Chapter 11, Problem 1 Determine whether the following statements are true or false, and briefly explain why:

(a) *A given total emission reduction in a polluting industry will be achieved at the lowest possible total cost when the cost of the last unit of pollution curbed is equal for each firm in the industry.*

**TRUE** - Suppose this statement was not true. Then the marginal cost for reducing pollution in one factory (say factory A) would be greater than the marginal cost of reducing pollution in another factory (say factory B) for the last unit that each reduced pollution. But if this were true, it would mean that the total cost of reducing pollution could be lowered if factory A were allowed to pollute one more unit and factory B was forced to pollute one less unit. Therefore to achieve a given total emission reduction at the lowest possible cost the cost the last unit of pollution curbed must be equal for each firm in the industry.

(b) *In an attempt to lower their costs of production, firms sometimes succeed merely in shifting costs to outsiders.*

**TRUE** – When a producer wants to cut their own private costs of production, they may do this my passing these costs onto outsiders (this is an example of a negative externality). Consider the excessive use of pesticides on crops. This activity reduces the amount of insect damage to crops, and thus lowers the farmer’s production cost. However, the pesticide runoff pollutes waterways. This increases the costs for outsiders, whether by decreasing their utility from inability to use certain waterways, or possibly by causing them to incur increased healthcare costs as a result of pollution in the waterways, and thus is an example of a negative externality.
Problem 3

Suppose that the supply curve of boom box rentals in Golden Gate Park is given by $P = 5 + 0.1Q$, where $P$ is the daily rent per unit in dollars and $Q$ is the volume of units rented in hundreds per day. The demand curve for boom boxes is $20 - 0.2Q$. If each boom box imposes $3 per day in noise costs on others, by how much will the equilibrium number of boom boxes rented exceed the socially optimal number?

Since the supply (private MC) curve in this market is given by $P = 5 + 0.1Q$, and the demand curve is given by $P = 20 - 0.2Q$, to find the equilibrium quantity we set $5 + 0.1Q = 20 - 0.2Q$ and find that equilibrium quantity is 5000 and equilibrium price is $10. (Note that 5000 = 50 hundred and quantity is measured in hundreds of units per day). However, since the boom boxes impose a $3 per unit cost on others, to obtain our social marginal cost curve we must shift our private marginal cost curve up by $3 for each and every unit. Therefore our social marginal cost curve is given by the equation $P = 8 + 0.1Q$. To find our social optimum we set social marginal cost = demand. Solving $8 + 0.1Q = 20 - 0.2Q$, we find our social optimum is at a quantity of 4000 and a price of $12 (again, remember quantity is expressed in terms of hundreds of units). So our equilibrium number of boom boxes (5000) exceeds the social optimum (4000) by 1000.
Problem 4
Refer to Problem 3. How would the imposition of a tax of $3 per unit on each daily boom box rental affect efficiency in this market?

If a tax of $3 per unit were imposed on each daily boom box rental, then this would shift the private marginal cost (supply) curve up by $3 for each and every unit. But then our private marginal cost curve and our social marginal cost curve would coincide. Thus in equilibrium we would now be equating marginal social cost and marginal social benefit, leading to the optimum level of social efficiency being attained.