ECON 441: Handout 5
Midterm 1 Review
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Exercise 1: Externalities

A city of 1000 residents has an automaker (that acts competitively). Assume that the city is on an island, and is thus isolated from the outside world. The automaker sells cars x, and has a cost function $C(x) = \frac{1}{2}x^2$. The market demand curve for cars is $D(p) = 1000 - p$. However, each car sold increases pollution and the rate of car accidents. Assume the extra pollution and increase in the rate of accidents imposes a social cost of \$100 per car.

1. What is the private marginal benefit of a car?

2. What is the equilibrium quantity and price of cars that will be sold with no government intervention?

3. What is the socially optimal number of cars?

4. What is the deadweight loss associated with this market failure?

5. Propose a tax on consumers that would lead to the socially efficient quantity of cars.

6. What happens if this tax is instead imposed on the automaker?

Exercise 2: Public Goods

Joel and Greg are roommates and need to pool their money to pay for Wi-Fi quality, W. Each unit of Wi-Fi quality costs p. Let W_J, W_G denote the units of Wi-Fi quality that each roommate buys, respectively, and assume that total apartment Wi-Fi quality is additive. So $W = W_J + W_G$ (they cannot buy private Wi-Fi). Other than Wi-Fi, they spend money on "other consumption", C_J, C_G, respectively. Joel doesn't really care too much about Wi-Fi quality, and so he has preferences:

$$U_J(C_J, W) = C_J W$$

Greg, however, streams high-definition movies and cares a lot about having good quality Wi-Fi. He has Cobb-Douglas preferences:

$$U_G(C_G, W) = C_G^{\frac{1}{5}} W^{\frac{4}{5}}$$

Each roommate has income I. First assume that the roommates decide how much to spend on Wi-Fi without talking to each other.

1. What are the budget constraints for each roommate?

2. Find Joel's best response function.

3. Find Greg's best response function.

4. Define a Pure Strategy Nash Equilibrium in this context. Find such an equilibrium.

5. Assume that $p_w = 1$. Simplify your answer from above. How does the amount that each roommate spends on Wi-Fi compare to what they would do privately (i.e. if they lived alone)?