**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**EC 741 Exam I Fall 2023**

**R. Congleton Graduate Public Economics I WVU**

This take-home exam is due Sunday October 8 at midnight. Your answers should be as clear and precise as possible.

Be sure to proof the exam before emailing it to me at [roger.congleton@mail.wvu.edu](mailto:roger.congleton@mail.wvu.edu).

Your exam file should have the name: **EC741-last name-exam1.docx**, where last name is obviously your last name.

I expect to grade the exams on Monday October 9, and plan to print them out and return them in class on Tuesday October 10. Good luck with the exam.

**This is an open book open notes exam.** No other web resources are permitted and no consultations with your fellow students or professors is permitted. If you find any of the questions to be less than clear, please write me at the above email address. The exam will take several hours to complete, so plan to have sufficient time to do a good job. Take-home exams are intended to be learning experiences. You should end the exam understanding more than you did when you started.

1. Review of Basic Concepts and Tools from Public Finance

* (20 points) Define and briefly discuss the relevance of the following terms as clearly and precisely as possible. (3 or 4 sentences should be sufficient for each.)

1. Normative Statement
2. Roving Bandit (Olson)
3. Fiscal Illusion
4. Progressive Tax
5. Ricardian Equivalence

* (20 points) In the space below, use neoclassical geometry to analyze the effects of a targeted tax (an excise tax) on markets and individuals.

1. First use supply and demand curves to illustrate the effect of such a tax on market prices and output, and the distribution of benefits and the cost of the subsidy. Label all important details.
2. On a separate diagram, use budget constraints and indifference curves to show the effect of the above tax on a typical consumer in the taxed market illustrated in “a.” Clearly label all relevant details.
3. On the same diagram, draw in the budget line and indifference curve associated with a lump sum or general tax that generates exactly the same revenue from this taxpayer, and discuss the sense in which such a tax can be said to be superior to the original excise tax.
4. A carbon tax can be thought of as an excise tax on fossil fuels. Discuss briefly the relevance of a, b, and c for such a tax system, and briefly discuss the case in which such a tax could be regarded as a Pigovian tax. (About two paragraphs should be enough.)

* 10 points) Determine the marginal and average tax rate schedules for the following income tax schedule:

T = C + .25Y

1. Provide the equations corresponding to the marginal tax rate and average tax rate schedules below.
2. Determine the values of C that makes the tax schedule (i) regressive, (ii) proportional, and (iii) progressive.
3. What values of C allow the tax schedule to be interpreted as guaranteeing a minimal income level? Explain briefly (2 or 3 sentences should suffice).
4. More Advanced Public Economics Questions and Analytics

* (15 points) Use marginal benefit and cost curves to analyze a three-person public goods problem.

1. First, illustrate the "high demander provides" equilibrium, in which one person provides all of the public good because his or her marginal benefits are greater than the others and the MC of the service is not prohibitive. Label the associated output level Q\*.
2. On the same diagram, determine whether this output level is Pareto efficient. If a different output would be Pareto optimal, label it Q\*\*. Briefly explain your reasoning. (1-2 sentences should be sufficient.)
3. Finally, draw in the Lindahl solution to this public goods problem on the same diagram. Label all important details.
4. Briefly explain why this possibility is of interest for the political economy of public policy. (One paragraph of 5-6 sentences should be sufficient, but more may be used if necessary).
5. Political Economy of Public Economics

* (15 points) Develop a calculus-based characterization of the median voter’s demand for a pure public good that will be funded through a proportional income tax (on all income). Total tax revenue will thus be tNYA, where YA is average income and N is the number of taxpayers. Assume that voters have similar utility functions, Ui=u(Xi, G), where Xi is the private consumption of individual i, which is determined by after-tax income, Xi = (1-t)Yi. Let G be the service level of a pure public good, and C=c(G) be the production cost of the public service. The median voter’s income is YV.

1. In the space below, characterize the optimization problem faced by a typical voter. (Hint: use the substitution method to express the optimization problem in terms of G.)

1. In the space below, characterize (mathematically) the ideal level of services and taxes for the median voter when there are N voter taxpayers.
2. What happens to the demand for this service if population (N) increases, other things being equal? What happens if median income increases? Explain your reasoning and demonstrate mathematically if possible. (Hint: apply the implicit function differentiation rule.)

* (20 points) Develop a calculus-based characterization of the median voter’s demand for a regulation that produces a pure public good such as environmental quality. Assume that the regulations reduce private consumption by raising prices or reducing pretax income or a combination of the two. Let Ui=u(Yi, E) where Yi = yi(R) is personal income (and private consumption) of voter i, R is regulatory stringency, and E = e( R, NYA(R)) is the effect of the regulation on the desired outcome, environmental quality. (NYA(R) is national income, with N being the number of workers and YA being average income.)

1. In the space below, write down the median voter’s optimization problem. (Hint: use the substitution method to express utility as a function of R and exogenous variables, N, and median private consumption XV.)
2. Characterize (mathematically) the ideal level of regulation for the median voter.
3. Explain why the median voter’s ideal level of regulation may be “too high” or “too low” relative to that that would maximize his or her own true utility.
4. Now think about the model. What additional variables could be added to strengthen the model? Suppose you were to estimate both the lean version developed in the question and the extended model that your answer to the first part of part of 5d implies. What variables would collect data on? Are there any statistical results that would tend to affirm or disconfirm the model? (2 paragraphs, about 5-6 sentences each.)