Industrial Organization

Midterm Spring 2025 – Solution Topics

1. True.

The dominant firm model describes markets consisting of a "big" (dominant) firm and a group of smaller, price-taking firms – the competitive fringe. If a "big" firm—one capable of capturing a significant market share—enters a perfectly competitive market (originally composed of infinitely many price-taking firms), the market structure transitions to that depicted by the dominant firm model.

2. False.

Consider a market with three symmetric firms—firm 1, firm 2, and firm 3—each with a constant marginal and average cost c, competing à la Bertrand. In this setting, the equilibrium price will be equal to marginal cost: $P = c$. If firms 1 and 2 merge without changing their marginal cost, the merged entity will still compete à la Bertrand against firm 3. Since both firms have identical marginal costs, the equilibrium price remains at c. Therefore, in this example, the merger between firms 1 and 2 does not affect the market equilibrium price.

3.

(i)

The probability of seizure by the authorities increases with the number of counterfeit bikes distributed. Moreover, if 100 or more bikes are distributed, all of them will be seized by the authorities.

(ii)

First, note that the firm will never distribute more than 100 bikes, as doing so would result in all units being seized, yielding zero profit.

For any given number n of counterfeit bikes distributed (with $n < 100$), the probability of seizure is $\frac{n}{100}$. Therefore, the expected number of bikes that successfully reach consumers is $(1 - \frac{n}{100})n$, and the firm earns 100 for each unit sold.

Thus, the firm's profit maximization problem can be written as:

$$\boldsymbol{\max_n \pi = 100n\left(1 - \frac{n}{100}\right)}$$

(iii)

$$FOC: \frac{d\pi}{dn} = 0 \Leftrightarrow 100 - 2n = 0 \Leftrightarrow \boldsymbol{n^* = 50}$$

The firm will earn $\boldsymbol{\pi = 100 \times 50 \times \left(1 - \frac{50}{100}\right) = 2500}$.

(iv)

By having two firms, $n = n_1 + n_2$. Therefore, the probability of seizure by the authorities is now:

$$\boldsymbol{p(n_1 + n_2) = \begin{cases} \dfrac{n_1 + n_2}{100} & if\ n_1 + n_2 < 100 \\ 1\ if\ n_1 + n_2 \geq 100 \end{cases}}$$

(v)

The problem is analogous to the one described in (i). In this case, both firms face symmetric optimization problems: each chooses the number of counterfeit bikes to distribute, taking into account that the probability of seizure depends on the total number of counterfeit bikes in the market.

$$\boldsymbol{\max_{n_i} \pi_i = 100 n_i \left(1 - \frac{n_i + n_j}{100}\right)}$$

(vi)

Solving the maximization problem for firm 1:

$$FOC: \frac{d\pi_1}{dn_1} = 0 \Leftrightarrow 100 - 2n_1 - n_2 = 0 \Leftrightarrow \boldsymbol{n_1^* = 50 - \frac{n_2}{2}}$$

By symmetry $n_1^* = n_2^* \rightarrow n_1^* = 50 - \frac{n_1^*}{2} \Leftrightarrow \boldsymbol{n_1^* = \frac{100}{3} = n_2^*}$.

(vii)

Each firm will earn $\boldsymbol{\pi = 100 \times \frac{100}{3} \times \left(1 - \frac{\frac{200}{3}}{100}\right) = \frac{10000}{9}}$.

(viii)

No, in this case each firm will profit $\frac{10000}{9}$. Therefore, industry profits $\left(\frac{20000}{9}\right)$ are smaller than monopoly profits found in (iii).

(ix)

Yes, in this case there is a negative externality affecting the firms' decisions. Each firm fails to internalize the impact of its own distribution on the other firm's outcome—specifically, that increasing its own number of distributed bikes raises the total quantity in the market, thereby increasing the overall probability of seizure and reducing the number of bikes from the rival firm that actually reach consumers. As a result, total industry profits decline.

Specifically, note that if firms cooperated and each distributed 25 bikes (half of the monopoly quantity), both would earn 1250, an amount greater than $\frac{10000}{9}$, which is the profit each firm obtains under non-cooperative behavior.

4.

(i)

Before the entry of the new firm, the incumbent operated as a monopolist:

$$\max_{P} \pi_I = (P-2)(10-P)$$

$$FOC: \frac{d\pi_I}{dP} = 0 \Leftrightarrow 10 - 2P + 2 = 0 \Leftrightarrow \boldsymbol{P = 6 \wedge q = 4 \wedge \pi_I = 16}$$

(ii)

Note that when $MC_E = 1$, the incumbent's profit will be zero regardless of its pricing decision. Therefore, it should base its pricing strategy solely on the scenarios where $MC_E = 6 \vee MC_E = 7$, as in both cases the incumbent remains the most efficient firm.

Consequently, the incumbent should set a price of $\boldsymbol{P_I = 6 - \varepsilon}$. Note that even when $MC_E = 7$, the incumbent maximizes its profit by charging its monopoly price of 6 (or $6 - \varepsilon$), as found in (i).

(iii)

Not quite. If, after entry, the incumbent earns zero profit, it can infer that the entrant's marginal cost is 1, since only a more efficient entrant would be able to undercut the incumbent's price and eliminate its profits. Conversely, if the incumbent earns positive profits following entry, this implies that the entrant's marginal cost must be either 6 or 7—the incumbent cannot distinguish between these two cases, as in both it remains the most efficient firm and, consequently, continues to be the sole producer.

(iv)

$$\boldsymbol{E[\pi_I] = \frac{1}{3}\pi_I(When\ MC_E = 1) + \frac{1}{3}\pi_I(When\ MC_E = 6) + \frac{1}{3}\pi_I(When\ MC_E = 7)}$$
$$\boldsymbol{= \frac{1}{3} \times 0 + \frac{1}{3} \times 16 + \frac{1}{3} \times 16 = \frac{32}{3}}$$

(v)

As previously explained, if the entrant's marginal cost is either 6 or 7, the incumbent will be able to undercut the entrant and retain the entire market, earning positive profits while the entrant earns zero.

If, on the other hand, the entrant's marginal cost is 1, it will choose the price that yields the highest profit—either by slightly undercutting the incumbent (i.e., by charging $6 - 2\varepsilon$) or by setting its monopoly price.

By charging $6 - 2\varepsilon \rightarrow \pi_E = (6-1) \times 4 = 20$.

By charging its monopoly price:

$$\max_{P} \pi_E = (P-1)(10-P)$$

$$FOC: \frac{d\pi_E}{dP} = 0 \Leftrightarrow 10 - 2P + 1 = 0 \Leftrightarrow \boldsymbol{P = 5.5} \wedge \boldsymbol{q = 4.5} \wedge \boldsymbol{\pi_E = 20.25}$$

Since charging its monopoly price yields a higher profit, if the entrant has a marginal cost of 1, it will set a price of 5.5 and earn a profit of 20.25.