ECO 401-002, 003
Spring 2013
Problem Set #8

Due: Friday, April 26

6 pts.

1. Consider the markets for butter (B) and margarine (M), where the demand curves are
   $Q_M = 20 - 2P_M + P_B$ and $Q_B = 60 - 6P_B + 4P_M$
   and the supply curves are
   $Q_M = 2P_M$ and $Q_B = 3P_B$.
   a) Find the equilibrium prices and quantities for butter and margarine.
   b) Suppose that an increase in the price of vegetable oil shifts the supply curve of margarine to $Q_M = P_M$. How does this change affect the equilibrium prices for butter and margarine? Using words and graphs, explain why a shift in the supply curve for margarine would change the price of butter.

3 pts.

2. Joe and Mary each consume food and clothing. Joe's MRS is 3F for 2C. Mary's MRS is 1F for 1C. Describe a transaction that would result in a Pareto improvement.

3 pts.

3. Consider an economy that produces two goods, food (x) and clothing (y). Production of both goods is characterized by constant returns to scale. Given current input prices, the marginal cost of producing clothing is $10 per unit, while the marginal cost of producing food is $20 per unit. What is the marginal rate of transformation of x for y? How much clothing must the economy give up in order to get one additional unit of food? Illustrate in a diagram.

3 pts.

4. Why is it not generally socially efficient to set an emissions standard allowing zero pollution?

6 ptr.

5. Consider an economy with two individuals. Individual 1 has an inverse demand curve for a public good given by $P_1 = 60 - 2Q_1$, while individual 2 has an inverse demand curve for the public good given by $P_2 = 90 - 5Q_2$. The prices are measured in $ per unit. Suppose the marginal cost of producing the public good is $10 per unit. What is the efficient level of the public good? Illustrate.

21 pts. total

1. a) In equilibrium we must have quantity supplied equal to quantity demanded in both the butter and margarine markets. This implies in equilibrium we will have

$$Q_M^d = Q_M^s \quad \text{and} \quad Q_B^d = Q_B^s$$

Substituting in the given curves implies

$$20 - 2P_M + P_B = 2P_M$$
$$60 - 6P_B + 4P_M = 3P_B$$

Solving for P_B in the first equation and substituting into the second equation imply

$$60 + 4P_M = 9(4P_M - 20)$$
$$60 + 4P_M = 36P_M - 180$$
$$P_M = 7.5$$

When $P_M = 7.5$, $P_B = 10$. At these prices, $Q_M = 15$ and $Q_B = 30$.

b) When the supply curve for margarine shifts to $Q_M^s = P_M$, we have

$$20 - 2P_M + P_B = P_M$$
$$60 - 6P_B + 4P_M = 3P_B$$

Solving the first equation for P_B and substituting into the second equation implies

$$60 + 4P_M = 9(3P_M - 20)$$
$$60 + 4P_M = 27P_M - 180$$
$$P_M = 10.43$$

When $P_M = 10.43$, $P_B = 11.30$. At these prices, $Q_M = 10.43$ and $Q_B = 33.91$. The increase in the price of vegetable oil increases the price of margarine and decreases the quantity of margarine consumed. As consumers switch to butter, the price of butter rises and the quantity of butter consumed goes up.

The price of butter rises when the price of vegetable oil rises because butter and margarine are substitutes. The effects can be seen in the graphs.


Market for margarine

Market for butter
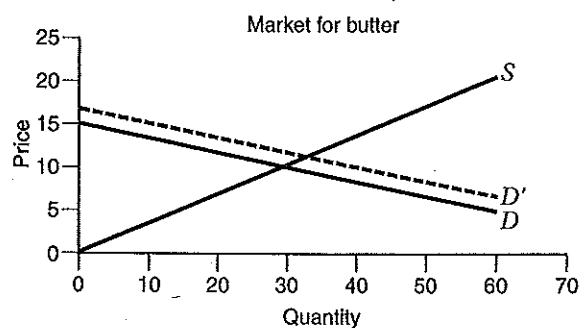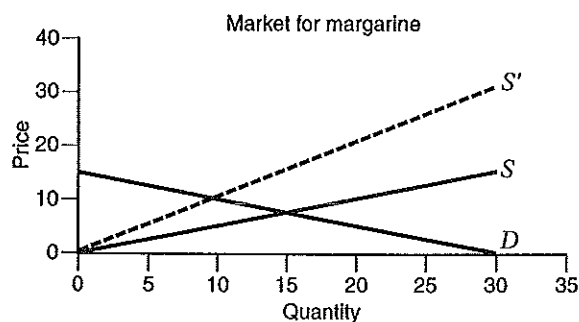
Because the goods are substitutes, when the supply of margarine declines raising the price of margarine, consumers substitute butter for margarine, increasing demand for butter and raising both the equilibrium price and quantity of butter.

2. Joe's MRS = 3F : 2C , Mary's MRS = 1F : 1C

Joe gives Mary 2½ F for 2C. Mary would have given up 2½ C to get 2½ F, so she is better off. Joe would have given Mary 3F to get 2C, but since he only had to give her 2½ F, he is better off.

3.

marginal cost of clothing = MC_y = \$10

marginal cost of food = MC_x = \$20

$MRT_{x,y}$ = MC_x / MC_y = 2

Clothing can be "transformed" into food by shifting resources out of the production of clothing and into the production of food, at the rate of two units of clothing per one unit of food.
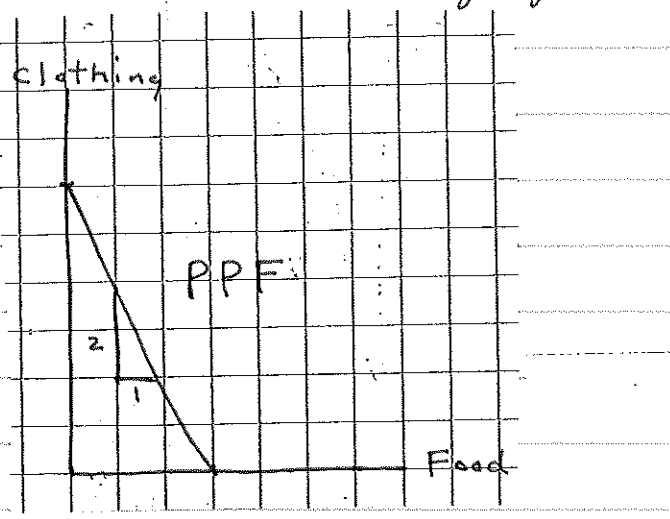
4.

If the government were to set an emissions standard allowing zero pollution, this standard would not be socially efficient. By setting the standard at zero, the government could reduce pollution by preventing polluting industries from producing goods that society values. By setting the standard at zero, however, the government will also eliminate the benefits to society from production of these goods. In general, the social benefits from producing will likely exceed the social costs up to some nonzero level of production (pollution) implying the socially efficient level of production is nonzero.

5.
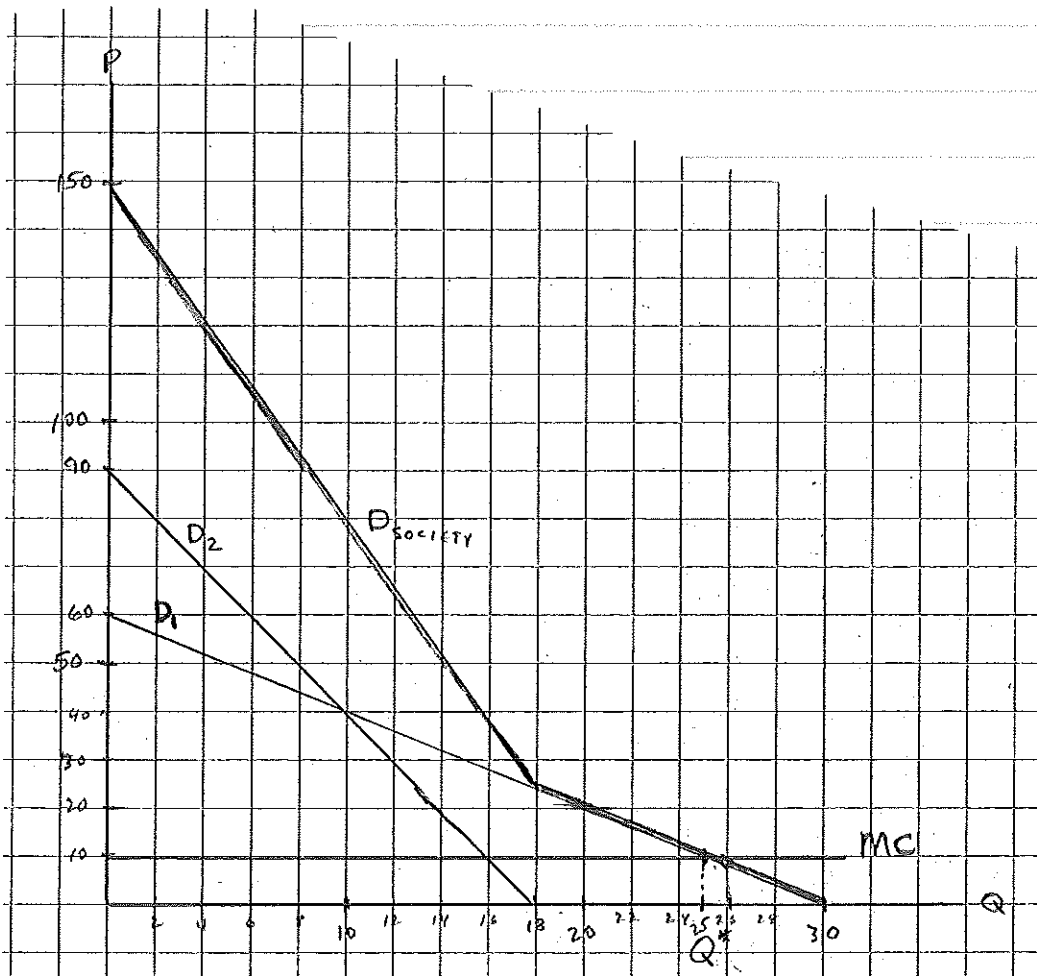
$D_1 \Rightarrow P_1 = 60 - 2Q_1$

$D_2 \Rightarrow P_2 = 90 - 5Q_2$

since the good is non-rival and non-excludable, Society's demand curve is the _vertical_ summation of D_1 and D_2. Optimal or efficient level of provision is where Society's demand curve intersects marginal cost: $Q^* = 25$. At that output marginal social benefit equals marginal cost.