Day 8: Homework

Question 1 :
Go to `http://oyc.yale.edu/sites/default/files/problemset6_1.pdf` and answer the first question there.

Question 2: A sheep wanders into a lions' den. There are 11 lions in the den, and the rule is that only the oldest lion can eat the sheep. However, if the oldest lion eats the sheep he falls asleep, so the second oldest lion can choose to eat the oldest lion. If the second oldest lion eats the sheep he falls asleep, and so the third oldest lion can choose to eat the second oldest lion, etc. A lion cannot eat the lion in front if it is not asleep. Should the first lion eat the sheep?

(This is the same game we played in class, except with one more lion)

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A particular product is worth a cents. Two companies enter the market, and they each can make the product at a cost of c cents per unit. Each unit of product produced will reduce the price of the product by b cents. The profit(payoff) for Company 1 is

$$[a - b(Q_1 + Q_2)]Q_1 - cQ_1, \tag{1}$$

and the profit (payoff) for Company 2 is

$$[a - b(Q_1 + Q_2)]Q_2 - cQ_2. \tag{2}$$

Thus Company 1's strategy is Q_1, and Company 2's strategy is Q_2, where Q_1, Q_2 are the amount of units produced.

We had calculated that the best response of company 1 to company 2 producing Q_2 units is

$$Q_1 = \frac{a-c}{2b} - \frac{Q_2}{2}, \tag{3}$$

and the best response of Company 2 to Company 1 producing Q_1 units is

$$Q_2 = \frac{a-c}{2b} - \frac{Q_1}{2}. \tag{4}$$

In the Cournot model, both companies operate simultaneously, and we calculated that the Nash equilibrium was for each company to make $\frac{a-c}{3b}$ units. In the homework, we also

calculated that in the Cournot model both companies make a profit of $\frac{(a-c)^2}{9b}$.

Question 3: In class, we calculated that if the companies take turns to make products,

(a) The first company should make $\frac{a-c}{2b}$ units.

(b) The first company's profit is $\frac{(a-c)^2}{8b}$ if they make $\frac{a-c}{2b}$ units. This is more than the Cournot Nash equilibrium profit of $\frac{(a-c)^2}{9b}$.

How much should the second company produce, and how much profit will they make? Is it more or less than the Cournot Nash equilibrium profit (if both companies decide at the same time)?