

Answer the following questions using less than ten pages of text, diagrams, and equations. An electronic version of your exam should be e-mailed to me in pdf or word format at congleto@gmu.edu with the header "grad pf exam" by class time on April 13. Be sure to label all important details in any diagrams used.

(Partial credit will be given for entirely graphical solutions to any of the mathematical problems.)

1. Briefly define and discuss the relevance of the following terms. (20 points, about two pages):
 - a. club good
 - b. Pareto efficient outcome
 - c. Social welfare function
 - d. Ramsey tax
 - e. Fiscal illusion
 - f. Leviathan

2. (15 points, about one page) Construct a two person, three strategy public goods provision game that illustrates the free-rider problem.
 - a. Label all details and briefly describe the nature of the dilemma.
 - b. Now introduce a conditional tax or fine that is sufficient to solve the problem. Demonstrate that the new Nash equilibrium with the tax is Pareto efficient.
 - c. What is the smallest tax that that is sufficient to solve the problem illustrated by your the game?
 - d. Is your conditional tax a Pigovian tax? Why or why not (a short paragraph).

3. (10 points, about one page) Al's marginal benefit function for a pure public good is $MB_a = 300 - 2Q$ and Bob's MB function is $MB_b = 150 - Q$. Suppose that Al initially provides the public service and that it can be produced at constant costs with $MC = 60$.
 - a. Find the "high demander" output of the pure public good.
 - b. Find the Pareto optimal output of this public good.
 - c. Determine the Pigovian subsidy rate that can induce Al to produce the Pareto optimal level of the local public good.
 - d. Depict your results in a diagram, and label all details.

4. (10 points, about half a page) Tax Schedule Properties
 - a. Determine marginal and average tax rates for the following tax schedule:

$$T = C + .20Y$$

- b. Under what conditions is this tax schedule progressive, regressive, or proportional?
 - c. Explain briefly what you have done and the normative relevance of the progressivity concepts. (1-2 paragraphs).

5. (15 points, about a page) Suppose that two tax-revenue maximizing governments impose proportional taxes of t_1 and t_2 on labor in a setting in which labor demand is $1000 - 20w$, and labor supply is $30w$, where w is the prevailing wage.
 - a. Find the equilibrium wage and labor supply in the labor market that exists without a tax.
 - b. Find the equation that describes the tax revenue of one of the two governments as a function of the other's revenues.
 - c. Characterize one of the government's optimal (revenue maximizing) tax policies.
 - d. Characterize the Nash equilibrium for this fiscal commons problem.
 - e. How is the equilibrium tax burden distributed between firms and consumers?

6. (10 points, about a page) Suppose that two government jointly produce flood control for New Orleans: the Louisiana state government and the New Orleans city government. Suppose that both governments respond to their respective median voter interests in flood control. The state's median voter has expected net benefits equal to: $P(F)[B_s(F) - C_s(F)] - a c(F_s)$ and the city's median voter has expected net benefits $P(F)[B_c(F) - C_c(F)] - b c(F_c)$, where $F = F_s + F_c$ and cost share $b > a$.
 - a. Characterize each government's optimal investment in flood control, F_s^* and F_c^* , and discuss briefly the meaning of your results..
 - b. Characterize the Nash equilibrium of the flood control game and discuss briefly the meaning of your result. (Hint: your mathematical results will be quite abstract and general.)
 - c. Is this outcome Pareto efficient for the two median voters? (Briefly explain.)
 - d. What additional information would you need to characterize (model) the Pareto efficient level of flood control for New Orleans? (a long paragraph)

7. (20 points, 2-3 pages) discuss the pros or cons of Pigovian taxes as a source of central government revenue. (Hint: a complete answer will include one or more perspectives on optimal taxation, political decisionmaking, and some criticism of the alternatives that you chose not to use. Try to develop a consistent essay and include a few references to the relevant literature.)