

Short Answer - 40 points

Answer the following questions to the best of your ability. For full credit, show all of your work and clearly indicate your final solution for each party by circling the answer. Be sure to properly label any and all graphs you make. Partial credit is very much in play, so attempt every question.

1. [10 points] Imagine a firm with the cost function $C(Q) = Q^3 + 100Q + 200$. Currently, the firm can sell its product for a price of \$175. What is the short-run profit maximizing quantity? Imagine the government imposes a \$60 per-unit tax on the good that this firm sells. What is the new short-run profit maximizing quantity, assuming the price goes up to \$208

2. [10 points] For a firm with the cost function $C(Q) = \frac{1}{4}Q^3 - 3Q^2 + 25Q + 60$, below what price will the firm shut down? What are the firm's profits at that price?

3. [10 points] Maria is the sole producer of dog outfits in Eugene and faces the following cost function:

$$C(Q) = Q^2 + 9$$

The demand for dog outfits is given by

$$Q_D = 112 - 4P$$

. What price will Maria charge and how much will she produce if she is maximizing profit?

4. [10 points] Imagine two firms are competing in Stackelberg competition. Firm A is the follower and has the best response function $Q_A = 100 - Q_B$, where firm B is the leader. Firm B has the cost function $C(Q_B) = \frac{1}{2}Q_B^3$. The market demand curve is $P = 250 - Q$. Write down firm B's profit function and find their profit maximizing quantity.

Long Answer - 102 points

1. [24 points] The firm you manage is a monopolist in the internet business in Eugene. You face a cost function $C(Q) = Q^2 + 80Q + 400$. Demand for internet in Eugene is given by the demand curve $P = 200 - Q_D$. *No matter how much you complete this problem, do not forget to try the graph.*
 - (a) [4 points] Write down the profit function of your firm, using the fact that it is a monopoly. Find the profit-maximizing quantity for the **monopolist**. find the price the **monopolist** will charge.
 - (b) [4 points] If the government forces your firm to be **perfectly competitive** (government always bullying business around), what would the market equilibrium price and quantity be (in the short-run)?
 - (c) [8 points] In the (Q, P) plane, graph and label the market demand curve, your firm's marginal cost curve and your firm's marginal revenue curve. Add a label for the perfectly competitive short-run supply curve you use d in part b. Label the P and Q values associated with the monopoly outcome from part a, and the P and Q values associated with the short-run perfectly competitive equilibrium outcome from part b.
 - (d) [4 points] Imagine that the barriers to entry that have helped you maintain your monopoly status have disappeared. Now, any other firm that wants to join your market can. Assuming all these new firms have the same cost function as your firm, what will the long-run market equilibrium price and quantity be? How many firms would exist?
 - (e) [4 points] You decide you miss the good old days and team up with one of the new firms to invent a technology that changes both of your cost functions to $C(Q) = 20Q$. By forming a cartel with this new technology, you successfully kick every other firm out of the market. However, one day the other firm stabs you in the back and breaks the cartel agreement, and you end up competing in Cournot competition. How much do you produce, what is total market quantity, and the market price? Are consumers happier under true perfect competition in the long-run (as in part d) or do they prefer this imperfectly competitive outcome with better technology?

2. [18 points] You are employed by Ferrari to run their Formula 1 car production factory. The production function of a new part is given by $F(L, K) = L \cdot K$. Currently the wage, w , is \$12.50 and the rental rate, r , is \$1.25.

As a hint for somewhere in this problem: $\sqrt{40,000} = 200$, $\sqrt{400,000} = 632$, $\sqrt{4,000,000} = 2000$ (you might not need all of these). *Do not forget to attempt the graph regardless of how much of the problem you do.*

- (a) [3 points] Find the MRTS and price ratio. Ferrari's Team Principal, Frédéric Vasseur, rings you up and says you need to produce 400,000 parts for the season. Write down the quantity constraint that represents this.
- (b) [5 points] What are the cost-minimizing demands for labor, L^* , and capital, K^* ? What is your minimized cost, C^* ?
- (c) [8 points] On a graph in the (L, K) plane, draw and label the isoquant quantity constraint in this problem. Add the isocost line corresponding to the minimized cost: label it the value of C^* from part b. Label the L^* and K^* values at the cost-minimizing point with your answers from part b.
- (d) [2 points] If you tried to construct a minimized cost function, $C^*(Q)$ for this problem, and used it to do profit maximization, you would get an answer that did not make any sense (you would actually find the profit-minimizing quantity rather than the profit-maximizing quantity). Why? **Hint: Look closely at the production function**

3. [30 points] Suppose the market for thrifted clothes in Springfield is perfectly competitive. The thrift firms are identical and have long-run cost functions given by $C(Q) = 10Q^3 - 100Q^2 + 300Q$. Market demand is given by $Q_D = 5,000 - 90P$.
- (a) [3 points] What is the marginal cost curve for each firm in this market?
 - (b) [3 points] What is the average total cost curve for each firm in this market?
 - (c) [10 points] Find the long-run equilibrium price for this market
 - (d) [5 points] What is the equilibrium level of output in this market?
 - (e) [5 points] How many firms are in the market in the long-run equilibrium?
 - (f) [4 points] Suppose market demand increases. What do you expect will happen to Q^* , P^* , and the number of firms? For each of these, mention if it will increase, decrease, or stay the same and explain your reasoning. Address both the short-run and long-run dynamics. A graph may also help your explanation.

4. [30 points] Two firms are engaged in Cournot competition. Firm A has costs according to $C_A = 0.5a^2$ and firm B has costs according to $C_B = 0.75b^2$. Market demand is given by $P = 114 - 0.5Q$ where $Q = a + b$.
- (a) [2 points] What is the name of this type of market? (The answer is not Cournot)
 - (b) [4 points] What is firm A 's best response function?
 - (c) [4 points] What is firm B 's best response function?
 - (d) [6 points] What is the Nash Equilibrium of this game?
 - (e) [8 points] Suppose instead of a simultaneous game (Cournot) the two firms engaged in a sequential game (Stackelberg) where firm B is the follower. What is the Nash Equilibrium of this game?
 - (f) [6 points] Does firm B earn higher profits in the Stackelberg game or the Cournot game? If so, why? (Show your work)