PROBLEM SET THREE--ECON 3010

1. A monopolist can segment its market into two sub-markets, call them 1 & 2. TC = $200 + 5Q, with Q = q1 + q2. The demand in the sub-markets is:

\[ P_1 = 20 - \frac{q_1}{2} \quad \text{&} \quad P_2 = 35 - q_2. \]

a) Find the profit-maximizing q1, q2, P1, P2, & \( \pi \). Also find \( E^D_P \) in each sub-market at the profit-maximizing P & q.
b) Which sub-market gets the lowest P? Why?

2. In Figure 1, is \( \pi \) maximized when \( q_A = 30 \) & \( q_B = 20 \)? Explain.

3. Assume there is a monopoly with TFC = 0 & a constant MC. Draw the diagram for this. What are the profit-maximizing P, Q (\( = q \)), & \( \pi \)? What is the DWL due to this monopoly? How does your answer change if competitive rent seeking occurs?

4. To operate in a certain occupation, one must have a permit. No new permits have been issued, one can buy a permit from someone who has one (they are good for perpetuity), & the restriction on entry means each individual in the occupation expects \( \pi \) of $25,000 per year. What will be the price of a permit (\( P_P \)) be if \( r = .05 \)?

5. Going to school now for 4 years will cost $40,000 per year & will add to your earnings by $20,000 per year. If \( r = 4\% \) & you will work for 40 years, what is the net PV of this investment?

6. Suppose a seller (for whom there are no competitors) has 2 types of buyers: Premium & Discount. The firm offers 2 goods for sale, A & B, with A of higher quality. The values buyers have for A & B are:

\[ Value^\text{Premium}_A = \$10, \quad Value^\text{Premium}_B = \$6, \quad Value^\text{Discount}_A = \$7, \quad \text{&} \quad Value^\text{Discount}_B = \$4 \]

MC = AC = $6 for A & $3 for B. There are \( N_D \) Discount customers & \( N_P \) Premium customers.

a) What are the profit-maximizing \( P_A \) & \( P_B \), & what is \( \pi \)?
b) Suppose the seller can downgrade B to product C, at a lower per unit cost of \( 50\% \). Also, \( Value^\text{Premium}_C = \$4 \) & \( Value^\text{Discount}_C = \$3 \). What are the profit-maximizing \( P_A \) & \( P_C \), & when would it pay the seller to switch from B to C?
Figure One

$\begin{align*}
\text{MC} \\
\text{MR}_A \\
\text{MR}_B \\
\end{align*}$
1. a) & b) MC = $5. TR_1 = 20q_1 - \frac{q_1^2}{2} & TR_2 = 35q_2 - q_2^2. Thus MR_1 = 20 - q_1 & MR_2 = 35 - 2q_2.
Set MR_1 = MC & MR_2 = MC: 20 - q_1 = 5 & 35 - 2q_2 = 5, so q_1 = q_2 = 15.

Insert q_1 into the demand for sub-market 1 & do likewise for sub-market 2 & get P_1 & P_2: P_1 = $12.5 & P_2 = $20.

\[ \pi = P_1q_1 + P_2q_2 - 200 - 5(q_1 + q_2) = $137.5. \]

\[ E_p^D = \frac{1}{slope}q \text{, so } E_{p_1}^{D_1} = -2(12.5)/15 = -1.67, \text{ & } E_{p_2}^{D_2} = -20/15 = -1.33. \text{ The sub-market with the highest } |E_{p}^{D}| \text{ gets the lowest } P--- \text{sub-market 1.} \]

2. The relevant MC is MC for Q = 50, which is clearly > $15. Thus, the \( \pi \)-maximizing Q < 50.

Given the firm sells Q = 50, it should sell more in sub-market A & less in sub-market B since, with q_A = 30 & q_B = 20, MR_A = $15 & MR_B = $10. If the firm sells 1 more unit in sub-market A & 1 less unit in sub-market B, \( \Delta TR = $15-$10 = $5 \text{ & } \Delta TC = 0, \text{ so } \Delta \pi = $5. \text{ The firm should continue to sell more in sub-market A & less in sub-market B until MR_A = MR_B, which } \Rightarrow q_A > 30, q_B < 20, \text{ & } $10 < MR_A = MR_B < $15. \]

3. Using **Figure Two**, with no rent seeking, P = P-M, Q = Q_M, & \( \pi = PS = Y \) (TFC = 0), CS = X, & DWL = Z.

With competitive rent seeking, P = P_M, Q = Q_M, & \( \pi = PS = 0. \text{ All } \pi = PS \text{ is competed away. }\)

DWL = Z + some of Y. If all rent seeking involves resource use (not bribes), then DWL = Z + Y.

If only bribes are used, DWL = Z.
4. \( P_p = \text{expected } \pi \) since individuals will continue to bid up the price until they would just break even (earn zero \( \pi \) after buying a permit). Thus, \( P_p = \frac{25,000}{.05} = \$500,000 \).

5. We must find the PDV of a $1 per year for 4 years (3.63), the PDV of a $1 per year for 40 years (19.8), & \( \frac{1}{(1.04)^4} = .855 \) since the individual receives the benefits starting 5 years (& not 1 year) from now.

Thus, PDV(benefits) = \( (.855)(19.8)(20,000) = \$338,580 \).

PDV(cost) = \( (3.63)(40,000) = \$145,200 \).

NPV = \$193,380.

6. a) With no competition, set \( P_B \) so \( C_{SB}^{Discount} = 0 \) (Discount buyers won’t buy A given what optimal \( P_A \) will be). Thus, \( P_B = \$4 \). At \( P_B = \$4 \), \( C_{SB}^{Premium} = \$2 \). Thus, set \( P_A \) so \( C_{SA}^{Premium} = \$2 \), or

\[
\text{Value}_{A}^{Premium} - P_A = \$2, \quad 10 - P_A = \$2, \quad \text{or } P_A = \$8.
\]

Call profit \( \pi_1 \). Now \( \pi_1 = (4-3)N_D + (8-6)N_p = N_D + 2N_p \).

b) Now set \( P_C \) to take all CS from Discount buyers, so \( P_C = \$3 \).

With \( P_C = \$3 \), \( C_{SC}^{Premium} = \$1 \). Thus, set \( P_A \) so \( C_{SA}^{Premium} = \$1 \), or \( P_A = \$9 \).

Now \( \pi = \pi_2 = (3-2.5)N_D + (9-6)N_p = .5N_D + 3N_p \).

\( \pi_2 > \pi_1 \) if \( .5N_D + 3N_p > N_D + 2N_p \).

\( N_p > .5N_D \).

If the # of Premium customers is more than \( \frac{1}{2} \) the # of Discount customers, it pays to degrade from B to C. Selling C & not B to Discount buyers lowers \( \pi \) from each of these buyers by 50¢ (P↓ by $1 but cost per unit↓ by 50¢). Profit per Premium buyer↑ by $1 (P_A↑ $1).