Homework 6

1.a. What is the residual demand faced by firm i?

$$D^r(p) \doteq D(p) - S^o(p)$$

$$S^o(p) \doteq (n-1) \cdot S_i(p)$$

$$S^{o*} = 24 \cdot (150 + 1.25p^*)$$

$$D^{r*} = 4000 - 2p^* - 24 \cdot (150 + 1.25p^*)$$

$$D^{r*} = 400 - 32p^*$$

$$S(p) \doteq n \cdot S_i(p) = 3750 + 31.25p$$

$$Q^* = 3750 + 31.25p^* = 4000 - 2p^*$$

$$\begin{bmatrix} p^* \\ Q^* \end{bmatrix} = \begin{bmatrix} -31.25 & 1 \\ 2 & 1 \end{bmatrix}^{-1} \cdot \begin{bmatrix} 3750 \\ 4000 \end{bmatrix}$$

$$\begin{bmatrix} p^* \\ Q^* \end{bmatrix} = \frac{1}{133} \begin{bmatrix} 1000 \\ 530000 \end{bmatrix} \approx \begin{bmatrix} 7.52 \\ 3954.96 \end{bmatrix}$$

$$D^{r*} \approx 400 - 32 \cdot 7.52$$

$$D^{r*} \approx 159.4$$

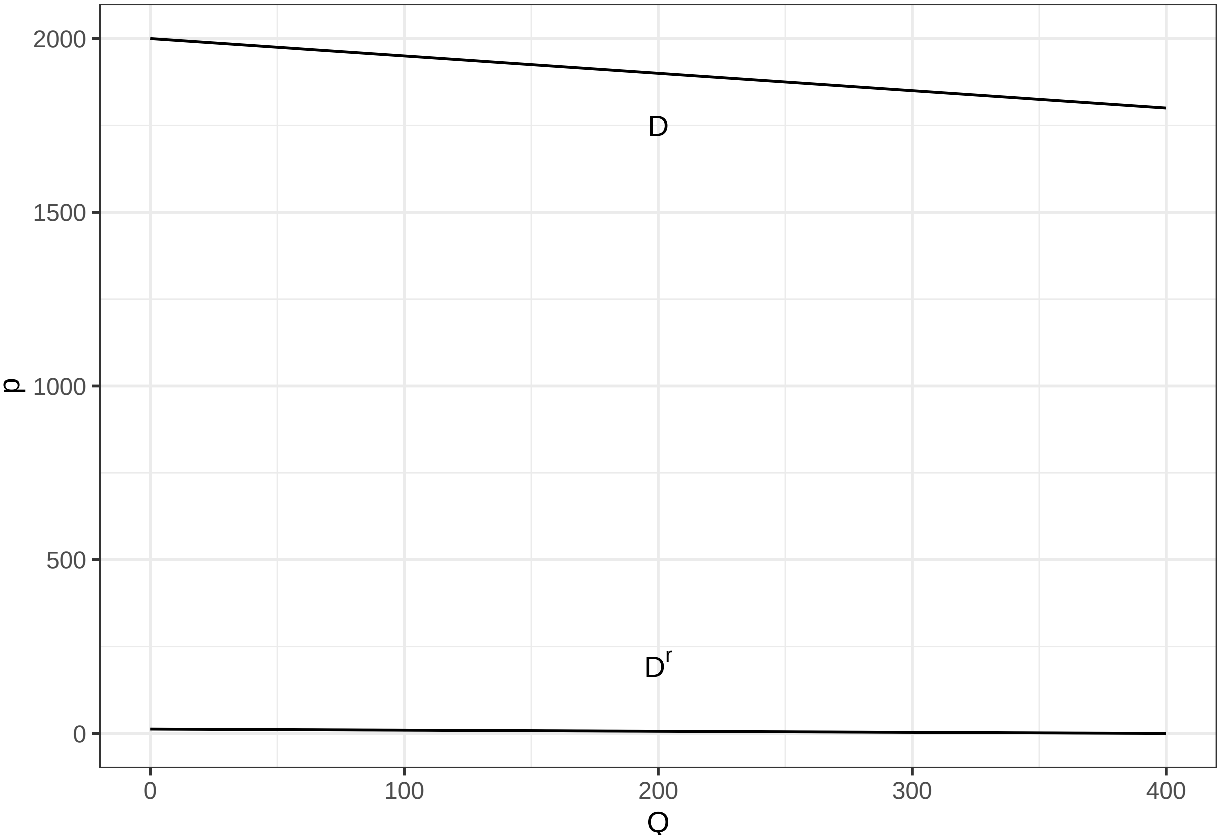
1.b. Find the inverse residual demand curve for firm i and the inverse market demand curve.

See 1.a.

$$D^r(p) = 400 - 32p \Rightarrow D^r_{inv}(Q) = \frac{25}{2} - \frac{Q}{32}$$

$$D(p) = 4000 - 2p \Rightarrow D_{inv}(Q) = 2000 - \frac{Q}{2}$$

1.c. Draw the inverse residual demand curve for firm i and the inverse market demand curve. Show that the (inverse) residual demand curve for firm i is flatter than the (inverse) market demand curve. Residual demand is almost horizontal but the market demand curve is steeper.



2. if $p = \$120$, $AVC = \$(40 + 10q)$, and $FC = \$100$, what is the SR profit-maximizing level of output, q^*? What is the total profit at q^*?

$$q^* \Leftarrow \frac{\delta \Pi}{\delta q} = 0 \text{ solved for } q.$$

$$\frac{\delta \Pi}{\delta q} = \frac{\delta R}{\delta q} - \frac{\delta VC}{\delta q} = \$(120 - 40 - 20q) = \$(80 - 20q)$$

$$0 = \$(80 - 20q^*) \Rightarrow q^* = 4$$

$$\Pi^* = p \cdot q^* - TC - VC(q^*) = \$(120 \cdot 4 - 100 - 40 - 20 \cdot 4) = \$360$$

3. For each scenario, determine whether the firm should shut down or not.

3.a. In the short run, $R = \$6,000$, $VC = \$7,500$, and $FC = \$12,000$.

Operating: $\$(6,000 - 12,000 - 7,500) = -\$13,500$; Not Operating: $-\$12,000$

The firm should not operate. It should shut down. Losses are greater if they operate.

3.b. In the short run, $p = \$15$, $q^* = 30$, $AVC = \$\frac{q}{3}$, and $FC = \$3,000$.

$$R = \$15 \cdot 30 = \$450$$
$$VC = AVC(q^*) \cdot q^* = \$\frac{30}{3} \cdot 30 = \$300$$

Operating: $\$(450 - 3,000 - 300) = -\$2,850$; Not Operating: $-\$3,000$

The firm should operate. It should not shut down. Losses are greater if they shut down.

3.c. In the long run, $R = \$10,000$, $VC = \$5,500$, and $FC = \$6,000$.

$$\Pi = \$(10,000 - 5,500 - 6,000) = -\$1,500 < 0$$

The firm should shut down, as profit is less than 0.

4.a. Label the plot:

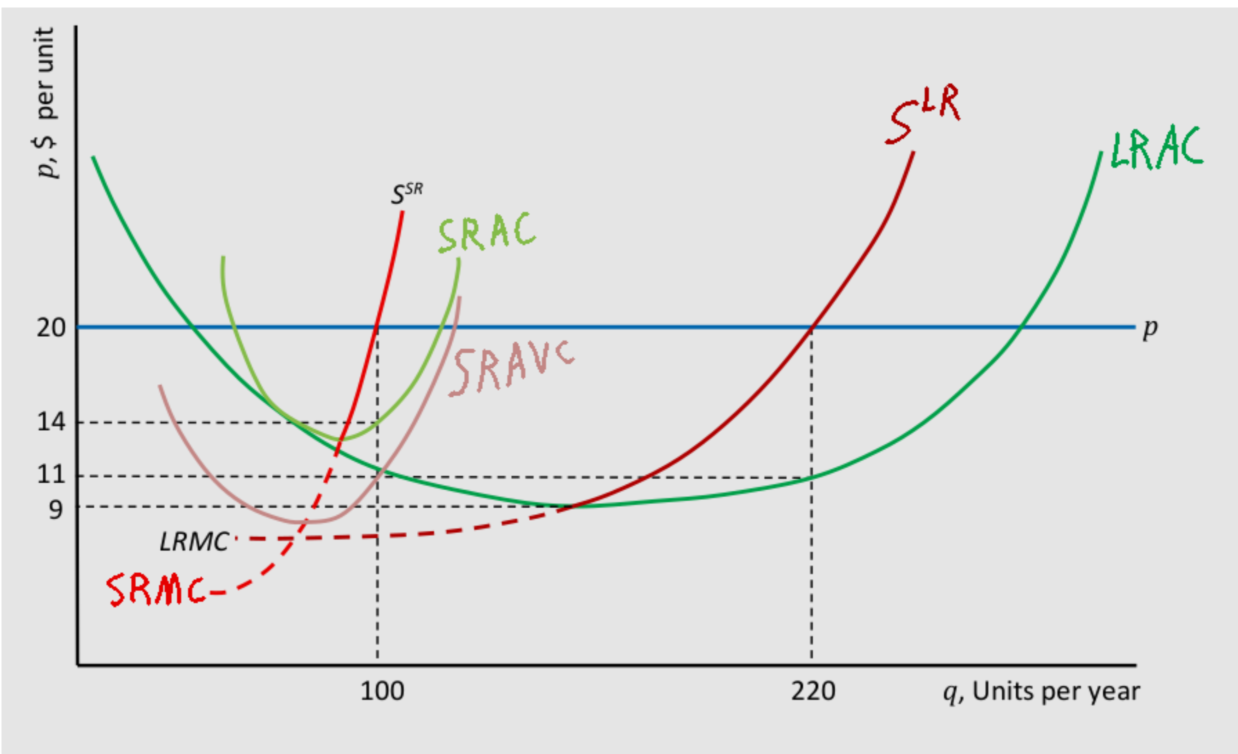


Figure 1: Plot.png

4.b. What is the firm's optimal short-run output?

100

4.c. How much is the firm's short-run profit?

$14

4.d. What is the firm's optimal long-run output?

220

4.e. How much is the firm's long-run profit?

$11

4.f. What is the firm's long-run shit down price?

$9