

Economics 644 – Midterm

Please answer ALL questions on this examination. Be sure to explain any non-standard notation that you use. *Justify your answers!*

1. (30%) Consider n firms (with $n > 1$) that compete Cournot-style facing the (inverse) demand curve $P = 36 - Q$, where $Q = \sum_{i=1}^n q_i$. Assume that $C_i(q_i) = 6 \cdot q_i$ for all $i = 1, \dots, n$.
 - a. In general terms, define Nash Equilibrium.
 - b. Find the Nash Equilibrium of the above game. (Hint: impose symmetry only after taking the first order condition!)
 - c. Show what happens to the (1) equilibrium market quantity, (2) equilibrium market price, and (3) equilibrium individual firm profits as the number of firms increases to infinity. Explain the intuition behind the results.

2. (30%) Consider the following simultaneous move game:

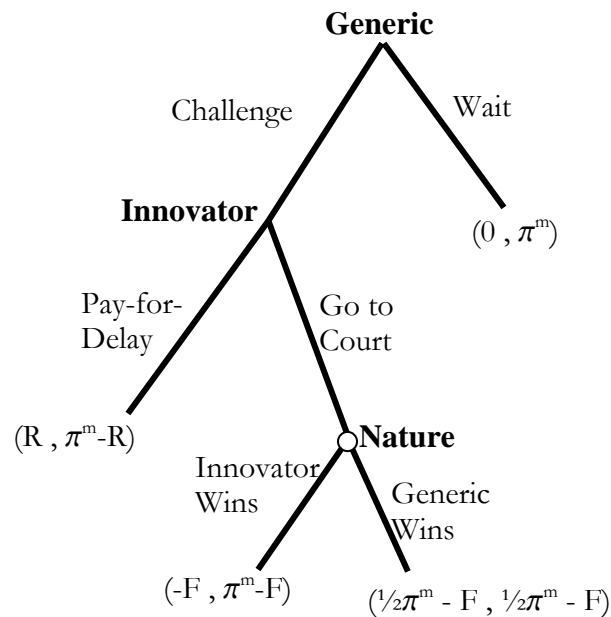
		Player 2		
		L	C	R
Player 1	T	(0, 1)	(0, 0)	(0, 0)
	M	(5, 0)	(0, -1)	(5, -1)
	B	(4, -1)	(-1, -2)	(5, -1)

- If they exist, find all *strictly dominated strategies* for each player.
- If they exist, find all *weakly dominated strategies* for each player.
- Solve for all *Pure Strategy* Nash Equilibria of the game. Which, if any, of the equilibria include strictly and/or weakly dominated strategies?
- Which, if any, of the Nash Equilibria you solved for in part (c) are *strict* Nash Equilibria? Explain your reasoning.

3. (40%) Pharmaceutical companies spend large amounts of money to research and develop new drugs and then enjoy exclusivity over all sales for a period of time (i.e., the patent period). These innovators act as monopolists during this period of time.

Generic drug manufacturers will generally enter the market once the patent(s) expire and the price of the drug quickly falls to the competitive price. Often, during the course of the patent period, a generic firm will challenge the legality of the patent and seek to enter the industry immediately. The innovator can then either go to court with the generic firm, or at times will simply pay the generic a lump sum to stay out of the market until the end of the patent period (this tactic is often called “Pay-for-Delay”). Going to court is costly for both firms and the outcome is uncertain.

Consider the following extensive game:



Payoffs are denoted (X,Y) where X is the Generic's payoff and Y is the Innovator's payoff.

Assume that if the firms go to court there is a 50% chance that each of them will win, so e.g., the innovator will go to court if the expected payoff from doing so is greater than the Pay-for-Delay payoff.

Note, there are two players in the game -- the move by nature is governed by the probabilities that each firm wins in court.

π^m is the monopoly profit, R is the pay-for-delay lump-sum payment, and F are court costs. Assume $\pi^m > F > \frac{1}{2}\pi^m > R > 0$.

- a. Will the innovator firm, faced with a patent challenge, strictly prefer the Pay-for-Delay strategy? Explain your answer.
- b. What is the generic firm's optimal strategy in this game?
- c. Congress has considered passing a law which bans Pay-for-Delay practices. They argue that such practices delay when cheaper generic drugs are available to consumers. Suppose the Pay-for-Delay option is no longer available to the innovator. What is the generic firm's best response strategy in this new game. (All other strategies, payoffs, and assumptions remain unchanged.)
- d. Will the actions by Congress result in consumers enjoying cheaper drug alternatives sooner than they would otherwise?