Problem 1 (25 minutes)

True/False/Uncertain. Provide brief justifications.

1. Caffeine is a highly addictive substance found in coffee, tea, and some soda. Therefore, its consumption should be regulated or taxed.

2. Voters rarely get to choose the exact level of spending on a public good. Instead, they are provided with two options—a proposed spending level posed by the government and a default (or "reversion") level that would be enacted if the proposal were rejected by voters. This behavior is consistent with a size-maximizing government.

3. The opportunity cost of a government purchase varies depending on whether the market for the purchased good is perfectly competitive or monopolistic. In the absence of cost concessions, a monopolist supplier will charge the government at a markup, making the project more costly.

4. Stratmann (1995) documented a condition of "logrolling" in Congress, in which members of Congress trade votes on one bill for votes on another. Logrolling should be banned since it is abuse of power by Congress members seeking to maximize their own benefits.

5. To evaluate the effectiveness of vouchers in improving educational attainment, we can offer a given number of vouchers to any student in a particular town on a first-come-first-serve basis and compare the educational performance of the student receiving vouchers with those who do not receive vouchers.

Problem 2 (25 minutes)

[Note: partial credit will be given for correct intuition, even if you cannot figure out the math.]

Two siblings, Amy and Bob both enjoy drinking coffee (C) and watching Netflix (N). Their utility functions are, respectively

$$U_A = ln(C_A) + 2 \cdot ln(N_A)$$

$$U_B = ln(C_B) + ln(N_B)$$

Let $p_C = 1$ be the unit price of coffee (\$/cup) and $p_N = 2$ the unit price of Netflix (\$/day). Let the total budget on coffee and Netflix be $I = \$20$.

Living in the same household, Amy and Bob share their Netflix account. Specifically, if one person pays for 1 day of Netflix, then the other person can also enjoy 1 day's Netflix for free. Hence, the actual amount of Netflix that one consumes is the sum of two individual quantities: $N = N_A + N_B$.

1. Suppose their parents care equally about both of them. What will be the level of coffee and Netflix consumption their parents choose for Amy and Bob?

2. Suppose their parents give \$10 each to Amy and Bob and tell them to choose their own coffee and Netflix consumption individually. What will be the total level of coffee and Netflix consumption? Note Amy and Bob still live in the same household and share the Netflix account.

3. Suppose their parents want to put either Amy or Bob in charge of coffee and Netflix spending. The person in charge will maximize the joint utility function with a personal bias. Specifically, if Amy is in charge of family finance, she will maximize $U = U_A + \frac{1}{2}U_B$ subject to the family budget constraint. On the other hand, if Bob is in charge of family finance, he will maximize $U = U_B + \frac{1}{2}U_A$ subject to the family budget constraint. Suppose that you are the parents of Amy and Bob. Who would you prefer to be in charge of the decision and why? How does your preferred outcome compare to parts 1 and 2 and why?

Problem 3 (30 minutes)

[Note: partial credit will be given for correct intuition, even if you cannot figure out the math.]

Anna and Ben each owns an oil company on the gulf coast. If Anna chooses to invest x_A units of resources in oil exploration and produce d_A barrels of oil, her production cost is

$$TC_A(d_A, x_A) = \frac{1}{2}d_A^2 + (x_A - 2)^2$$

Oil exploration yields an additional benefit if the identification of the location of oil allows for others to drill for oil more effectively. In particular, suppose Ben's total cost depends on the number of barrels of oil he drills d_B as well as Anna's investment in oil exploration:

$$TC_B(d_B, x_A) = \frac{1}{2}{d_B}^2 + 2d_B - x_A d_B$$

Assume oil sells in a perfectly competitive market for $p = \$2$ per barrel.

Accidents on oil rigs, which occur with probability $\delta = 0.6$, cause spills which damage the inhabitants of the gulf states. In the event of an accident, the combined value of damage to residential properties, long-term health, etc. is estimated to be \$2 per barrel. Suppose the damage can be costlessly recouped through the legal system. Assume all parties involved are risk neutral.

1. Identify all sources of externalities and classify them as positive, negative or both. Determine whether the Coase theorem applies.

2. What is the equilibrium amount of resources that Anna will invest in oil exploration x_A? Given Anna's choice of x_A, find the equilibrium level of Ben's production d_B.

3. What is the socially optimal level of d_A, d_B and x_A? Compare your answers from part 2 and 3.

4. Now suppose that the inhabitants of the gulf states **cannot** recoup any of the cost through the legal system. How does your answer to part 3 change? Explain the intuition.

5. Let's continue with the situation in part 4, where the cost cannot be recouped. Intuitively, what combination of two government policy instruments could move us towards the social optimum? Mathematically, can you calculate the optimal level of government intervention to be implemented?

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