Answer Key to Problem 2 (Part a) Consider a market containing four identical firms, each of which makes an identical product. The inverse demand for this product is $P = 100 - Q$, where P is the price and Q is aggregate output. The production costs for all 4 firms are identical and given by $C(q_i) = 150 + 20q_i$, $(i = 1,2,3,4)$, where q_i is the output of firm i. This means for each of these firms, variable costs (marginal costs) are constant at $20 per unit and fixed costs are $150.

a. Identify the Cournot equilibrium output for each firm, the product price and the profits for the four firms.

For firm 1: $MR_1 = 100 - 2q_1 - q_2 - q_3 - q_4 = 20$

The best response function for firm 1 is: $q_1 = 40 - \frac{1}{2}(q_2 + q_3 + q_4)$

<u>Approach 1:</u> Since the marginal costs are identical for all 4 firms, we can use the condition $q_1 = q_2 = q_3 = q_4 = q$.

$q = 40 - \frac{1}{2}(q + q + q)$ ➔ $q_1 = q_2 = q_3 = q_4 = q = 16$

<u>Approach 2:</u> The best response functions for the four firms are

$$q_1 = 40 - \frac{1}{2}(q_2 + q_3 + q_4)$$

$$q_2 = 40 - \frac{1}{2}(q_1 + q_3 + q_4)$$

$$q_3 = 40 - \frac{1}{2}(q_1 + q_2 + q_4)$$

$$q_4 = 40 - \frac{1}{2}(q_1 + q_2 + q_3)$$

➔ $Q = 160 - \frac{1}{2} \times 3Q$

➔ $Q = 64$

Thus, $q_1 = 40 - \frac{1}{2}(Q - q_1) = 40 - \frac{1}{2}(64 - q_1) \Longrightarrow q_1 = 16$. Similarly, $q_2 = 16, q_3 = 16, q_4 = 16$.

The market price is P=100-64=36.

Profit for each firm is (36-20)*16-150=106.