University of Toronto
Economics 336Y – Public Expenditures

Final examination
April 8, 2008

General Instructions: Write your name in block (capital) letters and your student number on all exam booklets you use. You may use pocket calculators (but you won't need to). You must not refer to books, computers, or any other aids. You have 110 minutes.

Part A. Short answer questions: **Answer THREE of the following questions.** In all cases your answer should include definitions of the *words in italics*. **Be very brief!** (30 of 60 total points.)

1. In 2003, a "congestion charge" was imposed on private vehicles entering central London during peak traffic periods; reveneus from the charge were dedicated to increasing subsidies to public transit in the area. Based on the article by Leape (2006), discuss the chief categories of economic costs and benefits that resulted from the scheme. In particular, how do the government revenues resulting from the charge enter the calculation? On the basis of Leape's calculations, is it possible to conclude that the charge resulted in a Pareto improvement for residents of the London metropolitan area?

2. The students in a course like getting high marks but dislike hard work. The instructor of the course "grades on a curve": regardless of exam performance, a fixed percentage of students receive As, Bs, and so on. Is the outcome Pareto efficient from the perspective of the students? (Ignore the preferences of the instructor.) Justify your answer carefully, and clearly explain your assumptions.

3. In an effort to reduce greenhouse gas emissions, some governments have recently instituted *carbon taxes*, under which those consuming fossil fuels are required to pay a specific tax per ton of carbon dioxide (CO2) emitted. Other governments have instituted systems of tradable permits for CO2 emissions, which specify the total quantity of emissions and require individual emitters to buy permits to emit CO2. Compare a system of tradable permits to a carbon tax that generates the same total level of emissions. Discuss 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?

4. According to the Coase theorem, should air polluters have the right to emit pollution, or should victims have a right to clean air? Explain your answer. Name one other factor, not considered in the Coase theorem, that would cause you to change your answer, and explain why.

Part B. Problem-solving questions: **Answer ALL of the following questions.** (30 of 60 points.)

5. (a) Suppose that average time for a single car to travel a given distance on a highway is $T(N)$ hours when there are N other cars on the highway. Should a toll be charged as a Pigouvian tax on use of the highway? Explain your answer. If drivers value their commuting time at w dollars per hour, find an expression for the optimal toll rate.

   (b) Traffic flow studies show that, at 8 a.m. on a typical weekday, there is a unbroken line of congested traffic on the westbound 401 highway from Oshawa (east of Toronto) to Yonge Street (in the centre of Toronto); by 9 a.m., congestion on this highway has largely dissipated. If a highway toll is to be charged on Pigouvian principles to cars entering the 401 at that time, should it be higher for cars entering near Oshawa (further east), or near Yonge Street (further west)?

6. A steel company is considering building a new plant which could cause external damage to a neighbouring laundry. Let the benefit of the plant to the steel company (in additional profits) be B and the cost of the plant to the laundry (in lost profits) be C. The difficulty is that the only the companies, and not the government, observe B and C. Instead, the government believes that

$$B = \begin{cases} 1 & \text{with 50\% probability} \\ 3 & \text{with 50\% probability} \end{cases}$$

   and

$$C = \begin{cases} 0 & \text{with 50\% probability} \\ 2 & \text{with 50\% probability} \end{cases}$$

   (a) If the government was able to learn the values of B and C, what decision rule should it use to determine whether the steel plant should be built or not, if it seeks to maximize aggregate profit of the two companies? What is the probability that the plant gets built, in terms of the above beliefs?

   (b) Now suppose the government can observe that $C = 2$, but it is uncertain about B in the way described above. Can the government impose a tax on the steel plant, if it is built, to achieve the efficient outcome of part (a)? If so, what is the tax rate?

   (c) Now suppose that the government is uncertain about both B and C, in the way described above. Does there exist a tax (or subsidy) policy that achieves the efficient outcome, in spite of government's uncertainty? Describe it in general terms and justify your answer by appealing to results proved in the lectures. For bonus points, write down the exact tax/subsidy system and prove that it achieves the efficient outcome.