Econ 327: Game Theory

Homework #1

University of Oregon

Due: Oct. 11^{th}

Question:	**Question 1**	**Question 2**	**Question 3**	Total
Points:	20	20	20	60
Score:				

For homework assignments:

- Complete *all* questions and parts.
- You may choose to work with others, but everyone must submit to Canvas individually. Please include the names of everyone who you worked with below your own name.

Name _____

Question 1. [20 points] **Multiple Choice**

(a) **A**lice, **B**ob, and **C**onfucious each put one dollar in a pot and each toss a fair coin. **A**lice wins if the coins are *all heads* **or** *all tails*, **B**ob wins if there are *2 heads* and *1 tail*, and **C**onfucious wins if there are *1 head* and *2 tails*.

What are the *expected payoffs* for each player? [1]

A. $EU_A = \$0$, $EU_B = \$0$, $EU_C = \$0$

B. $EU_A = -\$0.25$, $EU_B = \$0.125$, $EU_C = \$0.125$

C. $EU_A = -\$0.50$, $EU_B = \$0.25$, $EU_C = \$0.25$

D. $EU_A = \$0.50$, $EU_B = -\$0.25$, $EU_C = -\$0.25$

(b) Consider three different outcomes, A, B, and C. Outcome A is Pareto efficient, and outcome B is not Pareto efficient. Choose one of the following:

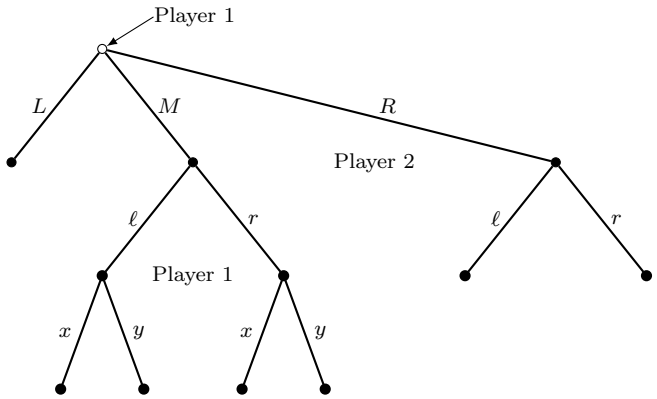
A. C cannot be Pareto efficient.

B. A can not be Pareto dominated by C.

C. C is Pareto dominated by A

D. C is Pareto dominated by B

(c) Consider the game tree below



How many *strategies* does each player have? (recall that a strategy is a complete plan of action for *every* eventuality)

A. Player 1: 9 strategies, Player 2: 4 strategies

B. Player 1: 12 strategies, Player 2: 4 strategies

C. Player 1: 7 strategies, Player 2: 2 strategies

D. Player 1: 7 strategies, Player 2: 4 strategies

(d) Consider the game tree from the previous question. Which of the following is a complete strategy for Player 1?

A. $\{L\}$

B. $\{x \text{ if } \ell\}$

C. $\{L, x \text{ if } \ell,\ y \text{ if } r\}$

D. $\{L,\ x\}$

(e) Consider the variation of the Survivor Flags game with 100 flags where each team taking any number of flags between 1 and 10 and the team to take the last flag wins.

How many flags should the first team take?

A. 1

[1] Adapted from Dixit, Skeath, & McAdams (2021)

B. 2
C. 5
D. 10

Question 2. Imagine a sequential moves version of rock-paper-scissors where player 2 gets to pick what they will do after player 1 picks. Please model the game in its extensive form (as a game tree). Assume both player 1 and player 2 only care about the result of the game and have the following preferences over the result of the game: win $\succ$ tie $\succ$ loss. [2]

(a) Answer the following questions:

i. [2 points] How many nodes are there?

ii. [2 points] How many branches are there?

iii. [2 points] How many terminal nodes are there?

(b) [6 points] Prune the tree as much as possible. How many branches were you able to eliminate? (A complete answer should include your drawing(s) of the game tree)

(c) [8 points] Use the same setup, but now imagine player 1's preferences change because they want to be seen as a "tough guy". Given that what they want to play remains the same, they still have the following preferences over the result of the game: win $\succ$ tie $\succ$ loss. However, they now would prefer to lose playing rock than win playing paper or scissors. Please create a new game tree so the payoffs reflect these new preferences.

Prune the tree as much as possible.

How many branches were you able to eliminate? (Include your drawing(s))

[2] Ethan Holdahl, University of Oregon

Question 3. [20 points] Analyze the extensive form game tree from Fraser, Hipel, and Monte, *Approaches to conflict modeling: A study of a possible USA-USSR nuclear confrontation*, Journal of Policy Modeling, 1983.

Abstract:

A possible nuclear confrontation between the USA and USSR is analyzed using five different models from game theory in order to compare the various approaches that can be taken in the analysis of conflicts. Of particular importance is an improved metagame analysis model that provides a comprehensive procedure for analyzing not only the nuclear conflict but also any other type of real world conflict that can arise in practice. When the improved metagame analysis model is linked with a new state transition model, the dynamics of the game can be thoroughly studied.

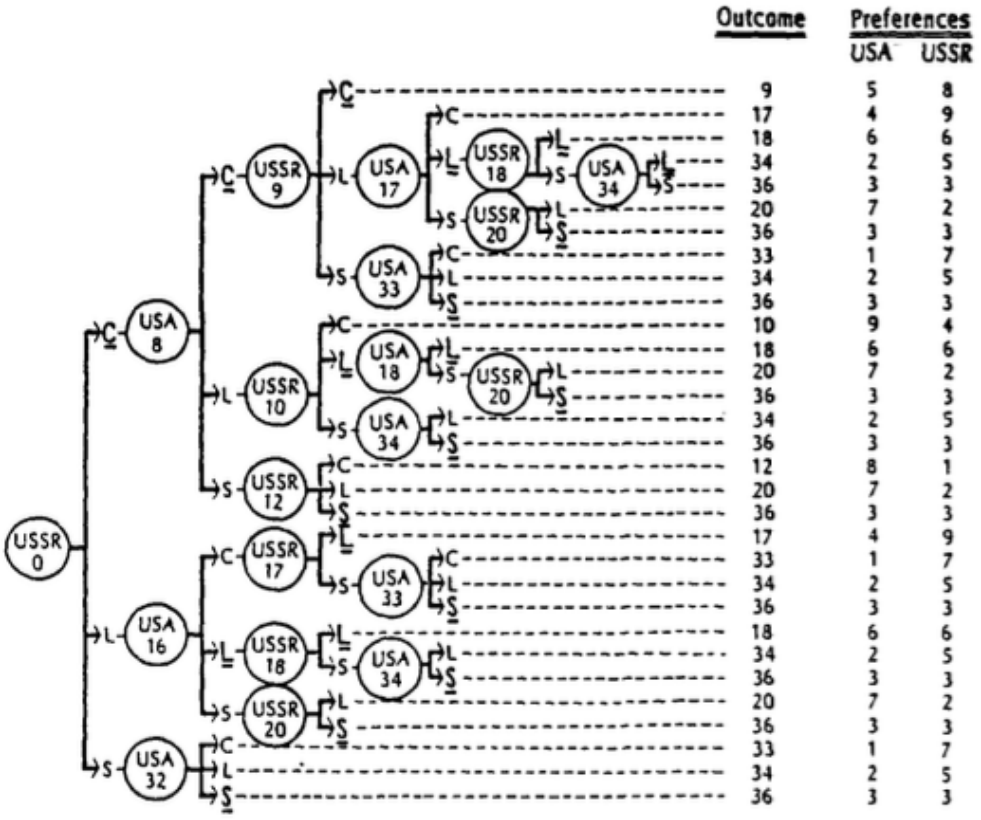


Figure 2. Extensive form of the game.

What is the *rollback equilibrium* outcome?