P1/4

## Ch.14: Oligopoly

1. Suppose that the market demand function is:

$$p = 150 - Q$$
$$Q = q_1 + q_2 \text{ (duopoly)}$$

Assume that the marginal cost for both firms is \$60 per unit and fixed cost is zero.

a. Find the monopoly output, price, and profit; show them on a diagram.
b. Assuming Cournot-duopoly , find the two best response functions and draw them.
c. Calculate the Cournot equilibrium output, price and profit for each firm.
d. Compare the outputs, prices and profits from a and c.
e. Calculate the Stackelberg equilibrium output, price and profit for each firm when firm1 moves first.

(a)

The demand function:

$$P = 150 - Q$$

or $AR = 150 - Q$

$\therefore MR = 150 - 2Q$

Note: Slope of MR is 2 times slope of the AR.

At equilibrium

$MC = MR$

$$60 = 150 - 2Q$$

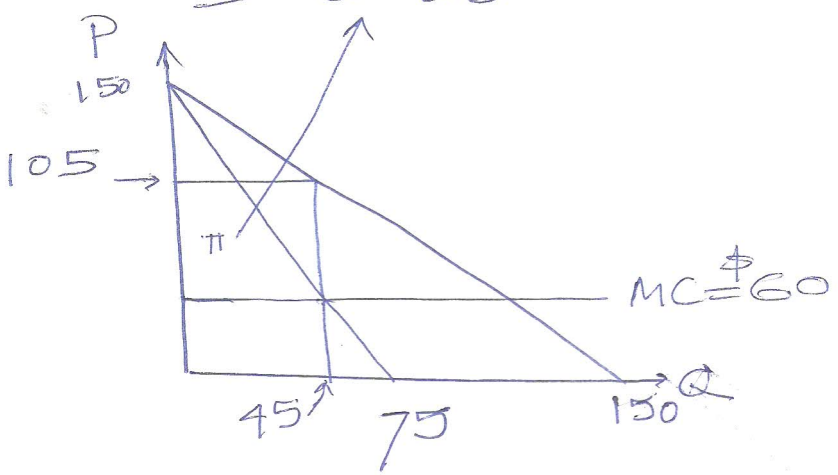
$$2Q = 90 \quad \therefore Q = 45 \text{ units}$$

$$P = 150 - 45 = \$105$$

$$\pi = R - C$$

$$= \$105(45) - \$60(45)$$

$$= \$2025$$



(b)/c/d For Cournot duopoly

$$P = 150 - [q_1 + q_2]$$

For firm-1,

$$AR_1 = P_1 = [150 - q_2] - q_1$$

$$MR_1 = [150 - q_2] - 2q_1$$

Best response function (BRF$_1$) is where $MC = MR_1$

$$60 = [150 - q_2] - 2q_1$$

$$2q_1 = 90 - q_2$$

$$\boxed{q_1 = 45 - \frac{q_2}{2}} \rightarrow BRF_1$$

Similarly $\boxed{q_2 = 45 - \frac{q_1}{2}} \rightarrow BRF_2$

At equilibrium

$BRF_1 = BRF_2$

$$q_1 = 45 - \frac{1}{2}\left[45 - \frac{q_1}{2}\right]$$

$$\frac{3q_1}{4} = \frac{45}{2}$$

$$q_1 = \frac{45 \times 4}{2 \times 3} \Rightarrow 30 \text{ units}$$

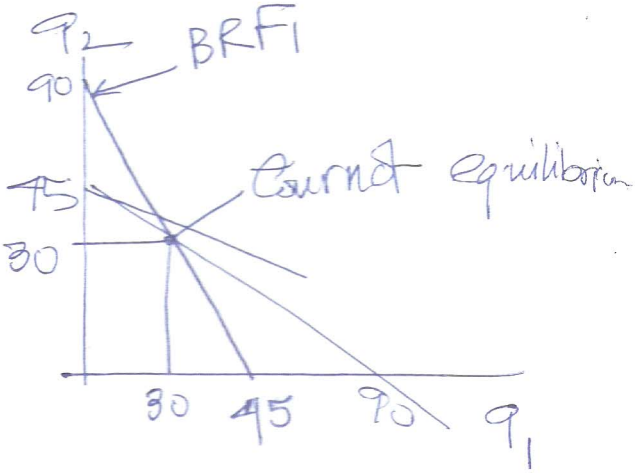
$\therefore q_2 = 30$ units

$$P = 150 - [30 + 30] = \$90$$

$$\pi_1 = R_1 - C_1 = \$90 \times 30 - \$60 \times 30$$

$$= \$900$$

$\therefore \pi_2 = \$900$




(d)

| | Output | Price | $\pi$ |
|---|---|---|---|
| monopoly | 45 | \$105 | \$2025 |
| Cournot | 60 | \$90 | 1800 |

(e) for Stackelberg equilibrium,

set $BRF_2$ into the demand function facing firm 1,

$$P_1 = 150 - q_1 - q_2$$

$BRF_2$: $q_2 = 45 - \frac{q_1}{2}$

$$\therefore P_1 = 150 - q_1 - \left[45 - \frac{q_1}{2}\right]$$

$$= 105 - q_1 + \frac{q_1}{2}$$

$$P_1 = 105 - \frac{q_1}{2}$$

$$P_1 = 105 - \frac{q_1}{2}$$

$$MR_1 = 105 - q_1$$

$MC = 60$

$$\therefore 60 = 105 - q_1$$

$$q_1 = 105 - 60 = 45 \text{ units}$$

$$\therefore q_2 = 45 - \frac{q_1}{2} = 45 - \frac{45}{2} = \frac{45}{2} \text{ units}$$

$$\therefore Q = 45 + \frac{45}{2} = 67.5$$

$$P = 150 - 67.5 = \$82.5$$

$\pi_1 = R_1 - C_1 = 45(82.5) - 45(60) = \$1012.5$

$\pi_2 = R_2 - C_2 = 22.5(82.5) - 22.5(60) = \$506.25$