Practice and Study Questions for Chapters 10 -14
(with partial solutions)

1. If each competitive firm in an industry has the short-run cost function $TC = 50 + 5q + q^2$, and the market price is \$35 **(We will do in Class)**

   a. What is the profit-maximizing output level for each firm?

   b. What is the total revenue and what are the profits?

2. Suppose, in Question 1, that fixed costs were \$250 instead of \$50. How does this change affect the firm's output decision and profits? Should the firm continue to operate? **(We will do in Class)**

3. In a competitive industry consisting of 10,000 firms, the short-run marginal cost curve for each firm is given by MC = 200 + 30Q. The demand curve faced by the industry is given as

   P = 400 - .002Q.

   Find the equilibrium price and quantities for the industry and each firm.

Solution

The supply curve for the industry is equal to the sum of the individual marginal cost curves:

We need to sum the individual MC – but you have to make sure you sum the Q's

Individual MC = 200 + 30Qi

Solving for individual Qi   Qi = -200/30 + MC/30

Q = 10,000 x Qi = -2,000,000/30 + 10,0000/30MC

Solve now for MC which will be same as P

(10,0000/30)MC = 2,000,000/30 + Q

Divide all by 30/10,000

MC = 200 + (30/10,000)Q or MC = 200 + .003Q

Set demand equal to supply: 400 - .002Q = 200 + .003Q
200= .005Q: so Q = 200/.005 = 40,000 for the industry
Q for firm = 40,000/10,000 = 4
P = 200 + 30(4) = 320

4. If the the long run total costs for each firm in a competitive industry are given by:

$LTC(Q) = 2(Q)^3$ $12(Q)^2 + 25Q$, with long run marginal costs given as: $LMC = 6(Q)^2 - 24Q + 25$, what is the long run equilibrium price for the industry?

Solution:
Set AC = MC
AC = TC/Q **$AC = (2Q^3 - 12Q^2 + 25Q)/Q = 2Q^2 - 12Q + 25$**

$2Q^2 - 12Q + 25 = 6Q^2 - 24Q + 25$ **$4Q^2 = 12Q$** **Q=3**
Price = marginal cost **$MC = 6(3)^2 - 24(3) + 25 = 54 - 72 + 25 = 7$**

5. Find the elasticity of supply in Problem 4.

Solution:

Elasticity of supply = (P/Q)(l/slope) = (320/40,000)(1/.003) = 2.67

6. What are the conditions for profit maximization for a monopoly? Compare these conditions with those for perfect competition. How do these conditions differ? Look at second order conditions.

7. Understand the effects of taxation on both the perfectly competitive firm and the monopolist. What type of tax affects output? What type of tax does not affect output? **WE DID IN CLASS. Look at Lecture Notes**

8. Understand the concept of game theory as discussed in class. Be able to define a dominant strategy and Nash equilibrium. Understand the prisoner's dilemma. What is a maximin strategy? **Look at Notes**

9. What do we mean by a natural monopoly? What factors can account for the existence of a natural monopoly. What would be the socially optimum level of output in this model? What is a compromise solution? **Look at Notes**

10. The market demand curve for a pair of Cournot duopolists is given as: $P = 36 - 3Q$, $(Q = Q_1 + Q_2)$. The constant per unit marginal cost is 18 for each duopolist. Find the Cournot equilibrium price, quantity, and profits.

Solution:

$P = 36 - 3Q$, $Q = Q1 + Q2$, $MC = 18$
$TR_1 = 36(Q_1 + Q_2) - 3Q_1^2 - 3Q_2Q_1$

$MR_1 = 36 - 6Q_1 - 3Q_2$
Set MC = MR and solve for Q_1 $18 = 36 - 6Q_1 - 3Q_2$ $6Q_1 = 18 - 3Q_2$

$Q_1 = 3 - 1/2Q_2$

We can now solve for Q_2

You can show $Q_2 = 3 - 1/2Q_1$
$Q_1 = 3 - 1.5 + 0.25Q_1$ $0.75Q_1 = 1.5$ or $Q_1 = 2$ $Q = 4$

$P = 36 - 3(4) = 36 - 12 = 24$
Profit = PQ - MC(Q) = 24(2) - 18(2) = 48 - 36 = 12 for each firm.

11. Solve Problem 10 as a Bertrand model. Find the long-run equilibrium price, quantities, and profits.

Solution:
$P = MC = 18$ $18 = 36 - 3Q$ $Q = 18/3 = 6$
$Q_1 = Q_2 = 6/2 = 3$
Profit = PQ - MC(Q) = 18(6) - 18(6) = O
Profit (firm 1) = profit (firm 2) = O

12. Solve Problem 10 as a Stackelberg Leader-Follower model. Assume firm 1 is the leader.

Solution:
Stackelberg model:
Follower (firm 2):
$MR = 36 - 3Q_l - 6Q_2 = 18$ $Q_2 = 3 - ½ Q_1$

Leader (firm 1):
$P_1 = 36 - 3Q_2 - 3Q_1 = 36 - 3(6\text{-}Q1/2) - 3Q_1$
$P_1 = 36 - 18/2 + 3Q_1/2 - 3Q_1 = 27 - 3/2Q_1$
$MR_1 = 27 - 3Q_1$
Set $MR_1 = MC$ $27 - 3Q_1 = 18$ $3Q_1 = 9$ $Q_1 = 3$

$Q_2 = (6 - Q_1)/2 = (6 - 3)/2 = 3/2$
$Q = Q_1 + Q_2 = 3 + 3/2 = 9/2$
$P = 36 - 3(9/2) = 36 - 13.5 = 225$
Profit (firm 1) = P Q_1 – $MC(Q_1)$ = 22.5(31) – 18(3) = 67.5-54 = 13.5
Profit (firm 2) = PQ_2 – $MC(Q_2)$ = 22.5(1.5) – 18(1.5) = 6.75

13. You are the manager of a firm producing coffee. The marginal product of labor is $MP_L = 72L^{-1/2}$ Suppose that the firm is a competitor in the coffee market. The price of green coffee is $1 per pound. Further suppose that the firm is a competitor in the labor market. The wage rate is $12.00 per hour.

a. Given the information above what is the marginal revenue product of labor?
b. How much labor should the firm hire?

We did in class $L = 36$

14. Suppose a firm has an internal wage structure that can be described by the equation Wage/hr. = $8 + .2(VMP_L)$. Only the workers with a VMP/hr. of ________ will be paid exactly equal to their marginal product (assume Price level is equal to 1) What will these workers be paid? **$W = 10$**