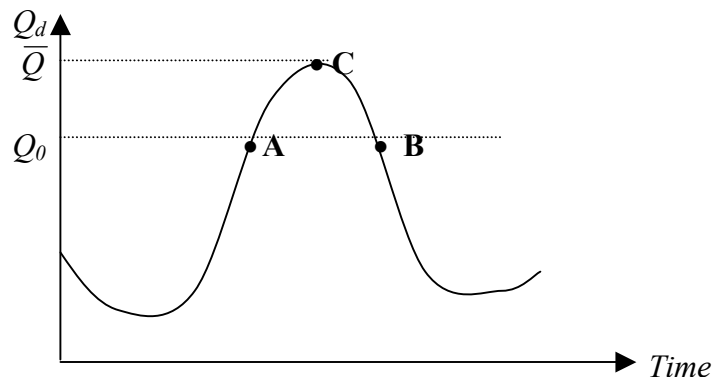


Exam 1
March 15, 2000

This is an 80-minute, 80 point CLOSED BOOK exam. Answer all questions.

Part 1: Short Answer (6 points each, 24 points total). Credit depends entirely upon your explanation.

- 1.1 Eight-ounce milk cartons are produced by 3 large dairies in the Boston area, and sold to three types of buyers. The first is school lunch programs, which decide purchases based on competitive bidding processes: dairies submit sealed bids, the contract is awarded to the lowest bidder, and all bids are made public once opened. The second is small restaurant and convenience stores, which buy at standard wholesale list prices. The third are restaurant and retail chains, where large buyers may sign annual supply contracts with price and quantity terms negotiated directly with a dairy. In which market do you think the 3 dairies are most likely to maintain a “cooperative” price level? In which market do you think this is least likely? Why?
- 1.2 The airline market is characterized by competition in strategic complements (primarily prices and frequent flyer programs). This implies that incumbent airlines facing potential entry into their markets will have a strategic incentive to overinvest in sunk capacity. True, False, or Uncertain? Explain.
- 1.3 “Merger policy is concerned almost exclusively with potential consumer harm from increased market power post-merger. This is a mistake! The primary effect of mergers is to reduce costs, and this benefit should more than offset market power concerns.” True, False, or Uncertain? Explain.
- 1.4 The diagram below illustrates the seasonal demand (Q_d) for gasoline. If marginal costs are constant, and retail gasoline stations are tacitly colluding, we would expect price-cost margins, $(P-MC)/P$, to be the same at points A and B, where demand is identical (Q_0), and slightly higher at point C, the peak demand point (\bar{Q}). True, False, or Uncertain? Explain.



Part 2. Longer problems. Answer all questions.

2.1 Game Theory (21 points): Consider a differentiated products duopoly game in which firms have three possible price strategies: C= collusion, B=Bertrand, and W=price war. Pay-offs for the two firms are given below in (π_1, π_2) order:

	Firm 2 Strategies		
Firm 1 Strategies:	C	B	W
C	4,4	0,5	-1,5
B	5,0	2,2	-1,1
W	5,-1	1,-1	0,0

- a. What are the possible pure strategy Nash equilibrium/equilibria to the one-shot play of this game? If firms play the game only once, what strategy do you expect each firm to play? What will their pay-offs be? Explain.

Now consider a two-period game with the pay-offs given above for each period. Suppose firms have the following beliefs:

- (i) If both firms play collusive in period 1, both will play Bertrand (B) in period 2.
 - (ii) If either firm cheats (plays P < collusive P) in period 1, both will revert to a price war (W) in period 2.
- b. Do beliefs (i) generate sub-game perfect equilibria in period 2? (i.e., is it in each firm's interest to behave as the beliefs predict it will)? Do beliefs (ii) generate sub-game perfect equilibria in period 2? Why or why not?
- c. Given beliefs (i) and (ii) and "reasonably patient" firms, what strategies do you expect the firms to play in period 1 and period 2, and what will their pay-offs be?

Extra credit: If firms discount the future at the common discount factor δ , for what values of δ will the equilibrium in (c) remain an equilibrium?

2.2 Oligopoly behavior (15 points): There are two firms producing reinforced concrete tubes used in tunnel construction. Fabrication processes, and hence cost functions, are the same for both firms:

$$C_i(q_i) = 5q_i \quad i = 1, 2$$

Market demand for these tubes is estimated at:

$$P = 53 - Q \quad Q = q_1 + q_2$$

- Suppose the two firms compete in quantities. What do you expect to be the equilibrium quantities, market price, and profits for each firm?
- Suppose firm 1 were able to commit to an output level before firm 2 has selected its output. What output level should firm 1 choose? What would be firm 2's best response? What would be the equilibrium market price and firm quantities?
- How much should firm 1 be willing to pay to make a credible first-mover output commitment to realize the equilibrium in (b)? How might it accomplish this? Be brief!

2.3. OPEC (20 points).

- a. An analysis of international oil production suggests that the marginal cost of developing an additional barrel/day of crude oil production capacity is about \$10,000 in the U.S. and U.K., and about \$2,000 in OPEC countries. Explain why this is inconsistent with perfect competition in the oil market. What market structure is consistent with this explanation, and why?

The graphs below plot nominal crude oil prices over the past thirty years, and World crude oil production as well as production by OPEC and the U.S. over roughly the same period.

Graph of Crude Oil Production vs. Barrels / Day (millions)
- From 1970-1997 - see <http://www.wtrg.com> - WTRG Economics

- b. Briefly describe the factors that you think were important in explaining the broad price trend from 1980 through March 1999.
- c. Briefly describe the factors you think are important in explaining the change in oil prices between March 1999 and current spot price levels of more than \$26.00/barrel.
- d. What do you expect the price of crude oil to be in May 2000, and why? (Credit depends entirely upon your explanation; there is not an obvious “right” answer.)

