Microeconomics I — Chiung-Yu Huang
1st Semester 2008 — January 15, 2009

FINAL EXAM

Problem I (60 pts): A number of stores offer film developing as a service to their customers. Suppose that each store offering this service has a cost function

$$C(q) = 50 + 0.5q + 0.08q^2,$$

and faces the market price P = \$8.5 per unit of service.

(a) What is the equilibrium quantity produced by the store? (10 pts)
(b) What is the lowest price at which the store would sell its output in the short run? (5 pts)
(c) Find the level of profit of the store. Is the industry in long-run equilibrium? Explain. (10 pts)
(d) If not, find the price associated with long-run equilibrium. (Hint: the minimum of the average cost) (10 pts)

Suppose now that a new technology is developed which will reduce the cost of film developing by 25 percent and the industry is in long-run equilibrium.

(e) How much would any one store be willing to pay to purchase this new technology? (Hint: (i) $C_{new}(q) = 0.75C(q)$, (ii) the profit of the store with new technology.) (15 pts)
(f) If all stores adopt the new technology and produce more, how the equilibrium price, quantity, and profit are going to change? (10 pts)

Problem II (60 pts): You manage 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 the number of assembly machines, and L the number of labor teams. Each assembly machine rents for $r = \$10{,}000$ per week and each team costs $w = \$4{,}000$ per week. Engine costs are given by the cost of labor teams and machines, plus \$3,000 per engine for raw materials. Your plant has a fixed installation of 8 assembly machines as part of its design.

(a) Does this production function exhibit constant, increasing or decreasing returns to scale? Explain. (5 pts)

(b) What is the cost function for your plant — namely, how much will it cost to produce Q engines? What are average and marginal costs for producing Q engines? (15 pts)

(c) How many teams are required for producing 1,250 engines? What is the total cost for producing 1,250 engines? (5 pts)

(d) Identifying the cost-minimizing level of K and L in the long run if producing 1,250 engines? What is the total cost? (15 pts)

(e) Graphically identify the level of capital, labor, and total cost of your answer in (d) and (e). (Note: Draw them together in one graph.) (10 pts)

(f) The *expansion path* shows how the cost-minimizing input choices vary as the scale or output of the operation increases. Draw a graph to show the expansion path in this case. (5 pts)

(g) Considering the following case: w increases to \$5,000 per week, r increases to \$11,000 per week, other things being equal. If Q = 1,250 is still produced, to minimize the cost, will you use more or less L and K comparing with your answer in (d)? Why? (5 pts)