

## Exercise 1: Cournot duopoly

Two firms compete in a market by simultaneously setting the quantity of a homogeneous good to produce. Both firms face a *constant marginal cost*  $c = 3$  and no *fixed cost*. *Inverse market demand* is  $P(Q) = 27 - 2Q$ , where  $Q$  is aggregate quantity. Payoffs are given by each firm's profits.

### Data of the problem

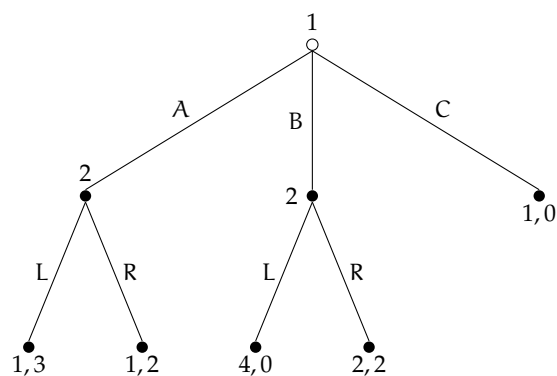
- Marginal cost:  $c = 3$ .
- Inverse demand:  $P(Q) = 27 - 2Q$  where  $Q = q_1 + q_2$ .

**Answer the following questions and explain your answer in detail.**

1. Compute the two firms' reaction functions and explain what they represent. [3 points]
2. Draw the two firms' reaction functions in the  $(q_1, q_2)$  space. [3 points]
3. Find the *NE* of the game. [3 points]
4. Clearly identify the *NE* in the same graph as in question 2. [1 point]
5. Show that:
  - i. Each firm producing half the monopoly quantity is a more "*(Pareto)-efficient*" strategy profile (in terms of profits) than the *NE*. [3 points];
  - ii. However, it is not a *NE* of the game (i.e., there exists a strictly profitable deviation for at least one firm). [2 points]

## Exercise 2

Consider the following **dynamic game of complete information**.



**Answer the following questions and explain your answer in detail.**

1. Find all the pure-strategy *Nash Equilibria*. [3 points]
2. Find all the *Subgame-Perfect Nash Equilibria*. [3 points]
3. Explain why one of the NE of question 1 is not a SPNE. [1.5 points]

From now on, assume that **player 2 cannot distinguish** action A from action B.

4. Explain how we should modify the tree above to represent this game. [1.5 points]
5. Explain why the strategy of player 2 is not a couple of actions (for instance LR or RR) like it was the case in question 1. [3 points]
6. Find the pure-strategy *Nash Equilibrium*. [3 points]