

**University of Toronto**  
**Economics 336 – Public Economics**

**Final examination**  
**December 14, 2009**

You may use pocket calculators (but you won't need to). You must not refer to books, computers, or any other aids. You have 3 hours.

**Part A.** Answer SIX questions from this part. (11 points each.)

1. Define the *excess burden* of an excise tax on a commodity. Can the excess burden of an excise tax ever be negative? Justify your answer.
2. Explain briefly how Registered Retirement Savings Plans work. According to theory, would an increase in the RRSP contribution limit increase private saving? What about net national saving? Illustrate your argument with graphs.
3. Define the *user cost of capital*. If Canada's corporation income tax were replaced by a cash-flow tax that permitted investment goods to be expensed, but interest and capital cost allowances became non-deductible, would the user cost of capital rise, fall, or remain unchanged? Justify your answer.
4. Define a *Condorcet winner*. Suppose there are 3 voters ( $L, M, H$ ) with preferences over three alternatives ( $l, m, h$ ) given by  $l > m > h$  for  $L$ ,  $m > l > h$  for  $M$ , and  $h > l > m$  for  $H$  (where  $>$  means "is preferred to"). Does a *Condorcet winner* exist in this case among ( $l, m, h$ )? If so, what is it? If not, why not?
5. Daily commuters choose between travel by car and train, according to whichever is faster for them. Explain why total commuting time could fall if some commuters for whom car is faster were forced to take the train. Would this change constitute a Pareto improvement?
6. Discuss the differences between *carbon taxes* and *cap-and-trade systems* of reducing emissions of greenhouse gases. If the two systems generate the same level of total emissions, what are the differences in the allocation of emissions among polluters, the price paid to pollute, and the resulting costs of production and output levels of industrial polluters. Which system is therefore better?
7. Under the new policy of the Toronto Transit Commission, university students will pay less for a monthly pass than other people. Can this difference in fees be justified by the theory of efficient cross-subsidization in a regulated natural monopoly? State clearly your assumptions about demand elasticities of students and other customers.

**Part B.** Answer BOTH questions from this part. (17 points each.)

8. The capacity of a subway system is measured by the maximum number of passengers per direction per hour (ppdph) it can carry. Suppose that the capacity of the TTC subway system is fixed at  $K$  ppdph. The capital cost of the subway is  $cK$ , and operating costs are zero. The

TTC has estimated that the inverse demand curve for total trips  $T$  on the subway at rush hour is given by the inverse demand function

$$w_r(T) = A_r - T$$

whereas at non-rush hour times it is given by

$$w_n(T) = A_n - T$$

If  $A_r > K > A_n$ , what price should be charged for trips on the TTC at rush hour? at non-rush hour times? Now suppose that the TTC has chosen capacity optimally. Will revenues be sufficient to cover the TTC's capital costs?

9. Acid rain pollution is produced from two sources, a power plant and a smelter. Studies show that the marginal cost of reducing acid pollution at the power plant is given by the function

$$MC_1(A_1) = 10 + A_1$$

where  $A_1$  is the units of acid rain reduction (or "abatement") at the power plant; and the marginal cost at the smelter is

$$MC_2(A_2) = 20 + A_2.$$

Suppose that the initial level of pollution was 120 units, but the government has limited pollution to 70 units by selling pollution permits to the two polluters – so that the total amount of abatement is 50 units.

Calculate the total demand for permits to pollute at any permit price  $p$  per unit of acid rain. If the permit market is competitive, what is the equilibrium price of a permit? How many permits are bought by the power plant, and how many by the smelter? Draw a graph illustrating your answer.