First Challenge: Solutions
Environmental Economics: ECO 345
Fall 2011

Question 1

a. Bacteria is a bad, is non-rival and non-excludable. It is overprovided, since the cedar tree owners are not charged by the apple orchards.

b. Whales hunted for food are goods and rival. The whales themselves are non-excludable in that anyone can harvest a whale for free, but of course once the whale is harvested it is excludable since the owner can prevent others from eating the harvested whale. The non-excludable part can cause an under provision of whales in that no inuit has an incentive to breed new whales.

c. Whales here are goods that are non-rival and non-excludable. The market provides too few whales.

d. Rhinos are goods that are non-rival, and Disney's fence makes them excludable. The rhinos are over provided in that Disney does not account for the externality costs.

Question 2

a. No. The allocation has total production equal to:

$$E_1 + E_2 = \min(2, 4) + \min(2, 1) = 2 + 1 = 3, \tag{1}$$

For the Pareto preferred, give for example firm one all the capital and labor so that $E_1 = \min(4, 5) = 4$. Since more is produced, we have a Pareto preferred allocation.

b. No. April has $MRS^A_{xp} = 2$, so she is indifferent between 1 unit of x and 2 units of p. She is willing to accept more p than Jack for 1 unit of x and therefore values x more. So a Pareto preferred allocation is for Jack to give April a small amount of x and an equal amount of p. Jack is as well off and April is better off, so the allocation is Pareto preferred.

c. The allocation is efficient. There is no way to make April better off without making Jack worse off.

d. No. The production possibilities frontier is $p = 4 + x^2$, so for $x = 2$ we have $p = 4 + 2^2 = 8$. Since $9 > 8$ we are not on the frontier. A Pareto preferred allocation is $x = 2$ and $p = 8$ (less pollution and the same production).

Question 3

Developers pay a penalty of not being allowed to develop if an endangered species is found on the property. Therefore, land owners have an incentive to kill endangered species before they are found.

Longer Questions

Question 4

a. Efficiency requires:

$$P_c = MC + MD, \tag{2}$$

$$\$20 = 2C + 8 + 2C + 4, \tag{3}$$

$$\$8 = 4C \quad \rightarrow \; C = 2. \tag{4}$$

b. For market provision, we set:

$$P = MC, \tag{5}$$

$$\$20 = 2C + 8, \tag{6}$$

$$\$12 = 2C \quad \rightarrow \; C = 6. \tag{7}$$

Profits are then:

$$\pi = P_C C - TC\left(C\right), \tag{8}$$

$$= \$20 \cdot 6 - \left(6^2 + 8 \cdot 6 + 36\right), \tag{9}$$

$$\pi = \$0. \tag{10}$$

c. Yes, the residents will pay the mining company to not to pollute. The efficient allocation of $C = 2$ results.

d. We have:

$$P' = MD = 2C + 4 = 2 \cdot 2 + 4 = 8, \tag{11}$$

for each unit of coal reduced.

e. Notice that the firm is reducing production from 6 to 2, so the compensation the residents must provide is:

$$P' (C_0 - C) = 8 (6 - 2) = \$32. \tag{12}$$

Total profits are then:

$$\pi = P_c C + 32 - TC (C), \tag{13}$$

$$= \$20 \cdot 2 + 32 - \left(2^2 + 8 \cdot 2 + 36\right), \tag{14}$$

$$\pi = \$16. \tag{15}$$

Profits are higher for the firm with the property right, so the firm benefits from owning the property right, but the efficient coal production results.

Question 5

a. Under II, each person pays \$420/100 = \$4.20. The 60 poor residents are not willing to pay this much, and so will vote against. Therefore, II does not pass under majority rule. Similarly, under III, the 60 poor pay nothing but get pollution clean up worth \$1, so they vote yes. Thus III passes under majority rule.

b. As seen in (a), II is not Pareto preferred, since the 60 must pay \$4.20 for something that they value as \$1. They are worse off. For III, the poor are better off. But the rich must now pay \$420/40 = \$10.50, but they only value the clean up at \$10. Thus III makes the rich worse off and is therefore not Pareto preferred.

c. But I is not efficient either. Consider making the rich pay \$10 each and the poor pay \$0.30 each. The poor are better off and the rich are indifferent, so we have a Pareto preferred allocation. Note that there exists many Pareto preferred allocations.

Question 6

a. For the box I get:

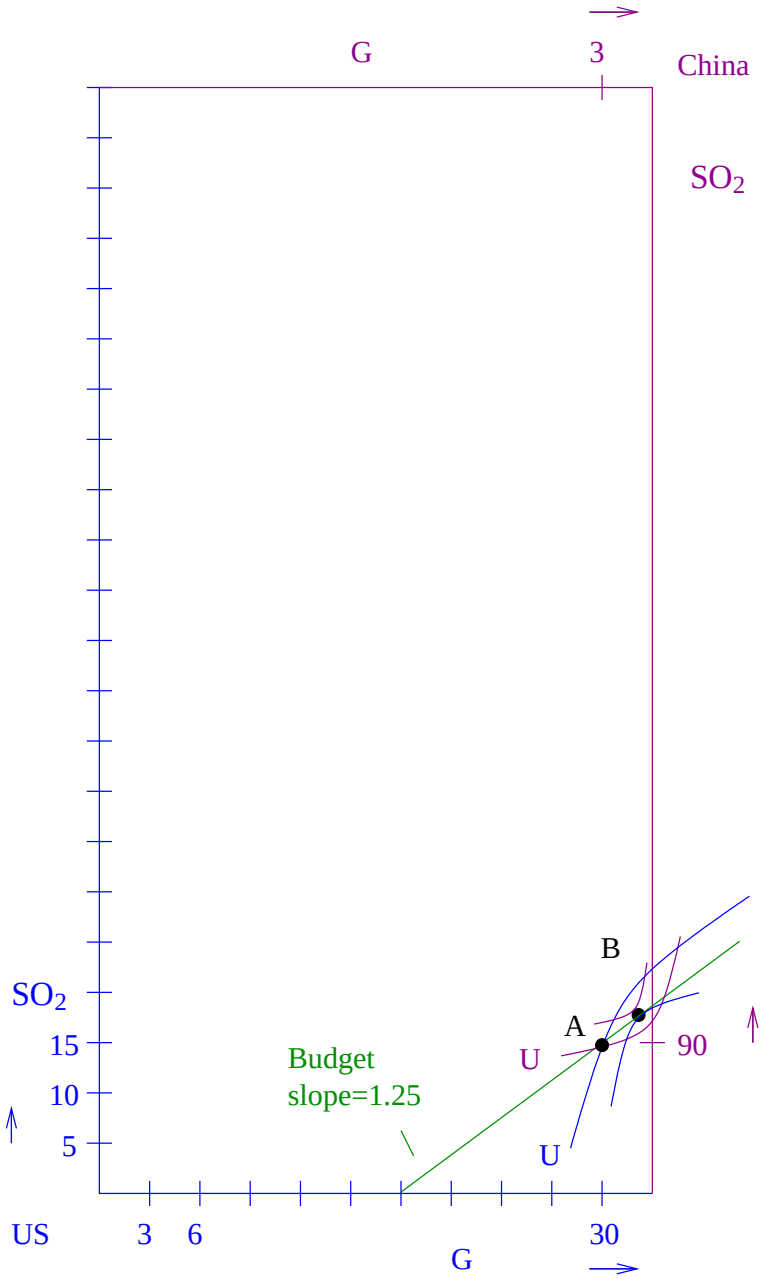

Figure 1: Edgeworth Box for the US and China.

b. The endowment point 'A' is not efficient: China is willing to accept one unit of pollution for one good, whereas the US is willing to accept 1.5 units of pollution to get a good. Therefore, the US wants goods more, and so it is efficient for China to reduce goods consumption and pollution (ship polluting factories to the US).

c. At the market equilibrium, the MRS for both the US and China equals the price ratio of 1.25.

d. Summer's statement is not true here. For Summer's statement to be true, we would need $MRS_{GP}^{US} < MRS_{GP}^{c}$. China is poor, but also has high pollution and prefers more goods and less pollution. But what matters is whether or not China wants goods more than the US does, relative to pollution. (In fairness to Summer's he mentions this assumption in his statement. His critics, however, attacked the statement on moral grounds, rather than checking if the assumptions are in fact true or not).