4. For each of the following situations, is the Coase Theorem applicable? Why or why not?

   a. A group of university students in a residence shares a communal kitchen. Some of the users of the kitchen never clean up the messes they make when cooking.

   b. The pollution from a copper smelter drifts out over a surrounding residential area.

   c. Loud gasoline-powered leaf blowers are used by some homeowners for driving leaves and other debris into piles, but also result in driving leaves and dust into the yards of neighbours.

5. The government of British Columbia has suggested a "cash-for-clunkers" program. Under this program, the government would buy up "clunkers" (older cars that emit a lot of pollutants and do not meet current pollution standards). Is this a sensible policy? Explain.

6. For each of the following, discuss the nature of the externalities involved and possible government responses:

   a. the outbreak of SARS (sudden acute respiratory syndrome) in Toronto in 2003;

   b. the H1N1 flu pandemic, as declared by the World Health Organization in June 2009;

   c. the use of firewood, dung, charcoal and other unimproved fuels for indoor cooking and heating in rural households in Sub-Saharan Africa and China; and,

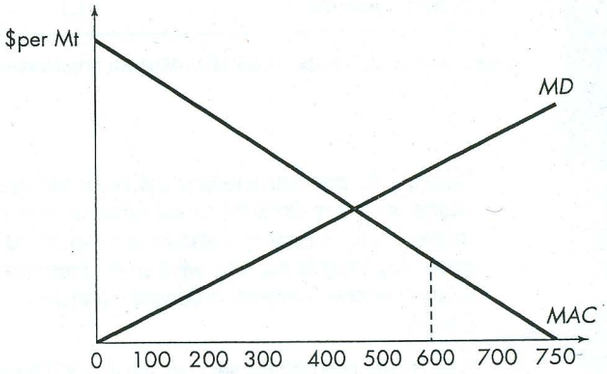
   d. driving on a (i) congested highway, and (ii) uncongested highway.

7. The private marginal benefit for commodity X is given by $10 - X$, where X is the number of units consumed. The private marginal cost of producing X is constant at \$5. For each unit of X produced, an external cost of \$2 is imposed on members of society. In the absence of any government intervention, how much X is produced? What is the efficient level of production of X? What is the gain to society involved in moving from the inefficient to the efficient level of production? Suggest a Pigouvian tax that would lead to the efficient level. How much revenue would the tax raise?

8*. In question 7, firms respond to the tax by lowering output and therefore the level of pollution. In practice, there may be other ways to reduce pollution that are less expensive for the firm. In this problem, a different framework is used. The focus is on the level of the pollutant, in this case GHG emissions, and firms are not restricted to reducing emissions by reducing output.

Suppose that in the absence of any corrective measures, the economy generates 750 megatonnes (Mt) of GHG emissions (E) per year. The damage created by an additional Mt of emissions is called the marginal damage. Assume the marginal damage function is $MD = 0.04$ E. Thus, if E = 750 Mt, the additional damage to society associated with one more Mt of emissions is \$30. The marginal abatement cost, the additional cost associated with a one Mt reduction in emissions, is given as $MAC = 45 - 0.06$ E. When there is no abatement, E = 750 Mt and the marginal cost of abatement is zero.

MD and *MAC* are illustrated at right. Emissions are measured on the horizontal axis in megatonnes per year and the vertical axis is measured in dollars.



   a. If E = 600 Mt, how much abatement (emissions reduction) has occurred? What is the marginal cost associated with lowering emissions by an additional Mt when E = 600? What is the marginal benefit of an additional Mt reduction in emissions when E = 600 (i.e., what is the marginal damage prevented)?

   b. If E = 600, calculate total abatement costs as the area below the *MAC* curve between 600 Mt and 750 Mt. Calculate total benefits from lower emissions as the area under the *MD* curve between 600 Mt and 750 Mt.

   c. For this economy, what is the socially optimal level of emissions, E*? (*Hint:* From an efficiency standpoint, emissions should continue to be reduced as long as the marginal benefit from emissions reductions exceeds the marginal abatement costs.)

   d. Suppose the government imposed a tax on emissions equal to \$12 per Mt of greenhouse gas emissions. How does the tax affect total emissions in the economy? Is the tax sufficient to reduce emissions to E*? Why or why not?

9*. Bart and Homer each operate a factory that pollutes the river and and harms Lisa's fishery. Reducing their emissions is costly for both producers. Bart's marginal cost of abatement is $MAC_B = 500 - 10e_B$. Homer's marginal abatement cost is $MAC_H = 1000 - 20e_H$. The government has decided that harmful emissions into the river need to be reduced by 18 units. To achieve this goal, two proposals are under consideration. Under proposal 1, Bart and Homer share the required emission reductions equally. Proposal 2 calls for the imposition of an emissions fee of \$120 per unit of pollutant. Evaluate the total abatement costs under each proposal. If the government's goal is efficiency, which proposal should it choose? Explain.

Income Quintile	Market Income (Before taxes and transfers)	Total Income (Before taxes and after transfers)	After-tax Income (After transfers)
Lowest Quintile	1.2	4.2	4.9
Second Quintile	7.4	9.5	10.6
Third Quintile	14.9	15.4	16.3
Fourth Quintile	24.5	23.5	23.9
Highest Quintile	52.1	47.3	44.3

Source: Statistics Canada CANSIM II database http://cansim2.statcan.ca/ Table 202-0701.

Calculate the cumulative income shares for all three income measures. Draw the Lorenz curve for each income concept using an Excel spreadsheet or by sketching a graph. According to the data, what contributes more to reducing income inequality in Canada—transfers or taxes? Discuss.

3. "I don't care how rich the very rich are. I care if they became rich in an unethical way, or if they use their riches in a particularly vulgar or revolting way. . . . I wouldn't mind if they lost [their wealth] or had it taxed away. But I do find poverty of the very poor unlovely. . . . That condition deserves, in my opinion, our most intensive care. I believe that the present focus on inequality of income diverts national attention from it." (Stein, 1996: A14). Do you agree with this statement? Is it consistent with utilitarianism?

4. "Mobility should play a bigger role in our thinking about poverty. The current standard, preoccupied with income snapshots, only echoes the current welfare formula, with its emphasis on supporting people in poverty rather than helping them to get out" (Jenkins, 1992: A10). Do you agree with this statement? In your answer, discuss how the quote relates to utilitarian criteria for evaluating government distributional problems and to the difficulties present in official statistics on the poverty rate.

5. Suppose there are only two people, Simon and Charity, who must split a fixed income of $100. For Simon, the marginal utility of income is:

$$MUs = 400 - 2Is$$

whereas for Charity, marginal utility is:

$$MUc = 400 - 6Ic$$

where *Ic*,*Is* are the amounts of income to Charity and Simon, respectively.

a. What is the optimal distribution of income if the social welfare function is additive?

b. What is the optimal distribution if society values only the utility of Charity? What if the reverse is true? Comment on your answers.

c. Finally, comment on how your answers change if the marginal utility of income for both Simon and Charity is constant:

$$MUc = 400$$
$$MUs = 400$$

6.* The economy consists of Will and Grace. They have identical utility functions $U = 100(y_i)^{0.5}$ where the marginal utility of income function is $MU = 50(y_i)^{-0.5}$. The total income available in the economy is fixed and equal to $20,000.

a. Use an Excel spreadsheet to graph the utilities possibility curve for the economy.

b. What is the welfare maximizing distribution of income if the social welfare function is $W = U^W + U^G$? What do the social indifference curves look like in this case?

c. What is the welfare maximizing distribution of income if the social welfare function is $W = \min[U^W, U^G]$. What do the social indifference curves look like in this case?

d. Suppose that Will and Grace do not have identical utility functions. Instead assume that Will's utility function is $U^W = 200(y_W)^{0.5}$ where marginal utility is given by $MU^W = 100(y_W)^{-0.5}$. Grace's utility is as above. Draw the new utility possibilities curve. What distribution of income maximizes social welfare when the social welfare function is $W = U^W + U^G$. Does the answer change if the social welfare function is given as $W = \min[U^W, U^G]$?

7.* Will and Grace are the only two people in the economy. Will's utility is given by $U^W = 100(y_W)^{0.5}$ while Grace's utility depends not only on her own income but also on Will's utility. Her utility function is:

*Difficult