Problem Sets 8

Due in class Nov. 19 F

1. Biwei manages a plant that mass-produces engines by teams of workers using assembly machines. The technology is summarized by the production function Q=5KL, where Q is the number of engines per week, K is the number of assembly machines, and L is the number of labor teams. Each assembly machine rents for r=$10,000 per week, and each team costs w =$5000 per week. Engine costs are given by the cost of labor teams and machines, plus $2000 per engine for raw materials. Biwei's plant has an installation of five assembly machines (K=5) as part of its design.
   1) What is the cost function for the plant—how much would it cost to produce Q engines? What are average and marginal costs for producing Q engines? How do average costs vary with Q?
   2) How many teams are required to produce 250 engines? What is the average cost per engine?
   3) Recommend for the design of a new production facility: What capital/labor (K/L) ratio should the new plant accommodate if it wants to minimize the total production cost at any level of output Q?

2. The demand schedule facing a business firm is shown below.

Price	Quantity	TR	MR	AR
$20	2	40		20
$19	3	57	+17	19
$18	4	72	+15	18
$17	5			
$16	6			
$15	7			
$14	8			
$13	9			
$12	10			
$11	11			
$10	12			

   1) Complete the total revenue, marginal revenue, and average revenue data in the table.
   2) What happen to the difference between selling price and marginal revenue as Q rises?
   3) How many units would the firm sell if the average cost is $8 per unit output and if the firm aims to maximize its economic profit (revenue minus costs)? What price would the firm charge?
   4) Can the firm charge $18? What is the corresponding economic profit?
   5) What is the economic profit of when the firm charges $14?

3. Biwei's Barbershop is a business in a perfectly competitive market with total cost of $TC = 0.5Q^2$ per day. The corresponding marginal cost is $MC=Q$. Assume that the market price of a haircut is $15. How many haircuts should Biwei give each day if he wants to maximize his profit? What is the profit?

4. If the direct production cost per unit (variable costs) is $1 and the market demand facing the firm is P=10-2Q, derive an expression for economic profit in terms of Q. No calculus required.
   1) Sketch a graph of economic profit against Q.
   2) For what values of Q would the firm break even?
   3) What are the optimal output and price to maximum profit?