EC 501: Problem Set 10
(Due in class on Tuesday, November 19)

1. Consider a static game with the following payoff matrix:

	L	R
T	10 , 5	5 , 3
B	5 , 0	20 , 2

(a) Find all Nash equilibria in pure strategies for this game.
(b) Find all Nash equilibria in mixed strategies for this game.
(c) Write down the normal form for the dynamic version of this game in which the row player moves first.
(d) Find all Nash equilibria in pure strategies for the dynamic game of part (c) and also find the subgame perfect equilibrium of that game.

2. Acme Drug Co. has a patent on the drug A-rene, the annual demand for which can be described by the demand curve:

Q = 4500 - 300P.

Production of the drug requires an annual fixed cost of $3,000 and a per unit marginal cost of $5.

(i) How many units of the drug will Acme produce each year, and what price will it charge, in order to maximize its profits? What will be its annual profits?
(ii) Now suppose that the Better Drug Co. has discovered B-rene, a new drug which seems to be identical to A-rene in all its effects. If Better enters the market, competition with Acme will conform to a Cournot duopoly. Better's costs are identical to those of Acme. What would be the equilibrium outcome of this duopoly? Specifically, how much would each firm produce and what would be the price? How much profit would each firm make? Would Better find it profitable to enter the market?
(iii) Would it be in the interests of society as a whole for Better Drug to enter into production? Identify the gainers and losers from Better's entry.
(iv) Suppose instead that, if Better enters the market, Acme plays as a Stackelberg leader. What would be the equilibrium outcome in this case?

3. There are (n+1) firms that produce soap in the city of Latherville. They all have identical cost and demand curves. For the ith firm, the average cost curve is

$$AC_i = \frac{72}{q_i} - 10 + q_i$$

where q_i is the amount of soap it produces. The inverse demand curve it faces is

$$p = 38 - q_i - 0.2\,\tilde{q}_i$$

where $\tilde{q}_i$ is the combined production level of the other n firms.

(i) Suppose the ith firm regards the output levels of the other firms fixed. Give an expression for its profit-maximizing output level (in terms of $\tilde{q}_i$.)
(ii) If each firm behaved as outlined in (i), what would be the equilibrium market price and quantity produced of soap, assuming there were a total of 11 firms in the industry? (Hint: Use your answer to (i) and the fact that the solution must be symmetric.)

(iii) If in the long run there is free entry and exit from the industry, how many firms would there be in the industry and what would be the market price and quantity? (Hint: Assume there are n+1 firms in long-run equilibrium. Then use your answer to (ii) and the fact that profits must be zero in the long run to solve for n.)

4. Able Widget Co. is the only producer of widgets, which it can produce at a cost of $2 per widget. The demand for widgets is

$$W = 14 - p$$

where p is the price of widgets.

(a) How many widgets would Able produce, what would be the price, and how much profit would Able make, if it maximized its profit?
(b) Now suppose Baker Widget Co. can enter the widget market by spending $4 in entry cost. Once it enters, Baker would also be able to produce widgets at a cost of $2 per widget, and Able and Baker would engage in Cournot (quantity-setting) competition. How much would each firm produce, what would be the price, and how much profit would each firm make in the Cournot equilibrium?
(c) Suppose, before Baker entered, Able could pre-commit to producing any output level. What output level would it select if it wished to maximize its profit? How much would each firm produce, what would be the price and how much profit would each firm make in this scenario?