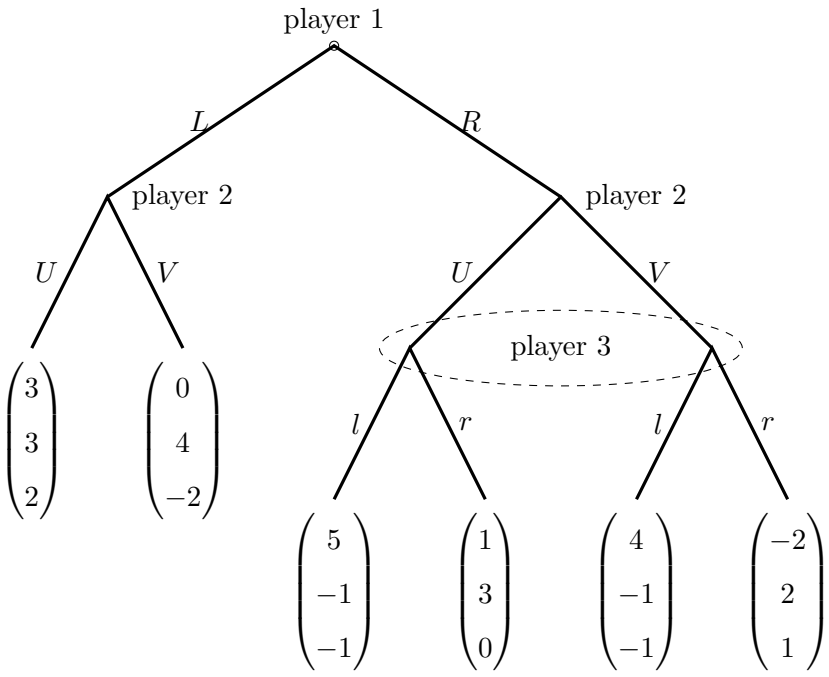
1. For the extensive-form game given below




(a) Write down the normal-form of the game.

(b) Find all pure strategy NE of the game.

(c) Find all subgame perfect NE of the game.

**Answer:**

(a) The normal-form

| | UU | UV | VU | VV |
|---|---|---|---|---|
| L | 3, 3, 2 | 3, 3, 2 | 0, 4, -2 | 0, 4, -2 |
| R | 5, -1, -1 | 4, -1, -1 | 5, -1, -1 | 4, -1, -1 |

$l$

| | UU | UV | VU | VV |
|---|---|---|---|---|
| L | 3, 3, 2 | 3, 3, 2 | 0, 4, -2 | 0, 4, -2 |
| R | 1, 3, 0 | -2, 2, 1 | 1, 3, 0 | -2, 2, 1 |

$r$

(b) Pure NE

$$(R, VU, r), \quad (L, VV, r)$$

(c) SPNE

$$(R, VU, r).$$

To see this, note that in the subgame after $L$, player 2's optimal choice is $V$. In the subgame after $R$, the NE is $(U, r)$.

| | l | r |
|---|---|---|
| U | -1, -1 | 3, 0 |
| V | -1, -1 | 2, 1 |

2. Two players, 1 and 2, simultaneously choose a number between 0 and 3, that is, $s_i \in \{0, 1, 2, 3\}$. If the sum of numbers they choose is less than or equal to 3, $s_1 + s_2 \leq 3$, each player $i$ gets $s_i$ dollars. However, if the sum they report is greater than 3, $s_1 + s_2 > 3$, each player gets 0 dollars. Identify all pure NE.

**Answer.** The strategic form

| | | player 2 | | | |
|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 |
| Player 1 | 0 | 0, 0 | 0, 1 | 0, 2 | 0, 3 |
| | 1 | 1, 0 | 1, 1 | 1, 2 | 0, 0 |
| | 2 | 2, 0 | 2, 1 | 0, 0 | 0, 0 |
| | 3 | 3, 0 | 0, 0 | 0, 0 | 0, 0 |

Four pure NE:

$$(3, 0), (2, 1), (1, 2), (0, 3), (3, 3).$$