PROBLEM SET ONE -- ECON 3010

1. Start with the following supply & demand schedules: \( P = 200 - 2Q \) & \( P = 20 + 4Q \).
   a) Find the market-clearing (equilibrium) \( P \) & \( Q \) and the \( E_P^{\text{supply}} \) & \( E_P^{\text{demand}} \) at the equilibrium \( P \) & \( Q \).
   b) If there is a $30 tax on sellers, find the equilibrium \( P \) & \( Q \).
   c) With no tax on sellers, but a $30 tax on buyers, find the equilibrium \( P \) & \( Q \).

2. a) Using Figure 1, what are CS & PS when the market clears?
   b) If there is a price ceiling of \( P_0 \), what are CS, PS, & DWL?
   c) If queues occur, what is different?

3. a) Using Figure 2, what are CS & PS when \( D = D_1 \)?
   b) Explain what CS & PS are with \( D_2 \), & what was responsible for the changes compared to \( D_1 \).

4. a) Using Figure 3, what are CS & PS with no tax?
   b) Suppose a tax of $Z per unit is imposed on sellers. What, are \( P \), \( Q \), CS, PS, DWL, & tax revenue?

Figure One
A tax per unit = $z

Figure Two

Figure Three
Answers

1. a) Set demand & supply (D & S) equal, find Q, & then insert Q into either D or S to find P:

\[ 200 - 2Q = 20 + 4Q \Rightarrow Q = 30 & P = $140 \]

\[ E_p = \frac{1}{slope} \frac{P}{Q}, \text{ so } E_p^{demand} = -\frac{1}{2} \frac{140}{30} \approx -2.33, \text{ & } E_p^{supply} = \frac{1}{4} \frac{140}{30} \approx 1.17. \]

b) A $30 tax on sellers ⇒ S is now P = 50 + 4Q---each seller now sells the same Q only if P is $30 higher. Now solving D & S yields Q = 25 & P = $150. ΔP = $10---1/3 of the tax. Each seller gets to keep $120---$20 less than before, so sellers bear 2/3 of the burden of the tax. Sellers bear a larger tax burden because they are less responsive to P than are buyers: \[ |E_p^{demand}| > E_p^{supply}. \]

c) With a $30 tax on buyers, each buyer is willing to pay $30 less, so D is: P = 170 - 2Q; solving D & S yields Q = 25 & P = $120. Buyers again end up paying $10 more, & sellers keep $20 less per unit compared to the case with no tax.

2. a) At market clearing, CS = u + v + y, & PS = w + x + z.

b) With a price ceiling = P₀, CS = u + v + w, PS = x. DWL = y + z.

c) With queues, the time costs of buying the good increase, which is like a tax on buyers. Demand decreases, lowering CS by the amount of the time costs---an additional DWL.

3. a) When demand is D₁, CS = b + d, & PS = g.

b) When demand is D₂, CS = a + b + c, & PS = d + e + f + g.

Consumers gain a + e on the Q₁ units they would have purchased without demand increasing because they value the good more, & gain c because Q ↑.

They lose d + c because P ↑. Ignoring e (which is gained & lost by consumers), consumers gain a + c & lose d---they could be better or worse off.

Producers gain d + e + f---they clearly are better off. Note: d is transferred from consumers to producers---it is not lost to society. Producers gain d + e on the Q₁ units they would have produced without demand increasing because P ↑, & gain f because Q ↑.

CS + PS increases by a + c + e + f----society clearly gains.

4. With no tax, CS = a + b + c, & PS = d + e + f.

With a tax of $Z per unit imposed on sellers, supply decreases & intersects demand at P₀ + z, Q₂.

Now CS = a & PS = f. Although producers receive total revenue of [P₀ + z][Q₂], they must give the government [Z][Q₂] = b + d---the tax revenue. DWL = c + e.