14.41 Public Economics
Problem Set #2
Due: Friday, October 4 2002

1) Consider a one year project which costs $300,000, provides an income of $70,000 a year for five years, and costs $30,000 to dispose of at the very end of the fifth year.   Assume that the first payment comes at the start of the year after the project is undertaken.

a) Should the project be undertaken at a 0% discount rate? 2%? 5%? 10%?

b) Suppose that the cost of disposal is uncertain and that there is a fifty-fifty chance that the cost will be $10,000 and $30,000. How does this uncertainty affect the cost-benefit calculation in part a, assuming that the government is (1) risk-neutral and (2) risk-averse? How should the government account for the additional risk?

2) There are two types of residents in Brookline and Boston, professors and students. Professors have an income of Y=200; students have an income of Y=100. Both Brookline and Boston provide road repair services for their citizens. Professors value road repair more than students because they have nicer cars. In fact, the value of road repair to each individual takes the form: $((Y*R)/10) - (R^2/2)$. The *per-resident* cost of road repair is 5R.

a)   What is the marginal value of road repair for each type of individual? What is the marginal cost to each type of individual?

b)   How much do professors want to spend on road repair? How much do students want to spend?

c)   Assume that residents are distributed as follows:

	Brookline	Boston
Professors	50	25
Students	25	50

If each town uses majority voting to determine how much road repair to provide, how much will each town provide? Are any residents unsatisfied with the amount of road repair?

d)   Now assume that professors and students are able to migrate between Brookline and Boston. Which residents will choose to move? What will the equilibrium distribution of residents be? Are any residents unsatisfied with the amount of road repair now? Is the provision of road repair efficient? Why or why not?

e)   Consider again the pre-migration equilibrium. The state of Massachusetts decides to pass a law about road repair. It requires that professors in the state must contribute 75 towards road repair in the town where they live; students must contribute 25 towards road repair in the town where they live. How much road repair will there be in each town under the new regime? Will any residents want to move and, if so, where and why?

3) For several years, the US experienced budget surpluses. Some members of Congress proposed that we spend part of the surplus on education, but they couldn't agree on how the money should be spent. Identify the key economic aspects of the following questions in your answer.

(a) The federal Hope Scholarship program, which began in 1998, gives families who pay income taxes (those with incomes above about $20,000/year) a credit of up to $1500 against their federal income taxes for money spent on the first two years of college. Congressman A, whose district is in the suburbs, says that we should increase the amount of the Hope Scholarship program because people who go to college earn more and are better able to support their families. Is Congressman A correct? Evaluate his point as a justification for this program.

(b) Congressman B, whose district is in the inner city, says that we should spend more to improve our public elementary schools instead, because everyone goes to elementary school but only middle-class and upper-class people go to college. Evaluate this rationale for government spending on elementary education

(c) Congressman C, a former public economics student, overhears their conversation and says that the government shouldn't spend any more money on elementary education because each family has already chosen its preferred level of elementary education spending. Explain what her argument is and why you do or do not think it applies.

(d) Congressman D, a Republican, says that we should give each community a block grant that must be spent on local education. Congressman E, a Democrat, argues that we should instead have a program where we provide matching grants to localities to match their spending on hiring teachers. Which proposal is likely to lead to the largest increase in education spending, and why (use graphs in your answer)?

(e) The state of Massachusetts is also considering increasing its spending on education due to a state budget surplus. One proposal is to lower tuition at state universities by $1000. A second proposal is to give state residents a $1000 grant they can use to attend any university in the state. Discuss how these two proposals will affect college attendance and private spending on education. Explain which proposal you would support and why.

4) Imagine you are the governor of Massachusetts 15 years ago and need to decide if you should support the `Big Dig' construction project.

The `Big Dig' is estimated to take 7 years to complete. The project will require $45 million in construction materials per year and $20 million in labor costs per year. In addition, the construction will disrupt transportation within the city for the duration of the construction. The transportation disruption lengthens transport times for 100,000 workers by 30 hours a year. All workers are paid 15 dollars an hour (assume that there are no distortions and that the wage reflects each worker's per hour valuation of leisure).

The `Big Dig', when finished, will ease transportation within the city. Each of the 100,000 workers will have their transport time reduced by 35 hours a year as compared to the pre-construction transport time. In addition, part of the `Big Dig' project is converting the space formerly taken up by the elevated highway into a large park. The State of Massachusetts has determined that each worker will value the park at 40 dollars per year. No one else will use the park.

Assume the government has a 5% discount rate and that the workers live forever. The benefits to the `Big Dig' begin in year 7, assuming the project begins in year 0 (i.e. the project runs for 7 years, from t=0 to t=6).

(a) Should you, as the governor, proceed with the project? Formally show the cost/benefit analysis.

(b) It occurs to you, after completing the calculation in part (a), that it is possible the cost estimates are uncertain. If the construction materials estimate is $45 million with 50% probability and $100 million with 50% probability, should the project proceed? Assume that the government is risk neutral.

(c) Now assume the government is risk adverse. The certainty equivalent to the construction cost `gamble' is -$450 million. (Note that the certainty equivalent refers to the *entire* 7 years of uncertain construction costs). Should you proceed with the project?