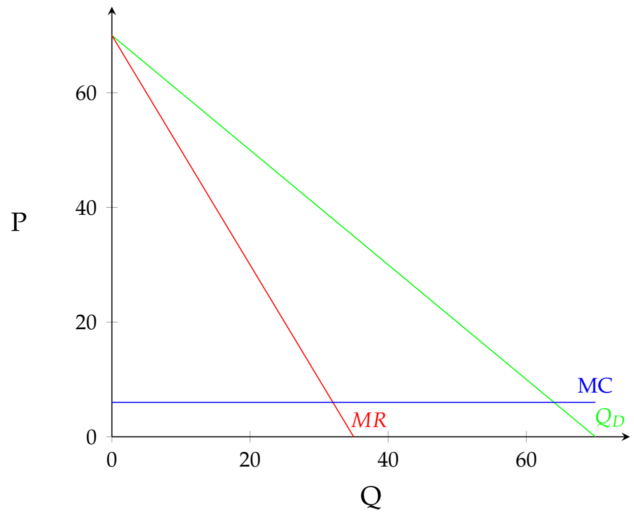
1

Given:

$$Q_D = 70 - P \quad (1)$$
$$AC = MC = 6 \quad (2)$$

1.a

The inverse demand would be $P = 70 - Q_D$. Since we are given that we are analyzing a monopolist and are provided the subsequent demand function, we know the marginal revenue curve is simply twice the slope of the market demand curve: $MR = 70 - 2Q$.



Additionally, to maximize profit, the monopolist will produce when $MR = MC$:

$$MR = MC \quad (1)$$
$$70 - 2Q = 6 \quad (2)$$
$$Q^* = 32 \quad (3)$$

Plugging this quantity back into our demand function, we will obtain the monopolist's price:

$$P^* = 70 - Q^* \quad (1)$$
$$= 70 - 32 \quad (2)$$
$$P^* = 38 \quad (3)$$

Therefore, we can now calculate the total profit the monopolist will receive:

$$\pi = P(Q)Q - MC(Q)Q \quad (1)$$
$$= 38(32) - 6(32) \quad (2)$$
$$\pi = \$1024 \quad (3)$$

1.b

Given that the new total cost function is: $C(Q) = 0.25Q^2 - 5Q + 300$. Marginal cost would then be $MC = 0.5Q - 5$. Again, to maximize profit, we would still need to satisfy the condition $MR = MC$:

$$MR = MC \quad (1)$$
$$70 - 2Q = 0.5Q - 5 \quad (2)$$
$$75 = \frac{5}{2}Q \quad (3)$$
$$Q^* = 30 \quad (4)$$

and the corresponding price would be:

$$\begin{aligned} P^* &= 70 - Q^* && (1)\\ &= 70 - 30 && (2)\\ P^* &= 40 && (3) \end{aligned}$$

Therefore, the new profits would be:

$$\begin{aligned} \pi &= P(Q)Q - MC(Q)Q && (1)\\ &= 40(30) - 0.25(30^2) - 5(30) + 300 && (2)\\ \pi &= \$825 && (3) \end{aligned}$$

2

Given:

$$\begin{aligned} TC &= 20Q && (1)\\ \text{Inverse demand: } P_D &= 100 - 2Q && (2) \end{aligned}$$

2.a

The marginal revenue, again, for a monopolist would be twice the slope of the inverse demand function: $MR = 100 - 4Q$. Marginal cost would be $MC = \dfrac{dTC(Q)}{dQ} = 20$. Therefore, to find the quantity the monopoly would produce, we set $MR = MC$:

$$\begin{aligned} MR &= MC && (1)\\ 100 - 4Q &= 20 && (2)\\ Q^* &= 20 && (3) \end{aligned}$$

$$\begin{aligned} P^* &= 100 - 2(Q) && (1)\\ &= 100 - 2(20) && (2)\\ P^* &= 60 && (3) \end{aligned}$$

2.b

$$\begin{aligned} L &= \frac{P - MC}{P} && (1)\\ &= \frac{60 - 20}{60} && (2)\\ L &= \frac{2}{3} && (3) \end{aligned}$$

2.c

Pareto optimal level would be at perfect competition where $P = MC$, or $P^* = \$20$. Plugging this price back into the market demand, we can obtain the Pareto market quantity:

$$\begin{aligned} P &= 100 - 2q && (1)\\ q &= 50 - \frac{P^*}{2} && (2)\\ q &= 50 - 10 && (3)\\ q^* &= 40 && (4) \end{aligned}$$

2.d

$$
\begin{aligned}
CS &= \frac{1}{2}(100-60)(20) \quad (1)\\
&= 400 \quad (2)
\end{aligned}
$$

$$
PS = (60-20)(20) \qquad = 800 \quad (1)
$$

$$
\begin{aligned}
DWL &= \frac{1}{2}(60-20)(40-20) \quad (1)\\
&= 400 \quad (2)
\end{aligned}
$$

2.e

$$
\begin{aligned}
CS' &= \frac{1}{2}(100-20)(40) \quad (1)\\
&= 1600 \quad (2)
\end{aligned}
$$

$$
PS' = 0 \quad (1)
$$

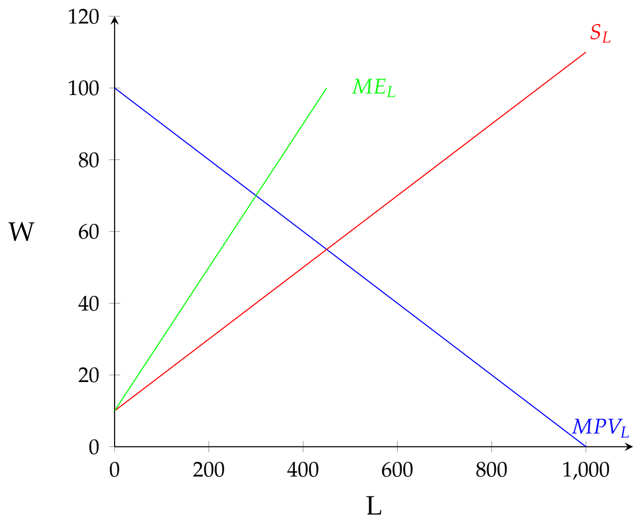
Under monopoly, consumers, therefore, lost 1200 surplus, 800 of which is gained by producers and 400 of which is dead-weight loss.

3

Given:

$$
\begin{aligned}
W_D &= 100 - \frac{L}{10} \quad (1)\\
W_S &= 10 + \frac{L}{10} \quad (2)
\end{aligned}
$$

The marginal expenditure would be twice the slope of the labor supply function: $ME_L = 10 + \frac{L}{5}$



3.a

To solve for the monopolistic salary, we would need to solve for labor where the ME_L intersects with W_D:

$$W_D = 100 - \frac{L}{10} = MFC_S = 10 + \frac{L}{5} \tag{1}$$
$$100 - \frac{L}{10} = 10 + \frac{L}{5} \tag{2}$$
$$1000 - L = 100 + 2L \tag{3}$$
$$900 = 3L \tag{4}$$
$$L = 300 \tag{5}$$

We can plug this labor quantity into our W_S to find the wage rate:

$$W_S = 10 + \frac{L}{10} \tag{1}$$
$$= 10 + \frac{300}{10} \tag{2}$$
$$= 40 * 1000 = \$40000 \tag{3}$$

The perfectly competitive salary would simply be where W_S meets W_D:

$$W_D = 100 - \frac{L}{10} = W_S = 10 + \frac{L}{10} \tag{1}$$
$$100 - \frac{L}{10} = 10 + \frac{L}{10} \tag{2}$$
$$1000 - L = 100 + L \tag{3}$$
$$900 = 2L \tag{4}$$
$$L = 450 \tag{5}$$

and the corresponding wage rate would be:

$$W_D = 100 - \frac{L}{10} \tag{1}$$
$$= 100 - \frac{450}{10} \tag{2}$$
$$= 55 * 1000 = \$55000 \tag{3}$$

3.b

The rate of exploitation would be $\frac{70-40}{70} \times 100 = 42.86$.

3.c

Employer surplus (ES) under monopsony would be given as:

$$WS = \frac{1}{2}(100-70)(300) + (70-40)300 \tag{1}$$
$$= 4500 + 9000 \tag{2}$$
$$= 13500 \tag{3}$$

Worker surplus (WS) under monopsony would be given as:

$$ES = \frac{1}{2}(40-10)(300) \tag{1}$$
$$= 4500 \tag{2}$$

Dead-weight loss (DWL) under monopsony would be given as:

$$DWL = \frac{1}{2}(70-40)(450-300) \tag{1}$$
$$= 2250 \tag{2}$$

3.d

$$W_S = 10 + \frac{L}{10} \tag{1}$$
$$45 = 10 + \frac{L}{10} \tag{2}$$
$$L = 350 \tag{3}$$

$$WS' = \frac{1}{2}(100-65)(350) + (65-45)(350) \tag{1}$$
$$= 6125 + 7000 \tag{2}$$
$$= 13125 \tag{3}$$

$$ES' = \frac{1}{2}(45-10)(350) \tag{1}$$
$$= 6125 \tag{2}$$

$$DWL' = \frac{1}{2}(65-45)(450-350) \tag{1}$$
$$= 1000 \tag{2}$$

3.e

The range would be from any wage above the monopolistic wage up past the competitive wage past the competitive wage until the wage reaches a point where it reaches the employment level of the monopolistic wage. The range would be from $40,000 up until $70,000.

4

Given:

$$TOC = 0.5q^2 + 10q \tag{1}$$
$$N^2 = 0.5w \tag{2}$$
$$TC = 0.5q^2 + 10q + w \tag{3}$$

4.a

Given:

$$Q_D = 1500 - 50P \tag{1}$$

First, we need to find the equilibrium for entrepreneurs:

$$Q_s^e = \sqrt{\frac{1}{2}w} \tag{1}$$
$$Q_d^e = n \tag{2}$$
$$Q_s^e = Q_d^e \tag{3}$$
$$\sqrt{\frac{1}{2}w} = n \tag{4}$$
$$\frac{w}{2} = n^2 \tag{5}$$
$$w = 2n^2 \tag{6}$$

We can now replace w in our total cost function in terms of n number of firms:

$$TC = \frac{1}{2}q^2 + 10q + 2n^2 \tag{1}$$
$$MC = q + 10 \tag{2}$$
$$AC = \frac{1}{2}q + 10 + \frac{2n^2}{q} \tag{3}$$

Setting $MC = AC$, we get:

$$MC = AC \tag{1}$$
$$q + 10 = \frac{1}{2}q + 10 + \frac{2n^2}{q} \tag{2}$$
$$\frac{1}{2}q^2 = 2n^2 \tag{3}$$
$$\frac{1}{4}q^2 = n^2 \tag{4}$$
$$q = 2n \tag{5}$$

The quantity supplied would, therefore, be:

$$Q_s = nq = n(2n) = 2n^2 \tag{1}$$

Additionally, because $P = MC$, we can find the price in terms of number of firms as:

$$P = MC \tag{1}$$
$$P = q + 10 \tag{2}$$
$$q = P - 10 \tag{3}$$
$$Q_s = np = n(P - 10) \tag{4}$$
$$2n^2 = n(P - 10) \tag{5}$$
$$2n = P - 10 \tag{6}$$
$$P = 2n + 10 \tag{7}$$

Plugging this into our given demand function:

$$Q_D = 1500 - 50P \tag{1}$$
$$= 1500 - 50(2n + 10) \tag{2}$$
$$= 1000 - 100n \tag{3}$$

Setting our demand and supply equal to each other:

$$1000 - 100n = 2n^2 \tag{1}$$
$$2n^2 + 100n - 1000 = 0 \tag{2}$$
$$2(n^2 + 50n - 500) = 0 \tag{3}$$
$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{4}$$
$$\frac{-50 \pm \sqrt{50^2 - 4(1)(-500)}}{2(1)} \tag{5}$$
$$\frac{-50 \pm 67.08}{2} \tag{6}$$
$$n = 8.54 \tag{7}$$

There would be 8.54 number of firms. Price would then be $P = 2n + 10 = 2(8.54) + 10 = \$27.08$. Industry output would be $2n^2 = 2(8.54^2) = 145.86$ units. Individual firm output would be $\frac{Q}{n} = \frac{145.86}{8.54} = 17.08$ units.

4.b

$$\pi = P(q)q - MC(q)q \tag{1}$$
$$= (27.08)(17.08) - (17.08 + 10)(17.08) \tag{2}$$
$$\pi = 0 \tag{3}$$

$$PS = \frac{1}{2}(27.08 - 10)(145.86) \tag{1}$$
$$= 1245.64 \tag{2}$$

$$CS = \frac{1}{2}(30 - 27.08)(145.86) \tag{1}$$
$$= 212.96 \tag{2}$$

Total surplus would be the sum of CS and PS: $1245.64 + 212.96 = 1458.6$.

4.c

Under monopoly, $MR = MC$ and the marginal revenue curve would be the twice the slope of the demand curve which would be:

$$MR = 30 - \frac{Q}{25} = Q + 10 \tag{1}$$
$$750 - Q = 25Q + 250 \tag{2}$$
$$Q = 19.23 \tag{3}$$

Then, since $P = q + 10 = 19.23 + 10 = \$29.23$.

$$CS = \frac{1}{2}(30 - 29.23)(19.23) \tag{1}$$
$$= 7.40 \tag{2}$$

$$PS = \frac{1}{2}(29.23 - 10)(19.23) \tag{1}$$
$$= 184.90 \tag{2}$$

Under monopoly, we see quantity supplied decreases from 145.86 down to 19.23, price increases from \$27.08 to \$29.23, consumer surplus decreases from 212.96 to 7.4, and producer surplus also decreases from 1245.64 down to 184.9.