

EconS 301- Intermediate Microeconomic Theory
Homework #5 - Due date: Thursday November 17th, 2022.

1. Consider a situation where two identical firms are simultaneously deciding whether to price high or price low. If both firms price high, they both receive half of the market's profits, $\frac{\pi}{2}$. If one firm prices high, while the other firm prices low, the low pricing firm receives all of the market's profits, π , while the high pricing firm receives 0 profits. If both firms price low, they both receive 0 profits.
 - (a) Depict the normal form representation of this simultaneous move game. Find all psNE.
 - (b) Suppose now that the firms decided to collude to charge a high price. For what minimal discount factor δ do the firms cooperate by charging a high price?

2. Calculate the HHI in the following markets, where three firms operate under different levels of market share:
 - (a) Each firm has an equal share of the market (i.e., 33.3 percent).
 - (b) One firm captures 50 percent of the market, while the other two each have 25 percent.
 - (c) One firm captures 80 percent of the market, while the other two each have 10 percent.
 - (d) Two firms have 45 percent of the market, while the other firm has 10 percent.
 - (e) How do these different market shares (in parts a–d) affect the HHI?

3. Consider a market with three firms producing a homogeneous good and facing a linear demand function $p(Q) = 1 - Q$, where $Q \equiv q_1 + q_2 + q_3$ denotes aggregate output. All firms face a constant marginal cost of production given by c , where $1 > c > 0$.
 - (a) Set up firm 1's PMP, differentiate with respect to its output q_1 , and obtain this firm's best response function. [*Hint*: It should be a function of firm 2's and 3's output, q_2 and q_3 .]
 - (b) Repeat the process for firms 2 and 3, to obtain their best response functions. [*Hint*: You should find that all firms have symmetric best response functions.]
 - (c) Interpret firm 1's best response function: if firm 2 were to marginally increase its output, does firm 1 increase or decrease its own output? Either way, by how much?
 - (d) Using the three best response functions for these firms, find the point where they cross. The triplet (q_1^*, q_2^*, q_3^*) characterizes the NE of this Cournot game.
 - (e) Is the equilibrium output that you found in part (d) increasing or decreasing in marginal cost c ?
 - (f) Find the price that emerges in equilibrium, along with the profits that every firm earns.

4. Two gasoline stations are situated across the street from each other and are in fierce competition. They face market demand of $p = 10 - 0.05Q$, where $Q = q_1 + q_2$ denotes aggregate output, and each has total cost $TC(q_i) = 10 + 0.5q_i$, where $i \in \{1, 2\}$ denotes the firm.
- (a) If firms compete in quantities, find each firm's best response function.
 - (b) Find equilibrium output for each firm, price, and profits.
 - (c) If firms collude, what equilibrium price and quantity will each firm offer? What will their profits be?
 - (d) If the firms play an infinitely repeated game, and they seek to coordinate their production decision through the Grim-Trigger Strategy considered in Example 14.5. What discount factor supports continued collusion?