Problem Set 3

1. Consider a 3-firm version of the Stackelberg game. Assume that market inverse demand is given by $p = 120 - Q$, and suppose that there are three firms that set their output sequentially: firm 1 sets $q_1$ in period 1, firm 2 sets $q_2$ in period 2, and firm 3 sets $q_3$ in period 3. Then, firms sell their output and collect their profits. Solve for the sequential-moves (i.e. Stackelberg) equilibrium. Make sure that you solve for the output level of each firm, and for the market price.

2. Your grandmammy built a factory years ago with capacity $k_1$. She knew that nowadays, the market inverse demand would be $p = 10 - q_1 - q_2$, where $q_1$ is the production of her (now your) factory and $q_2$ is the production that may come from an upstart factory that may be started by a firm called ABB (after the founder’s initials).

Your grandmammy and you have a cost of 2 to build a unit of capacity and a variable cost of 1 to produce output, so your total cost is $TC_1 = 2k_1 + q_1$ if $q_1 \leq k_1$ and $TC_1 = 3q_1$ if $q_1 > k_1$.

The entrant firm ABB has a cost of 2 per unit of output $q_2$ and a fixed cost of 7.

(a) Find your reaction function if grandmammy built a huge factory.
(b) Find your reaction function if grandmammy built a size 0 factory.
(c) Find ABB’s reaction function.
(d) Find the Cournot equilibria for the huge factory and tiny factory cases. What are ABB’s profits in each case?