\_\_\_

### Reduced Game Matrix

After elimination of strictly dominated strategies, are the Nash equilibria of the reduced game matrix equivalent to those of the original game matrix? \_\_\_\_\_

### Strictly Dominated Strategy Elimination with Mixed Dominating Strategy

Does the elimination of a row/column strategy that is strictly dominated by a mixed row/column strategy possibly eliminate a Nash equilibrium? \_\_\_\_\_

P1 \ P2	L	R
U	2, 2	2, 0
D	2, 1	1, 2

### Weakly Dominated Strategy

Write the letter of the strategy that is weakly dominated in the given game grid: \_\_\_\_\_

### Weakly Dominated Strategy Elimination

Does the elimination of a row/column strategy that is weakly dominated by a pure/mixed strategy possibly eliminate a Nash equilibrium? \_\_\_\_\_

P1 \ P2	L	R
U	2, 0	0, 0
D	1, 1	-1, -1

### Number of Nash equilibria

How many Nash equilibria exist for the given game grid?

- 1
- 2
- 3
- infinite

## The Odd Rule

Briefly express the Odd Rule in your own words. Include what is implied if the number of Nash equilibria is not odd.

## Social Welfare Stag Hunt

Social welfare maximization seeks a pure/mixed correlated equilibrium that produces the maximum expected sum of payouts while retaining the correlated equilibrium property. How many pure/mixed correlated equilibria satisfy social welfare maximization for the Stag Hunt game?

- 1
- 2
- 3
- infinite

## Balanced Stag Hunt

Define a balanced correlated equilibrium as an equilibrium that achieves minimum distance between expected player payouts while retaining the correlated equilibrium property. How many pure/mixed correlated equilibria satisfy maximum balance (i.e. minimum expected payout inequality) for the Stag Hunt game?

- 1
- 2
- 3
- infinite

## Social Welfare Battle of the Sexes

Social welfare maximization seeks a pure/mixed correlated equilibrium that produces the maximum expected sum of payouts while retaining the correlated equilibrium property. How many pure/mixed correlated equilibria satisfy social welfare maximization for the Battle of the Sexes game?

- 1
- 2
- 3
- infinite

## Balanced Social Welfare Battle of the Sexes

Define a balanced correlated equilibrium as an equilibrium that achieves minimum distance between expected player payouts while retaining the correlated equilibrium property. Social welfare maximization seeks a pure/mixed correlated

equilibrium that produces the maximum expected sum of payouts while retaining the correlated equilibrium property. How many pure/mixed correlated equilibria maximize balance plus social welfare for the Battle of the Sexes game?

- 1
- 2
- 3
- Infinite

### Battle of the Games

P1 \ P2	B	V
B	1, 3	1, 0
V	1, 0	2, 1

Player 1 and player 2 like different games. Player 1 prefers to go out and play billiards. Player 2 prefers to play video games. Suppose they must choose an activity from {B (billiards), V (video game)} simultaneously without communication. Player 2 is indifferent between going out to play billiards and staying home to play video games alone, but prefers to play video games with player 1. If they disagree on their chosen activity, player 2 gets the utility of playing video games alone, and player 1 calls the evening a zero.

### Battle of the Games Social Welfare Billiards

For the given game matrix, what is the probability of signal BB ( $p_{BB}$ ) if social welfare is maximized? Express to 2 decimal places: \_\_\_\_\_

### Battle of the Games Social Welfare Video Games

For the given game matrix, what is the probability of signal VV ( $p_{VV}$ ) if social welfare is maximized? Express to 2 decimal places: \_\_\_\_\_

### Battle of the Games Balanced Billiards

For the given game matrix, what is the probability of signal BB ( $p_{BB}$ ) if balance is maximized? Express to 2 decimal places: \_\_\_\_\_

### Battle of the Games Balanced Video Games

For the given game matrix, what is the probability of signal VV ( $p_{VV}$ ) if balance is maximized? Express to 2 decimal places: \_\_\_\_\_

### Battle of the Games Balanced Social Welfare

At which value of `balanceWeight` does the computed solution transition between the social welfare solution and the balanced solution? Express to 2 decimal places: \_\_\_\_\_

### 3-by-3 Game Matrix Exercises

P1 \ P2	L	C	R
U	1, 2	1, 3	2, 4
M	0, 4	2, 3	3, 4
D	0, 3	1, 3	4, 2

### 3-by-3 Social Welfare Correlated Equilibrium 1

With what probability will the signal sender choose to send the signals U and L simultaneously to players 1 and 2, respectively? That is, what is  $p_{UL}$ ? Express to four decimal places: \_\_\_\_\_

### 3-by-3 Social Welfare Correlated Equilibrium 2

With what probability will the signal sender choose to send the signals M and C simultaneously to players 1 and 2, respectively? That is, what is  $p_{MC}$ ? Express to four decimal places: \_\_\_\_\_

### 3-by-3 Social Welfare Correlated Equilibrium 3

With what probability will the signal sender choose to send the signals D and L simultaneously to players 1 and 2, respectively? That is, what is  $p_{DL}$ ? Express to four decimal places: \_\_\_\_\_

### Uneven Payoff Matching Game

P1 \ P2	A	B	C
A	1, 2	0, 0	0, 0
B	0, 0	2, 3	0, 0
C	0, 0	0, 0	4, 2

Players gain utility only when plays match, but payoffs are uneven.

### Uneven Payoff Matching Game Social Welfare A

Computing the social welfare maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play A? Express to two decimal places: \_\_\_\_\_

### Uneven Payoff Matching Game Social Welfare B

Computing the social welfare maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play B? Express to two decimal places: \_\_\_\_\_

### Uneven Payoff Matching Game Social Welfare C

Computing the social welfare maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play C? Express to two decimal places: \_\_\_\_\_

### Uneven Payoff Matching Game Balanced A

Computing the balanced maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play A? Express to two decimal places: \_\_\_\_\_

### Uneven Payoff Matching Game Balanced B

Computing the balanced maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play B? Express to two decimal places: \_\_\_\_\_

### Uneven Payoff Matching Game Balanced C

Computing the balanced maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play C? Express to two decimal places: \_\_\_\_\_

### Uneven Payoff Matching Game Balanced Social Welfare A

Computing the balanced social welfare maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play A? Express to two decimal places: \_\_\_\_\_

### **Uneven Payoff Matching Game Balanced Social Welfare B**

Computing the balanced social welfare maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play B? Express to two decimal places: \_\_\_\_\_

### **Uneven Payoff Matching Game Balanced Social Welfare C**

Computing the balanced social welfare maximizing correlated equilibrium with our toolset, with what probability will both players be signaled to play C? Express to two decimal places: \_\_\_\_\_