Industrial Organization
Midterm Spring 2022 – Solution Topics

I

False.

In a duopoly in which firms compete *à la* Bertrand, with $MC_A = MC_B = c$, the market price will be equal to c. This result is independent of the demand faced by firms A and B. A demand fluctuation will result in an adjustment of market quantity, not price.

II

False.

In a monopolistic competition type of market structure, it is true that the creation of differentiated varieties decreases price competition, which reduces consumers' welfare. However, the existence of different varieties brings economic value (surplus) to the consumers of this market. This effect is not measurable, but it might outweigh the negative effect of the reduced price competition.

III

i)

Cournot competition:

$$\max_{q_A} \pi_A = (10 - q_A - q_B)q_A - 4q_A$$

$$FOC\colon \frac{\partial \pi_A}{\partial q_A} = 0 \Leftrightarrow 10 - 2q_A - q_B - 4 = 0 \Leftrightarrow q_A^* = 3 - \frac{q_B}{2}$$

Given that firms A and B face the same demand and have an equal Marginal Cost, $q_A^* = q_B^*$ (symmetry).

In equilibrium:

$$\begin{cases} q_A^* = 3 - \frac{q_B}{2} \\ q_A^* = q_B^* \end{cases} \Leftrightarrow \begin{cases} q_A^* = 2 \\ q_B^* = 2 \end{cases}$$

$$Q = 4 \Rightarrow P = 6 \Rightarrow \pi_A = \pi_B = 4$$

ii)

Both firms adopt the new technology, with a lower MC (now, 2) but implying a capacity constraint of 2 units ($q_A \leq 2, q_B \leq 2$). Given the lower MC, it is intuitive that both firms would be willing to produce even more now; the constraint will be binding.

Therefore, $q_A^* = q_A^* = 2 \Rightarrow Q = 4 \Rightarrow P = 6 \Rightarrow \pi_A = \pi_B = 8$.

Thus, $Value\ of\ the\ Technology\colon 8 - 4 = 4$

iii)

Without a capacity constraint:

$$\max_{q_A} \pi_A = (10 - q_A - q_B)q_A - 2q_A$$

$$FOC: \frac{\partial \pi_A}{\partial q_A} = 0 \Leftrightarrow 10 - 2q_A - q_B - 2 = 0 \Leftrightarrow q_A^* = 4 - \frac{q_B}{2}$$

In equilibrium:

$$\begin{cases} q_A^* = 4 - \frac{q_B}{2} \\ q_A^* = q_B^* \end{cases} \Leftrightarrow \begin{cases} q_A^* = \frac{8}{3} \\ q_B^* = \frac{8}{3} \end{cases}$$

$$Q = \frac{16}{3} \Rightarrow P = \frac{14}{3} \Rightarrow \pi_A = \pi_B = \left(\frac{14}{3} - 2\right) * \frac{8}{3} = 7.(1)$$

$$Value\ of\ the\ Technology\ (without\ capacity\ constraint): 7.(1) - 4 = 3.(1)$$

iv)

The value of the technology (4, as obtained in part ii)) can be decomposed in two effects:

"Increased-efficiency effect"$= 3.(1)$ (as obtained in part iii)): this is the pure value of reducing the MC on a firm's profits.

"Reduced-competition effect"$= 4 - 3.(1) = 0.(8)$: the remainder of the technology value is explained by the capacity constraint it entails, due to the reduction in competitive pressure.

IV

i) Bertrand Paradox: $P = MC_A = MC_B = 3;\ \pi_A = \pi_B = 0$

ii) If both firms buy the technology: $P = MC_A = MC_B = 2;\ \pi_A = \pi_B = 0$. The value of the technology in this case is 0 for both firms.

iii) Each firm has two available strategies: buy the technology or not. This game can be represented in the following matrix:

A/B	Buy	Not Buy
Buy	-s,-s	$\underline{\pi}$,0
Not Buy	0, $\underline{\pi}$	0,0

Two NE: (Buy, Not Buy) and (Not Buy, Buy). Only one of the firms will buy the technology.

iv) The firms that buys the technology (let's assume it is firm A), sets a price equal to $P = 3 - \epsilon \approx 3$. The consumers surplus is unchanged.
The producer surplus increased from 0 to: $PS = \pi_A + s + \pi_B = 3 \times 7 - 2 \times 7 - s + s + 0 = 7$. As such, total welfare increases.

v) If both firms buy the technology: $P = MC_A = MC_B = 2 + c';\ \pi_A = \pi_B = 0$. The value of the technology in this case is 0 for both firms.

vi) Each firm has two available strategies: rent the technology or not. This game can be represented in the following matrix:

A/B	Rent	Not Rent
Rent	0,0	π,0
Not Rent	0, π	0,0

Three NE: (Rent, Not Rent); (Not Rent, Rent) and (Rent, Rent).

vii) S would choose a value for c' equal to $1 - \epsilon$. A value for c'=1 would make the firms indifferent between buying the technology or not (it was also accepted as a correct answer).