Monmouth COLLEGE

- Name: _____
- Date: _____
- Section: _____

ECON 300: Intermediate Price Theory

Problem Set #6 - Part #2: Suggested Solutions

Fall 2024

Problem 1. Monopoly

Suppose that the output market for good x is in perfect competition, and that the demand (Q_x^D) and supply (Q_x^S) functions are given as:

$$\begin{cases} Q_x^D = 600 - P_x \\ Q_x^S = 200 + P_x \end{cases}$$

1.A. Find the equilibrium price (P_x^*) and quantity (Q_x^*).

The equilibrium in a perfectly competitive market is achieved when supply meets demand:

$$Q_x^D = Q_x^S \quad \Rightarrow \quad 600 - P_x = 200 + P_x \quad \Rightarrow \quad \boxed{P_x^* = 200}$$

Plugging in the equilibrium price in either supply or demand will give us:

$$\boxed{Q_x^* = 400}$$

For the remainder of Problem 1, assume that good x is being produced by a single producer so that the market for good x is now monopolistic.

1.B. Derive the inverse demand function.

Recall that finding the inverse demand is simply to rearrange the demand function as follows:

$$Q_x^D = 600 - P_x \quad \Rightarrow \quad \boxed{P_x = 600 - Q_x^D}$$

1.C. Derive the producer's total revenue function, $TR(Q)$.

$$TR(Q) \equiv P_x \times Q \quad \Rightarrow \quad TR(Q) = (600 - Q) \times Q \quad \Rightarrow \quad \boxed{TR(Q) = 600Q - Q^2}$$

1.D. Derive the producer's marginal revenue function, $MR(Q)$.

$$MR(Q) \equiv \frac{d}{dQ} TR(Q) \quad \Rightarrow \quad \boxed{MR(Q) = 600 - 2Q}$$

Problem 1. Monopoly (continued)

Suppose that the monopoly producer's total cost function is given as follows:

$$TC(Q) = 812 - 200Q + \frac{1}{2}Q^2$$

1.E. Derive the producer's marginal cost function, $MC(Q)$.

$$MC(Q) \equiv \frac{d}{dQ}TC(Q) \quad \Rightarrow \quad \boxed{MC(Q) = -200 + Q}$$

1.F. Find the profit-maximizing quantity and price for the producer.

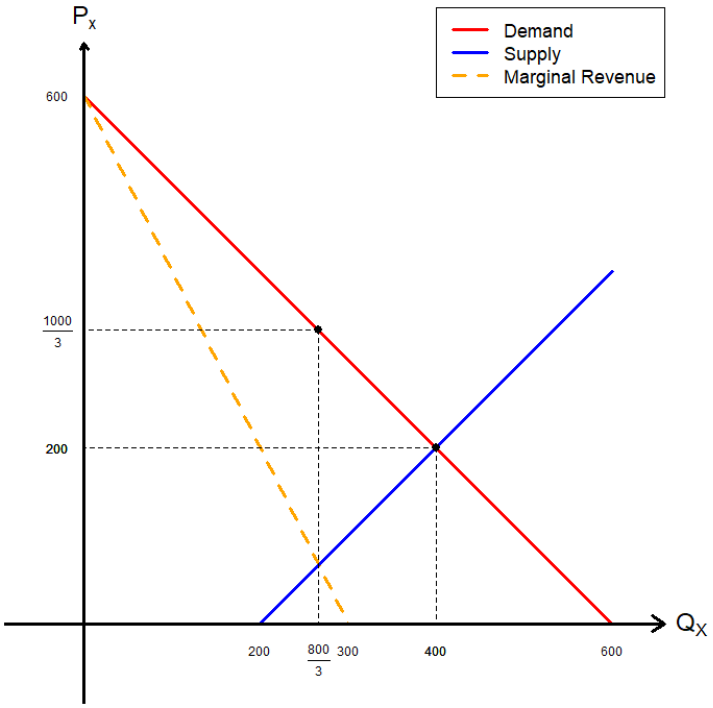
The profit maximizing monopolist will produce up to the point where $MR(Q) = MC(Q)$:

$$MR(Q) = MC(Q) \quad \Rightarrow \quad 600 - 2Q = -200 + Q \quad \Rightarrow \quad \boxed{Q^M = \frac{800}{3} \simeq 267}$$

The monopolist will price along demand, as it represents the consumers' willingness to pay:

$$\boxed{P_x^M = \frac{1000}{3} \simeq 333}$$

1.G Plot the two different equilbria in the empty chart. Make sure to plot and label all elements that are listed below:



- The demand curve
- The supply curve.
- The marginal revenue curve.
- The market equilibrium under perfect competition.
- The market equilibrium under a monopoly.

Problem 2. Monopsony

Consider a monopsony in the labor market with one employer, and infinitely many individuals supplying labor. The market for the output x that this firm produces is perfectly competitive, and the market price for the output is given as $P_x = 5$. We further assume that labor is the only input in the production process, and the firm's production function $F(L)$ and the labor supply $w(L)$ in the labor market is given as follows:

$$F(L) = 50 + 30L - L^2$$
$$w(L) = 10 + 2L$$

2.A Derive the firm's total cost function $TC(L)$.

$$TC(L) \equiv w(L) \times L \quad \Rightarrow \quad \boxed{TC(L) = 10L + 2L^2}$$

2.B Derive the firm's marginal cost function $MC(L)$.

$$MC(L) \equiv \frac{d}{dL} TC(L) \quad \Rightarrow \quad \boxed{MC(L) = 10 + 4L}$$

2.C Derive the firm's total revenue function $TR(L)$.

Recall that the output of the firm, Q_x is given by the firm's production function $F(\cdot)$:

$$TR(L) \equiv P_x \times Q_x \quad \Rightarrow \quad TR(L) = 5 \times F(L) \quad \Rightarrow \quad \boxed{TR(L) = 250 + 150L - 5L^2}$$

2.D Derive the firm's marginal revenue function $MR(L)$.

$$MR(L) \equiv \frac{d}{dL} TR(L) \quad \Rightarrow \quad \boxed{MR(L) = 150 - 10L}$$

Problem 2. Monopsony (continued)

2.E Find the profit-maximizing wage and labor for the employer.

The profit maximizing monopsony employer will hire up to the point where $MR(L) = MC(L)$:

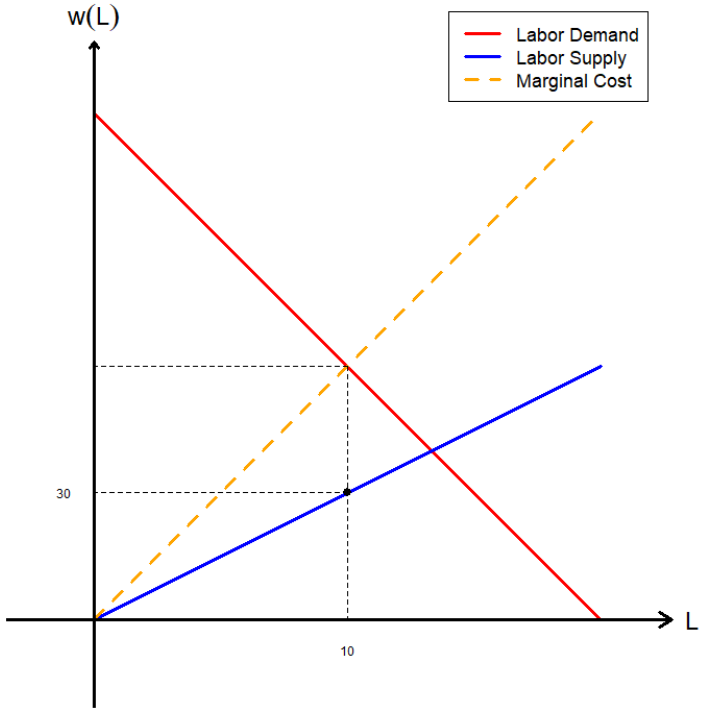
$$MR(L) = MC(L) \quad \Rightarrow \quad 150 - 10L = 10 + 4L \quad \Rightarrow \quad \boxed{L^M = 10}$$

The monopsony employer will set wages along labor supply, as it represents the workers' willingness to accept the job:

$$\boxed{w^M = 30}$$

2.F Plot the labor market equilibrium for the monopsony employer in the chart. Make sure to plot and label all elements that are listed below:

The chart is not to scale.



- The labor demand curve
- The labor supply curve.
- The marginal cost curve.
- The market equilibrium under monopsony.

- Score: _____
- Extra Credit: _____