CS4246 / CS5446

Tutorial Week 12

Muhammad **Rizki** Maulana
rizki@u.nus.edu

First

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

Wife (W)

Husband (H)	Ballet	Concert
Ballet		
Concert		

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

Husband (H) \ Wife (W)	**Ballet**	**Concert**
Ballet		H=0, W=0
Concert	H=0, W=0	

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

Husband (H) \ Wife (W)	**Ballet**	**Concert**
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

Husband (H) \ Wife (W)	**Ballet**	**Concert**
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

a) Argue that both the strategy profiles $\langle Ballet, Ballet \rangle$ and $\langle Concert, Concert \rangle$ are Nash equilibria.

Question

Husband (H) \ Wife (W)	**Ballet**	**Concert**
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

a) Argue that both the strategy profiles $\langle Ballet, Ballet \rangle$ and $\langle Concert, Concert \rangle$ are Nash equilibria.

Switch makes the value **worse**

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

a) Argue that both the strategy profiles $\langle Ballet, Ballet \rangle$ and $\langle Concert, Concert \rangle$ are Nash equilibria.

Switch makes the value **worse**

Husband (H) \ Wife (W)	**Ballet**	**Concert**
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Question

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume H: p ballet, (1-p) concert. Find p that makes W indifference

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume H: p ballet, (1-p) concert. Find p that makes W indifference

E[W=ballet] = E[W=concert]

Husband (H) \ Wife (W)	**Ballet**	**Concert**
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume H: p ballet, (1-p) concert. Find p that makes W indifference

$$E[W=\text{ballet}] = E[W=\text{concert}]$$

$$p * U_{W=\text{ballet}, H=\text{ballet}} + (1-p) * U_{W=\text{ballet}, H=\text{con}}$$

H=concert

Husband (H) \ Wife (W)	**Ballet**	**Concert**
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume H: p ballet, (1-p) concert. Find p that makes W indifference

$$E[W=\text{ballet}] = E[W=\text{concert}]$$

$$p * U_{W=\text{ballet}, H=\text{ballet}} + (1-p) * U_{W=\text{ballet}, H=\text{concert}} = p * U_{W=\text{concert}, H=\text{ballet}} + (1-p) * U_{W=\text{concert}, H=\text{concert}}$$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume H: p ballet, (1-p) concert. Find p that makes W indifference

$$E[W=\text{ballet}] = E[W=\text{concert}]$$

$$p * U_{W=\text{ballet}, H=\text{ballet}} + (1-p) * U_{W=\text{ballet}, H=\text{concert}} = p * U_{W=\text{concert}, H=\text{ballet}} + (1-p) * U_{W=\text{concert}, H=\text{concert}}$$

$$p * \quad 2 \quad + (1-p) * \quad 0$$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume H: p ballet, (1-p) concert. Find p that makes W indifference

$$E[W=\text{ballet}] = E[W=\text{concert}]$$

$$p * U_{W=\text{ballet}, H=\text{ballet}} + (1-p) * U_{W=\text{ballet}, H=\text{concert}} = p * U_{W=\text{concert}, H=\text{ballet}} + (1-p) * U_{W=\text{concert}, H=\text{concert}}$$

$$p * 2 + (1-p) * 0 = p * 0 + (1-p) * 1$$

Husband (H) \ Wife (W)	**Ballet**	**Concert**
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume H: p ballet, (1-p) concert. Find p that makes W indifference

$$E[W=\text{ballet}] = E[W=\text{concert}]$$

$$p * U_{W=\text{ballet}, H=\text{ballet}} + (1-p) * U_{W=\text{ballet}, H=\text{concert}} = p * U_{W=\text{concert}, H=\text{ballet}} + (1-p) * U_{W=\text{concert}, H=\text{concert}}$$

$$p * 2 + (1-p) * 0 = p * 0 + (1-p) * 1$$

$$p = 1/3$$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume W: q ballet, (1-q) concert. Find q that makes H indifference

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume W: q ballet, (1-q) concert. Find q that makes H indifference

E[H=ballet] = E[H=concert]

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume W: q ballet, (1-q) concert. Find q that makes H indifference

$$E[H=\text{ballet}] = E[H=\text{concert}]$$

$$q * U_{H=\text{ballet},W=\text{ballet}} + (1-q) * U_{H=\text{ballet}, W=\text{concert}} = q * U_{H=\text{concert}, W=\text{ballet}} + (1-q) * U_{H=\text{concert}, W=\text{concert}}$$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume W: q ballet, (1-q) concert. Find q that makes H indifference

$$E[H=\text{ballet}] = E[H=\text{concert}]$$

$$q * U_{H=\text{ballet},W=\text{ballet}} + (1-q) * U_{H=\text{ballet}, W=\text{concert}} = q * U_{H=\text{concert}, W=\text{ballet}} + (1-q) * U_{H=\text{concert}, W=\text{concert}}$$

$$q * \quad 1 \quad + (1-q) * \quad 0$$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume W: q ballet, (1-q) concert. Find q that makes H indifference

$$E[H=\text{ballet}] = E[H=\text{concert}]$$

$$q * U_{H=\text{ballet},W=\text{ballet}} + (1-q) * U_{H=\text{ballet}, W=\text{concert}} = q * U_{H=\text{concert}, W=\text{ballet}} + (1-q) * U_{H=\text{concert}, W=\text{concert}}$$

$$q * 1 + (1-q) * 0 = q * 0 + (1-q) * 2$$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(b) Find a Nash equilibrium where both players play mixed strategies.

Assume W: q ballet, (1-q) concert. Find q that makes H indifference

$$E[H=\text{ballet}] = E[H=\text{concert}]$$

$$q * U_{H=\text{ballet},W=\text{ballet}} + (1-q) * U_{H=\text{ballet},\,W=\text{concert}} = q * U_{H=\text{concert},\,W=\text{ballet}} + (1-q) * U_{H=\text{concert},\,W=\text{concert}}$$

$$q * 1 + (1-q) * 0 = q * 0 + (1-q) * 2$$

$$q = 2/3$$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

Question

Husband (H) \ Wife (W)		**Ballet**	
	Ballet	H=1, W=2	

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

Wife (W)

Husband (H)			Concert
	Concert		H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

H: p ballet, (1-p) concert
W: q ballet, (1-q) concert

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

H: p ballet, (1-p) concert
W: q ballet, (1-q) concert

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	pq H=1, W=2	p(1-q) H=0, W=0
Concert	(1-p)q H=0, W=0	(1-p)(1-q) H=2, W=1

H: p ballet, (1-p) concert
W: q ballet, (1-q) concert

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	pq H=1, W=2	p(1-q) H=0, W=0
Concert	(1-p)q H=0, W=0	(1-p)(1-q) H=2, W=1

H: p ballet, (1-p) concert
W: q ballet, (1-q) concert

$E[H] = pq * 1 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 2 = \frac{2}{3}$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	pq H=1, W=2	p(1-q) H=0, W=0
Concert	(1-p)q H=0, W=0	(1-p)(1-q) H=2, W=1

H: p ballet, (1-p) concert
W: q ballet, (1-q) concert

E[H] = pq * 1 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 2 = ⅔

E[W] = pq * 2 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 1 = ⅔

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

c) Compute the expected utility of all three equilibria for the husband. Do the same for the wife.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	pq H=1, W=2	p(1-q) H=0, W=0
Concert	(1-p)q H=0, W=0	(1-p)(1-q) H=2, W=1

H: p ballet, (1-p) concert
W: q ballet, (1-q) concert

$E[H] = pq * 1 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 2 = \frac{2}{3}$

$E[W] = pq * 2 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 1 = \frac{2}{3}$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(d) Compute the utility of both players going to their preferred activity, and the expected utility of for both players when they both select each activity randomly with equal probability.

Question

Wife (W)

Husband (H)	Ballet	Concert
Ballet		
Concert	H=0, W=0	

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(d) Compute the utility of both players going to their preferred activity, and the expected utility of for both players when they both select each activity randomly with equal probability.

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(d) Compute the utility of both players going to their preferred activity, and the expected utility of for both players when they both select each activity randomly with equal probability.

Recall answer from (c)

Wife (W)

Husband (H)	Ballet	Concert
Ballet	pq H=1, W=2	p(1-q) H=0, W=0
Concert	(1-p)q H=0, W=0	(1-p)(1-q) H=2, W=1

H: p ballet, (1-p) concert
W: q ballet, (1-q) concert

$E[H] = pq * 1 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 2 = \frac{2}{3}$

$E[W] = pq * 2 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 1 = \frac{2}{3}$

Wife (W)

Husband (H)	Ballet	Concert
Ballet	H=1, W=2	H=0, W=0
Concert	H=0, W=0	H=2, W=1

Husband and wife would like to go on a date-night out and there are only two venues for entertainment that night: a Ballet and a K-pop Concert. The wife wants to see the Ballet while the husband wants to see the Concert. But both of them prefer being together than being alone. Out of love for each other, they do not explicitly tell each other their own preferences (Bad idea!). The payoff matrix is shown below where the husband is the row player and the wife is the column player. Please work out the Nash equilibria for them.

(d) Compute the utility of both players going to their preferred activity, and the expected utility of for both players when they both select each activity randomly with equal probability.

Random: p = q = ½

H: p ballet, (1-p) concert
W: q ballet, (1-q) concert

Wife (W)

Husband (H)	Ballet	Concert
Ballet	pq H=1, W=2	p(1-q) H=0, W=0
Concert	(1-p)q H=0, W=0	(1-p)(1-q) H=2, W=1

E[H] = pq * 1 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 2 = ¾

E[W] = pq * 2 + p(1-q) * 0 + (1-p)q * 0 + (1-p)(1-q) * 1 = ¾

Second

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

Consider the following 3×3 two-person, zero-sum matrix game:

Want to maximize

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

Payoff for the row player

In this question, we assume that only pure strategies are considered.

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

Want to minimize

Want to maximize

Payoff for the row player

In this question, we assume that only pure strategies are considered.

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(a) Find the maxmin strategy and value for the row player.

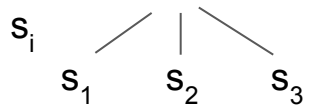
Question

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(a) Find the maxmin strategy and value for the row player.

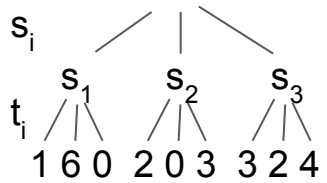


Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(a) Find the maxmin strategy and value for the row player.

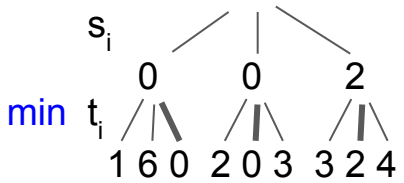


Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(a) Find the maxmin strategy and value for the row player.

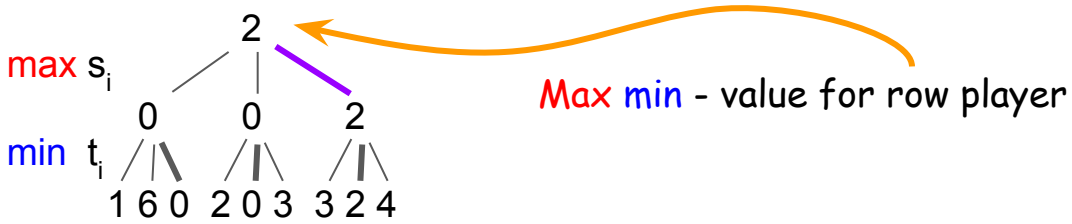


Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(a) Find the maxmin strategy and value for the row player.

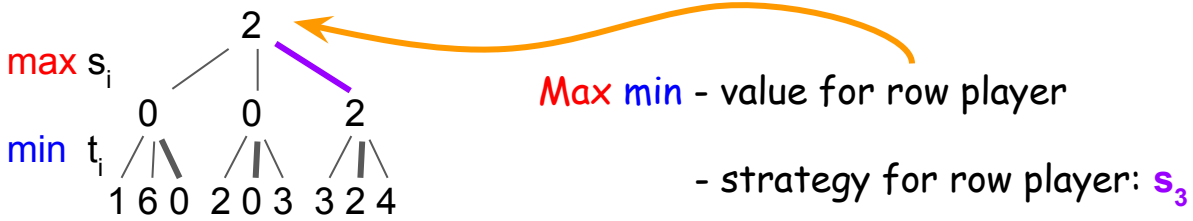


Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(a) Find the maxmin strategy and value for the row player.



Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(b) Find the minmax strategy for the column player against the row player and the minmax value for the row player.

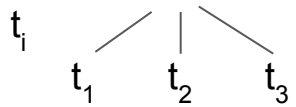
Question

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(b) Find the minmax strategy for the column player against the row player and the minmax value for the row player.

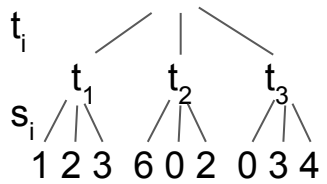


Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(b) Find the minmax strategy for the column player against the row player and the minmax value for the row player.

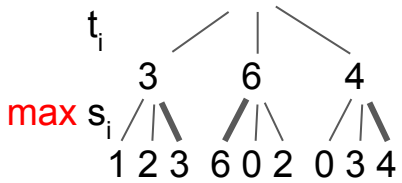


Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(b) Find the minmax strategy for the column player against the row player and the minmax value for the row player.

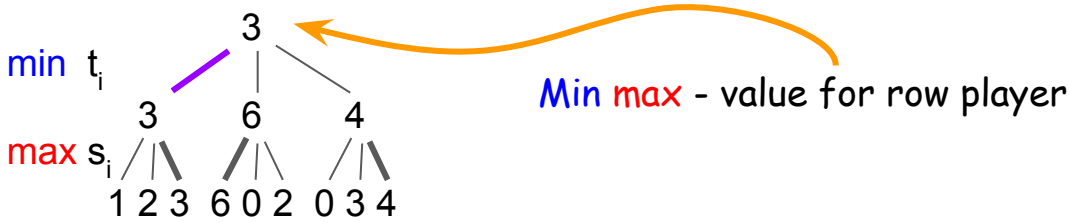


Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(b) Find the minmax strategy for the column player against the row player and the minmax value for the row player.

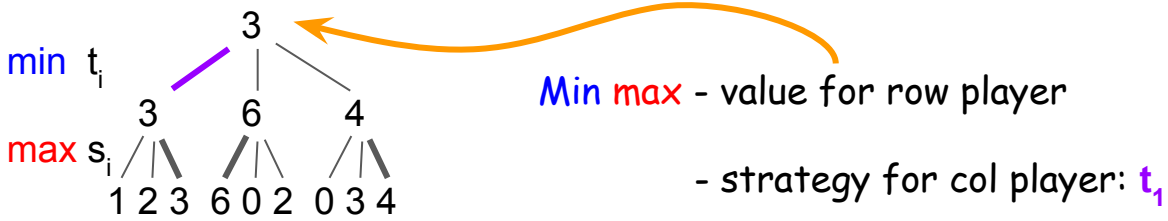


Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(b) Find the minmax strategy for the column player against the row player and the minmax value for the row player.



Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(c) Prove that, in general (i.e., not just for the game above), $\max_s \min_t u(s,t) \leq \min_t \max_s u(s,t)$.

Question

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(c) Prove that, in general (i.e., not just for the game above), $\max_s \min_t u(s,t) \leq \min_t \max_s u(s,t)$.

$$\forall s \, \forall t \min_{t'} \; u(s,t') \leq u(s,t)$$

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(c) Prove that, in general (i.e., not just for the game above), $\max_s \min_t u(s,t) \leq \min_t \max_s u(s,t)$.

$$\forall s \, \forall t \, \underbrace{\min_{t'} \; u(s,t') \leq u(s,t)}$$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$\leq$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(c) Prove that, in general (i.e., not just for the game above), $\max_s \min_t u(s,t) \leq \min_t \max_s u(s,t)$.

$$\forall s \, \forall t \min_{t'} \; u(s,t') \leq u(s,t)$$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$\leq$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$$\Rightarrow \quad \forall t \; \max_{s'} \min_t u(s',t') \leq \max_s u(s,t)$$

Consider the following 3×3 two-person, zero-sum matrix game:

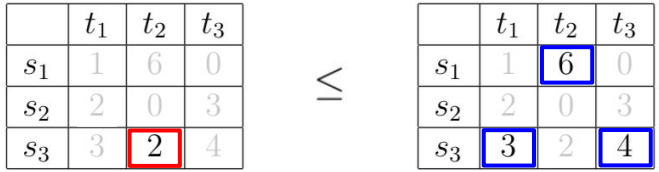
	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(c) Prove that, in general (i.e., not just for the game above), $\max_s \min_t u(s,t) \leq \min_t \max_s u(s,t)$.

$$\forall s \; \forall t \min_{t'} \; u(s,t') \leq u(s,t)$$

$$\Rightarrow \quad \forall t \; \max_{s'} \min_{t} u(s',t') \leq \max_{s} u(s,t)$$



Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(c) Prove that, in general (i.e., not just for the game above), $\max_s \min_t u(s,t) \leq \min_t \max_s u(s,t)$.

$$\forall s \; \forall t \min_{t'} \; u(s,t') \leq u(s,t)$$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$\leq$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$$\Rightarrow \quad \forall t \; \max_{s'} \min_t u(s',t') \leq \max_s u(s,t)$$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$\leq$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$$\Rightarrow \quad \max_{s'} \min_{t'} u(s',t') \leq \min_t \max_s u(s,t)$$

Consider the following 3×3 two-person, zero-sum matrix game:

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

In this question, we assume that only pure strategies are considered.

(c) Prove that, in general (i.e., not just for the game above), $\max_s \min_t u(s,t) \leq \min_t \max_s u(s,t)$.

$$\forall s \, \forall t \min_{t'} \; u(s,t') \leq u(s,t)$$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$\leq$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$$\Rightarrow \quad \forall t \; \max_{s'} \min_t u(s',t') \leq \max_s u(s,t)$$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$\leq$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$$\Rightarrow \quad \max_{s'} \min_{t'} u(s',t') \leq \min_t \max_s u(s,t)$$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

$\leq$

	t_1	t_2	t_3
s_1	1	6	0
s_2	2	0	3
s_3	3	2	4

Any Questions?

Contact the tutors:

- Rizki: rizki@u.nus.edu
- Abhinit: dcsabh@nus.edu.sg
- Evangelos: esigalas@u.nus.edu