1.) $Q(P) = P^{\epsilon}$

$\frac{dQ}{dP} = \varepsilon P^{\varepsilon-1} \cdot \frac{P}{P^{\epsilon}}$

$= \frac{dQ}{dP} \cdot \frac{P}{Q} = \varepsilon P^{\varepsilon-1} \cdot P^{1-\varepsilon}$

$= \frac{dQ}{dP} \cdot \frac{P}{Q} = \varepsilon$

$\therefore$ Elasticity of demand is ϵ

$TR = Q^{\frac{1}{\varepsilon}+1}$

$MR = \left(\frac{1}{\varepsilon}+1\right)Q^{\frac{1}{\varepsilon}}$

$\left(\frac{1}{\varepsilon}+1\right)Q^{\frac{1}{\varepsilon}} = 1$

$Q^{\frac{1}{\varepsilon}} = \frac{1}{\frac{1}{\varepsilon}+1}$

$Q^{\frac{1}{-2}} = 2$

$Q = \frac{1}{4}$

$\frac{dQ}{dP} \cdot \frac{P}{Q} = \varepsilon \cdot \frac{Q^{\frac{1}{\varepsilon}}}{Q}$

$\frac{dQ}{dP} \cdot \frac{P}{Q} = -2 \cdot \frac{2}{\frac{1}{4}}$

$\frac{dQ}{dP} \cdot \frac{P}{Q} = -16$

2.) $Q = 10 - P$

$P = 10 - Q$

Profit maximizing condition: $MR = MC$

$TR = P \times Q$

$TR = 10Q - Q^2$

$MR = 10 - 2Q$

$= 10 - 2Q = 0$

$10 = 2Q$

$Q = 5$

$P = 10 - Q$

$= 5$

$\therefore$ output sold by each competitive firm is 0.05

Total number of firm is 100

Total output sold by a competitive firm is 5

8. Output is homogenous and the demand curve is

$$P = 448 - Q.$$

There are two firms with identical costs given by $C = q_i^2$ where q_i is the production of firm i. The marginal cost of firm i is $MC_i(q_i) = 2q_i$.

(a) Find the Cournot equilibrium firm outputs.
(b) Find the Stackelberg equilibrium firm outputs.

Cournot : $P = 448 - (Q_i + Q_k)$

$TR_i = 448Q_i - Q_i^2 - Q_kQ_i$

$MR_i = 448 - 2Q_i - Q_k$

Profit max Q : $MR = MC$

$448 - 2Q_i - Q_k = 2Q_i$

$448 - Q_k = 4Q_i$

$\dfrac{448 - Q_k}{4} = Q_i$ -1

$TC = Q_i^2$

$MC = 2Q_i$

$BR_i(Q_k) = \dfrac{448 - Q_k}{4}$

Find $BR_k(Q_i)$

$TR_k = 448Q_k - Q_iQ_k - Q_k^2$

$MR_k = 448 - Q_i - 2Q_k$

Profit max : $MR = MC$

$448 - Q_i - 2Q_k = 2Q_i$

$448 - 3Q_i = 2Q_k$

$\dfrac{448 - 3Q_i}{2} = Q_k$ -2

sub 1 into 2

$Q_k = \dfrac{448 - 3\left(\dfrac{448 - Q_k}{4}\right)}{2}$

$Q_k = 224 - \dfrac{3}{8}(448 - Q_k)$

$Q_k = 224 - (3 \times 56) + \dfrac{3}{8}Q_k$

$\dfrac{5}{8}Q_k = 56$

$Q_k = \dfrac{448}{5} = 89.6$

$Q_i = \dfrac{448 - \dfrac{448}{5}}{4}$

$= 89.6$

$\therefore$ Cournot equilibrium of output is equal to 89.6

Stackelberg

Find $BR_k(Q_i)$: $\frac{448-3Q_i}{2} = Q_k$

Firm i set $MR_i = MC$

$TR_i = 448Q_i - Q_i^2 - Q_kQ_i$

sub Q_k into equation

$= 448Q_i - Q_i^2 - \frac{448Q_i}{2} + \frac{3Q_i^2}{2}$

$= 224Q_i + \frac{1}{2}Q_i^2$

$Q_k = \frac{448-3Q_i}{2}$

$MR_i = 224 + \frac{\cancel{2}}{\cancel{2}}Q_i$

$MR_i = MC$

$224 + Q_i = 2Q_i$

$224 = Q_i$

$\therefore$ stackelberg equilibrium is $Q_i = 168$ and Q_k will not produce

Application Software Industry

The application software industry is the sub-set of the computer software industry, this industry is about computer programs created for users to fulfill specialized goals. Examples are photoshop, Microsoft word, and accounting software. After covid-19 occurred the demand for this software increased as people had to work from home and required the specific software. This industry tends to grow continuously as people are more into technology now a day and the technology keeps on developing every day. Application software helps in solving business problems by providing a platform to perform operations such as business intelligence, content, communication and collaboration, and customer relationship management. The dominant firm in this industry is Microsoft, the current market capitalization is equal to $267 billion. This company operates through three segments: Productivity and Business Processes, Intelligent Cloud, and More Personal Computing. The fringe firms of this industry are Robinhood, GoPro, and Virtusa.