

ECON 384 - ASSIGN #1
W2013 - L. Priemaza

$$\textcircled{1} PV = (B_0 - C_0) + \frac{(B_1 - C_1)}{(1+r)^1} + \frac{(B_2 - C_2)}{(1+r)^2} + \dots + \frac{(B_T - C_T)}{(1+r)^T}$$

$$PV = (-\$5,000) + \frac{-\$10,000}{(1.045)} + \frac{\$20,000}{(1.045)^5}$$

$$= -\$5,000 - 9,569 + \$16,049$$

$= \$1,480 \rightarrow$ This value is POSITIVE;
this is a good investment.

$$\textcircled{2a} C_2 = \frac{(11 - \sqrt{C_1})^2}{4}$$

$$MRS = \frac{\partial C_2}{\partial C_1} = \frac{2}{4} (11 - \sqrt{C_1}) \cdot \frac{-1}{2} C_1^{-1/2}$$

$$= \frac{-1}{4\sqrt{C_1}} (\sqrt{C_1} + 2\sqrt{C_2} - \sqrt{C_1})$$

$$= \frac{-2\sqrt{C_2}}{4\sqrt{C_1}} = \boxed{\frac{-\sqrt{C_2}}{2\sqrt{C_1}}}$$

(2a) $MRS = \text{slope of IBL}$

$$\frac{-\sqrt{C_2}}{2\sqrt{C_1}} = -(1+r)$$

$$C_1 = \frac{C_2}{4(1+r)^2}$$

Intertemporal Budget Constraint: $C_2 = i_2 + (1+r)i_1 - (1+r)C_1$

$$C_2 = i_2 + (1+r)i_1 - \frac{(1+r)C_2}{4(1+r)^2}$$

$$C_2 + \frac{C_2}{4(1+r)} = i_2 + (1+r)i_1$$

$$C_2 = \frac{i_2 + (1+r)i_1}{1 + \frac{1}{4(1+r)}}$$

$$C_1 = \frac{C_2}{4(1+r)^2}$$

$$= \frac{i_2 + (1+r)i_1}{4(1+r)^2 \left[1 + \frac{1}{4(1+r)} \right]} = \frac{i_2 + (1+r)i_1}{4(1+r)^2 + (1+r)}$$

$$\textcircled{2b} C_2 = \frac{i_2 + (1+r)i_1}{1 + \frac{1}{4(1+r)}}$$

$$= \frac{\$100k + (1.2)\$1,600k}{1 + \frac{1}{4(1.2)}} = \frac{\$100k + \$1,920}{1.208\bar{3}}$$

$$C_2 = \$1,672k$$

$$C_1 = \frac{C_2}{4(1+r)^2} = \frac{\$1,672k}{4(1.2)^2}$$

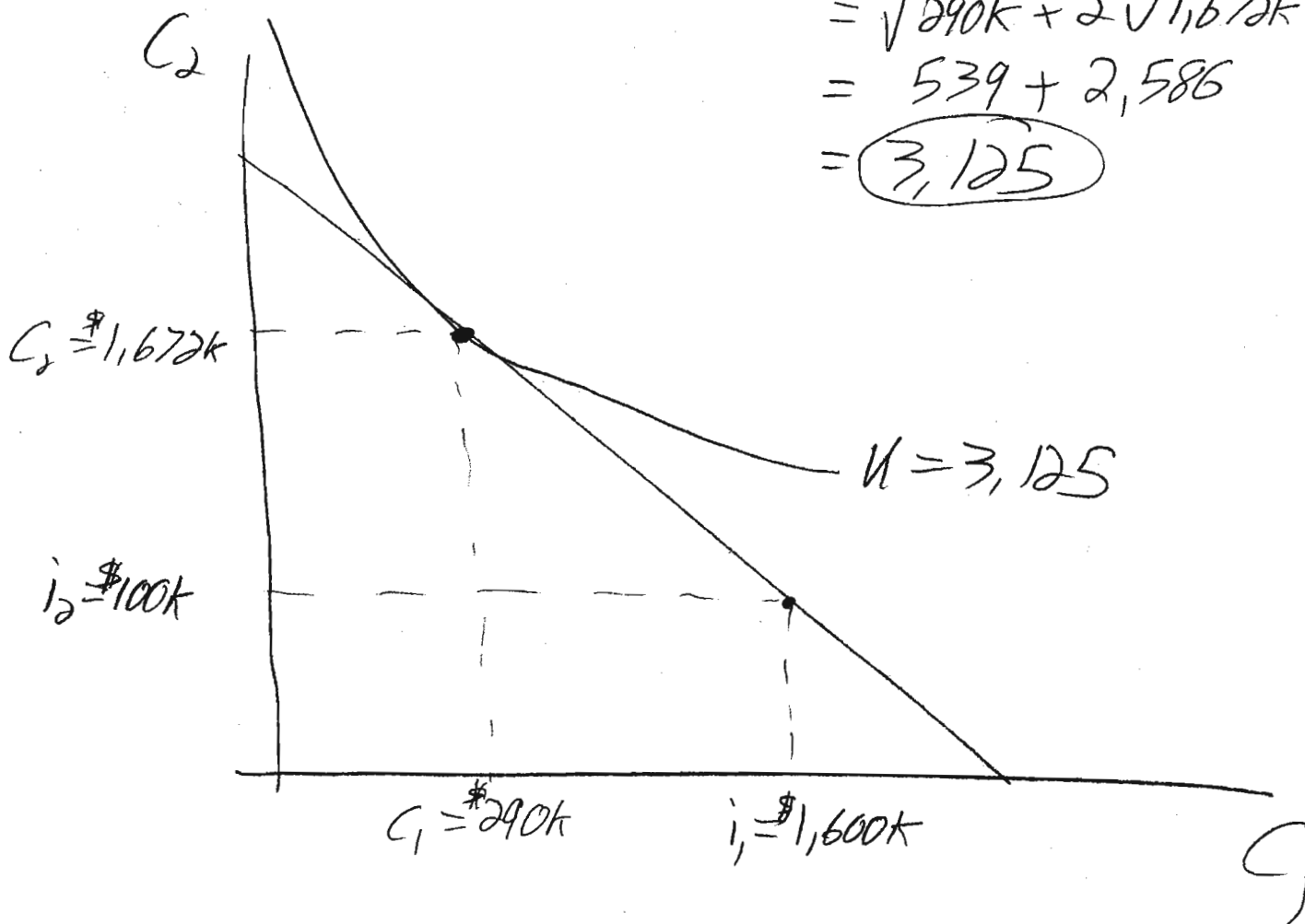
$$= \$290k$$

$$U = \sqrt{C_1} + 2\sqrt{C_2}$$

$$= \sqrt{290k} + 2\sqrt{1,672k}$$

$$= 539 + 2,586$$

$$= 3,125$$



(3a) (i) $P = 32 - Q_1 - Q_0$
(ii) $TR_1 = P Q_1 = 32 Q_1 - Q_1^2 - Q_0 Q_1$
 $MR_1 = \frac{\partial TR_1}{\partial Q_1} = 32 - 2Q_1 - Q_0$

(iii) $MR_1 = MC_1$
 $32 - 2Q_1 - Q_0 = 0$

$Q_1 = 16 - Q_0/2$

Since $Q_0 = (N-1)Q_1$
 $= 8Q_1$

(iv) $Q_1 = 16 - \frac{8Q_1}{2}$

$5Q_1 = 16$

$Q_1 = 3.2$

(v) $P = 32 - Q_1$
 $= 32 - 9(Q_1)$
 $= 32 - 9(3.2)$

$P = \$3.20$

(vi) $\pi_1 = (P - MC_1)Q_1$
 $= (\$3.20 - 0)3.2$

$\pi^* = \$10.24$

At a price of \$3.20, each firm produces 3.2 units for profits of \$10.24.

$$\begin{array}{|l|l|l|} \hline \textcircled{3b} & P = MC & P = MC \\ & 32 - Q_L = 20 & P = \$20 \\ & Q_L = 12 & \pi = (P - MC)Q \\ & & = (20 - 20)12 \\ & & \pi = \$0 \\ \hline \end{array}$$

12 Units are produced by each firm at a price of \$20 for economic profits of \$0.

$$\begin{array}{l} \textcircled{3c} \textcircled{i} P = 32 - Q_L - Q_F \\ TR_F = PQ_F = 32Q_F - Q_LQ_F - Q_F^2 \\ MR_F = \frac{\partial TR_F}{\partial Q_F} = 32 - Q_L - 2Q_F \\ MR_F = MC_F \Rightarrow 32 - Q_L - 2Q_F = 0 \\ \boxed{Q_F = 16 - Q_L/2} \end{array}$$

$$\begin{aligned} P &= 32 - Q_L - Q_F \\ &= 32 - Q_L - [16 - Q_L/2] \end{aligned}$$

$$\boxed{P = 16 - Q_L/2}$$

$$\begin{array}{l} \textcircled{ii} TR_L = PQ_L \\ = 16Q_L - Q_L^2/2 \\ MR_L = \frac{\partial TR_L}{\partial Q_L} = \boxed{16 - Q_L = MR_L} \end{array}$$

$$\textcircled{iii} MR_L = MC_L \Rightarrow 16 - Q_L = 5 \\ \boxed{11 = Q_L}$$

$$\begin{array}{l} \textcircled{iv} Q_F = 16 - Q_L/2 \\ = 16 - 11/2 \\ Q_F = 16 - 5.5 = \boxed{10.5 = Q_F} \end{array}$$

$$\begin{array}{l} \textcircled{v} P = 32 - Q_L - Q_F \\ = 32 - 11 - 10.5 \\ \boxed{P = \$10.50} \end{array}$$

3d-continued

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$$\pi_L = (P - MC_L) Q_L \\ = (\$10.50 - \$5.00) 11$$

$$\pi_L = \$60.50$$

$$\pi_F = (10.50 - 0) 10.5$$

$$\pi_F = \$110.25$$

$$\text{Market Share: Leader} = \frac{11}{11+10.5} \cdot 100 = 51.2\%$$

$$\text{Follower} = \frac{10.5}{11+10.5} \cdot 100 = 48.8\%$$

The leader sells 11 units @ \$10.50 each for a profit of \$60.50 & market share of 51.2%.

The Follower sells 10.5 units each for a profit of \$110.25 & market share of 48.8%.

S

$$P_S = 100 - Q_S + 2P_T$$

$$TR_S = P_S Q_S = 100Q_S - Q_S^2 + 2P_T Q_S$$

$$MR_S = 100 - 2Q_S + 2P_T$$

$$MR_S = MC_S$$

$$100 - 2Q_S + 2P_T = 0$$

$$Q_S = 50 + P_T$$

$$Q_S = Q_S$$

$$100 - P_S + 2P_T = 50 + P_T$$

$$P_S = 50 + P_T$$

T

$$P_T = 50 - Q_T + P_S$$

$$TR_T = P_T Q_T = 50Q_T - Q_T^2 + P_S Q_T$$

$$MR_T = 50 - 2Q_T + P_S$$

$$MR_T = MC_T$$

$$50 - 2Q_T + P_S = 0$$

$$Q_T = 25 + P_S/2$$

$$Q_T = Q_T$$

$$50 - P_T + P_S = 25 + P_S/2$$

$$P_T = 25 + P_S/2$$

$$P_S = 50 + [25 + P_S/2]$$

$$= 75 + P_S/2$$

$$P_S/2 = 75$$

$$P_S = 150$$

$$Q_S = 100 - P_S + 2P_T$$

$$= 100 - 150 + 2(100)$$

$$Q_S = 150$$

$$\pi_S = (P_S - MC_S) Q_S$$

$$= 150(150)$$

$$\pi_S = \$22,500$$

$$P_T = 25 + 150/2$$

$$= 25 + 75$$

$$P_T = 100$$

$$Q_T = 50 - P_T + P_S$$

$$= 50 - 100 + 150$$

$$Q_T = 100$$

$$\pi_T = (P_T - MC_T) Q_T$$

$$= 100(100)$$

$$\pi_T = \$10,000$$

Star charges \$150 for 150 users + profit of \$22,500.
Tesla charges \$100 for 100 users + profit of \$10,000.

- ⑥ ① It deals with timing of consumption
 ② It allows for a changing utility function

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⑥ 4-Firm Concentration Ratio: $40\% + 60\% = 100\%$
 Herfindahl-Hirschman Index: $40^2 + 60^2 = 5,200$

⑦ - Firm will undercut rivals' price
 - This will continue until $P = MC$ (Perfect Competition outcome)

⑧ - If profits exist, new firms will enter
 - This will adjust demand and/or costs until profits = 0.

⑨ Best Response - Action that gives the highest payout given the opponent's action.

In a Nash Equilibrium, best responses line up / correspond to each other.

⑩	Hot Guy	Hot Girl
Best Response	Study if Hot Girl Studies Flirt if Hot Girl Flirts	Study if Hot Guy Studies Study if Hot Guy Flirts
Dominant Strategy	N/A	Study
Dominated Strategy	N/A	Flirt
Nash Equilibrium: (Study, Study)		

$$④ Q_T = 120 - P$$

$$Q_F = P - 20$$

$$Q_D = Q_T - Q_F \\ = 120 - P - [P - 20]$$

$$Q_D = 140 - 2P$$

$$\boxed{P = 70 - Q_D/2}$$

$$① TR_D = P Q_D = 70 Q_D - Q_D^2/2$$

$$MR = \frac{\partial TR_D}{\partial Q_D} = \boxed{70 - Q_D = MR}$$

$$② MR_D = MC_D \Rightarrow 70 - Q_D = 30 \\ \boxed{Q_D = 40}$$

$$③ P = 70 - Q_D/2 \\ = 70 - 40/2 \\ \boxed{P = 50}$$

$$④ S_F: P = 20 + Q_F \\ 50 = 20 + Q_F \\ \boxed{30 = Q_F}$$

$$⑤ \pi_D = (P - MC_D) Q_D \\ = (\cancel{50} - 30) 40 \\ \boxed{\pi_D = \$800}$$

$$\text{Market Share: Dominant: } \frac{40}{40+30} \cdot 100 = \boxed{57.1\%}$$

$$\text{Fringe: } \frac{30}{40+30} \cdot 100 = \boxed{42.9\%}$$

At a price of \$50, the dominant firm sells 40 units (57.1% market share) for profit of \$800 + the fringe firms sell 30 units (42.9% of market share).