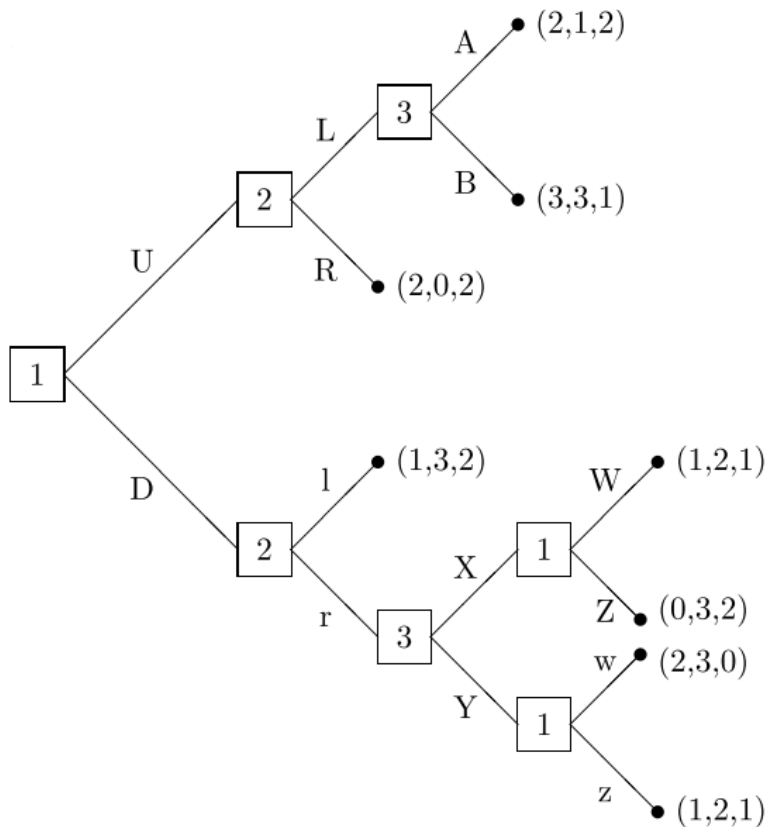# Chapter 2 Exercises: Sequential games

Exercise 1: Game tree

Find the outcome obtained by backwards induction in the following game tree.

Exercise 2: Electing a candidate

Three members of a committee should choose among four candidates A,B,C,D. The procedure is such that member 1 vetoes a candidate, observing this member 2 vetoes another, and observing members 1 and 2, member 3 vetoes a third candidate. The surviving candidate is elected. The preferences of the members (from best to worst) are as follows:

Member 1: C B D A

Member 2: B C A D

Member 3: A B C D

Find the elected candidate using backwards induction.

Exercise 3: Voting for a Pay Raise

Three legislators are voting under majority rule on whether to give themselves a pay raise. All three want the pay raise; however each face a small cost in voter resentment $c>0$. The benefit for the raise is $b>c$. They vote in the order 1-2-3.

What is the outcome obtained by backwards induction?

Exercise 4: Centipede game

Consider two players: Alice and Bob. Alice moves first. At the start of the game, Alice has two piles of coins in front of her: one pile contains 4 coins and the other pile contains 1 coin. Each player has two moves available: either "take" the larger pile of coins and give the smaller pile to the other player or "push" both piles across the table to the other player. Each time the piles of coins pass across the table, the quantity of coins in each pile doubles. For example, assume that Alice chooses to "push" the piles on her first move, handing the piles of 1 and 4 coins over to Bob, doubling them to 2 and 8. Bob could now use his first move to either "take" the pile of 8 coins and give 2 coins to Alice, or he can "push" the two piles back across the table again to Alice, again increasing the size of the piles to 4 and 16 coins. The game continues for a 6 rounds or until a player decides to end the game by pocketing a pile of coins.

1. What is the set of subgame perfect equilibrium?
2. Give an interpretation of that game.
3. Give a Nash equilibrium that does not belong to the set of subgame perfect equilibrium.

Exercise 5: *Paris-Zurich Bank* choice of opening branch in Shanghai

Paris-Zurich Bank is a European bank that has to decide whether to open a branch in Shanghai. The cost of opening a branch is estimated to €10 million. If the local market is sufficiently large and Chinese people are confident enough in the foreign bank to open accounts, the revenue is estimated to €60 million.

According to its own data, *Paris-Zurich Bank* estimates that the likelihood for such good conditions is 45%.

Before opening the branch, the bank can decide whether to pay €1 million for local prospecting.

There are 50% chances that the study draws the conclusion for encouraging conditions.

However, good conditions are not guaranteed: the study only reveal whether local conditions are favorable ex-ante. The probability for ex-post good conditions is 80% if the study draws an encouraging conclusion, and falls to 10% otherwise.

Which strategy do you suggest to *Paris-Zurich Bank*?