HW

6304640748

1.) firm 1 : $\pi_1 = TR_1 - TC_1$

$= (a - bQ_1 - bQ_2 - bQ_3)Q_1 - C_1$

$\frac{d\pi_1}{dQ_1} = a - 2bQ_1 - bQ_2 - bQ_3 = 0$

$a - bQ_2 - bQ_3 = 2bQ_1$

$Q_1 = \frac{a - bQ_2 - bQ_3}{2b}$

subsitute Q_2

$Q_1 = \frac{a - b\left[\frac{a - bQ_3}{3b}\right] - bQ_3}{2b}$

$= \frac{3a - a + bQ_3 - 3bQ_3}{6b}$

$Q_1 = \frac{2 - 6Q_3}{3b}$ ✱

2.) firm 2 : $TR_2 - TC_2$

$= (a - bQ_1 - bQ_2 - bQ_3)Q_2 - C_2$

$\frac{d\pi_2}{dQ_2} = a - bQ_1 - 2bQ_2 - bQ_3 = 0$

$2 - bQ_1 - bQ_3 = 2bQ_2$

subsitute Q_1

$2bQ_2 = a - b\left(\frac{a - bQ_2 - bQ_3}{2b}\right) - bQ_3$

$2bQ_2 = \frac{2a - a + bQ_2 + bQ_3 - 2bQ_3}{2}$

$4bQ_2 = a + bQ_2 - bQ_3$

$3bQ_2 = a - bQ_3$

$Q_2 = \frac{a - bQ_3}{3b}$ ✱

3.) : $\pi_3 = TR_3 - TC_3$

$\pi_3 = (a - bQ_1 - bQ_2 - bQ_3)Q_3 - C_3$

$\frac{d\pi_3}{dQ_3} = a - bQ_1 - bQ_2 - 2bQ_3 = 0$

$a - bQ_1 - bQ_2 - 2bQ_3$

$Q_3 = a - bQ_1 - bQ_2$

$= \frac{a - b\left(\frac{a - bQ_3}{3b}\right) - b\left(\frac{a - bQ_3}{3b}\right)}{2b}$

$= \frac{a + 2bQ_3}{6b}$

$6bQ_3 = 2 + 2bQ_3$

$Q_3 = \frac{2}{4b}$

equilibrium price ; $P = 2 - bQ$

$= 2 - b(Q_1 + Q_2 + Q_3)$

$= 2 - b\left(\frac{a}{4b} + \frac{a}{4b} + \frac{a}{4b}\right)$

$= 2 - \frac{3a}{4}$

$= \frac{2}{4}$

$= 0.25a$

2.) If there are N firms
$q_i^* = f(N)$, $P = f(N)$, $\pi_i = f(N)$

6304640748

assume $q_1 + q_2 + \dots + q_n = A$
$P = a - b(q_1 + q_2 + \dots + q_n)$
$P = a - bq_1 - bq_2 - \dots - bq_n$

$\pi_i = (P - c)q_i$

$\pi_1 = (a - bq_1 - bq_2 - \dots - bq_n)q_1 - c_1$
$\frac{\partial \pi_1}{\partial q_1} = 0 \Rightarrow q_1 = \frac{a}{2b} - 0.5(q_2 + q_3 + \dots + q_n)$
$\vdots$
$q_n = \frac{a}{2b} - 0.5(q_2 + q_3 + \dots + q_{n-1})$

$\therefore q_1^* = q_2^* = \dots = q_n^* = \frac{a}{b} - A$ -(a)

$A = q_1 + q_2 + \dots + q_n$
$A = n(\frac{a}{b} - A)$
$A = \frac{nq}{b} - nA$

$A + nA = n(\frac{a}{b})$
$A(n+1) = n(\frac{a}{b}) \rightarrow A = \frac{na}{(n+1)b}$

Sub A into (1) ; $q_1 = \frac{a}{(n+1)b}$

$\therefore q_i = \frac{a}{(n+1)b}$

3.) From question 2, what happen if $N \to \infty$ ——"—— $N = 1$

6304640748

In general

- If $N \to \infty$, it means the market output (Q) goes to a competitive level and the price (P^*) converges to marginal cost. The market is perfectly competitive market.
- In cournot model, there must be 2 or more firms competing in the market. So, if $n=1$, firm will becomes a monopolist.

if $h \to \alpha$;

- $q_i = \frac{a}{(n+1)b}$ will be nearly to 0 and each firm will sell at a nearly 0 unit
- $A = \frac{na}{(n+1)b}$ will be nearly to 0, q of every firms combined will be nearly a units
- $P = \frac{a}{n+1}$ will be nearly to 0, supply will increase as P decreases to nearly 0
- $\pi_i = \frac{a^2}{(n+1)^2 b} - C_i \to$ each firms will lose their profit.

if $h=1$

- $q_i = \frac{a}{(n+1)b} = \frac{a}{2b} \to$ since $q = \frac{a}{2b} < q = \frac{na}{(n+1)b}$, monopoly will sell less.
- $A = \frac{na}{(n+1)b} = q$, it means than firm will become a monopolist.
- $P = \frac{a}{n+1} = \frac{a}{2} \to$ since $P_m = \frac{a}{2} > P_c = \frac{a}{n+1}$, monopoly will set higher price.
- $\pi_i = \frac{a^2}{(n+1)^2 b} - C_i = \frac{a^2}{4b} - C_i \to$ since $\pi_m > \pi_c$, monopolist will earn higher profit.