

Econ 131  
Spring 2022  
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Final Exam

May 13

**Exam Instructions:**

- **Explanation should be written using pens (we recommend black or blue ink, as these often scan the best).** No pencils, except for graphs.
- **You must submit your solutions using the exam packet provided.** If you need more room to write your answers or need to re-draw a graph use the extra pages at the end. Make sure to note it clearly and accurately if your solutions continue on a different page.
- **Do not write your solutions on pages that say “Do not write on this page”.** Answers written on these pages will not be graded.
- **When time is called, STOP** writing, immediately **CLOSE** your exam packet and hold it up until it is collected by one of the GSIs.
- **Show your work.** Credit will only be awarded on the basis of what is written on the exam.
- **Sign the academic honesty pledge.** Cheating will be dealt with harshly.

Student Name:

Student ID Number:

**Affirm the academic honesty pledge below.** For those writing on a non-printed copy, please just write “Academic Honesty Pledge as on exam”, and sign your name.

**If you do not affirm this pledge, your exam will be marked invalid.**

**0. ACADEMIC HONESTY PLEDGE**

I confirm that I have abided by all academic honesty rules for UC Berkeley and Economics 131. I confirm that I did not see this exam before my official exam start time. I confirm that I have not shared and will not share this exam with anyone else. I confirm that I haven't copied from anybody else's exam.

Signature: \_\_\_\_\_

**1. True/False/Uncertain (20 points, 2 points per question.)**

Explain your answer fully based on what was discussed in class, since all the credit is based on the explanation. Your grade depends entirely on the substance of your justification, not on whether you are correct in writing “True” or “False”. Note that it is possible to answer each question for full credit with three sentences or fewer, and answers longer than ten lines long will not be graded.

- (a) Suppose three options for combatting climate change are put to a vote: L=low spending, M=medium spending, H=high spending. Suppose that M beats L in majority voting and that H beats M in majority voting. Does this imply that H beats L in majority voting?
- (b) A tax of \$1 per unit imposed on producers of good B has exactly the same economic impact as a tax of \$1 per unit imposed on consumers of good B.

(c) There is no need for government to provide retirement benefits as rational individuals can save for retirement themselves.

(d) More generous unemployment insurance benefits lead to longer unemployment spells, therefore the government should not provide any unemployment insurance benefits.

(e) Thanks to Obamacare, everybody in the United States can get affordable health care insurance.

(f) In the life-cycle model where people work and save when young and live off their savings and returns on savings when old, the government should not tax capital income.

(g) Majoring in economics in college has a large positive causal impact on future earnings.

(h) The spike in retirement hazard at the Early Retirement Age of 62 in the US Social Security system is evidence that many individuals do not follow the rational model of life-cycle savings.

(i) It is rational for someone to want the government to tax everyone in order to fund a public good and then for that person to try to avoid paying the tax herself.

(j) The optimal linear tax rate is never above the revenue maximizing tax rate.

## 2. Local Public Goods (20 points)

Destruction of wildlife due to wildfires is a serious problem in the state of Califirenia. The cities of Animaley (A) and Birdeley (B) are trying to decide how much they want to contribute to a joint fire department to provide fire protection services for both cities. The two cities ( $i = A, B$ ) have identical preferences:

$$U_i(x, F) = \log(x) + 3 \log(F),$$

where  $\log$  denotes the natural logarithm,  $x$  is each city's private consumption, and  $F$  is the sum of total contributions to the joint fire department. Animaley contributes  $f_A$  and Birdeley contributes  $f_B$  to finance fire services, so total spending on the joint fire department is  $F = f_A + f_B$ . Assume that  $p_x = p_F = 1$ , where  $p_x$  is the price of one unit of private consumption and  $p_F$  is the price of one unit of public good. Finally, assume that Animaley's budget is \$100 and Birdeley's budget is \$50.

- (a) What are the characteristics of a pure public good? Do fire departments and fire protection services fit these characteristics? Please explain why or why not **in no more than five sentences**. (3 points)

(b) For the rest of the problem, let's assume that the fire department is a pure public good. Write down the budget constraint and determine the private equilibrium level of contributions for each city,  $f_A$  and  $f_B$ . Show that total fire services  $F_{private}$  are equal to 60% of the total budget \$150 (\$150 is the sum of \$100 from town A and \$50 from town B). (3 points)

(c) Derive the socially optimal contribution to fire services  $F_{social}^*$  and express it as a percentage of the total budget \$150. Why is this percentage higher than in question (b)? *Hint: you don't need to derive socially optimal  $f_A^*$  and  $f_B^*$  separately.* (2 points)

- (d) Governor of Califirenia Gabby Oldsom is aware of the difference in private equilibrium contributions versus the social optimum level of fire protection for the two cities, and she proposes a block grant of \$30 that is to be distributed **proportionally** to cities' existing budgets, i.e., \$20 to town A and \$10 to town B. Derive the new levels of private contributions  $f_A$  and  $f_B$  in equilibrium. Discuss whether this block grant would help to achieve socially-optimal level of fire services spending under the free market allocation. *Hint: this last part does not require math and can be done with reasoning.*

*(3 points)*

- (e) Suppose that Governor Oldsom decides to drop the block grant idea. However, she is still determined to bring spending on fire services in both cities to the social optimum level. She approaches a prominent economist at the University of California at Berkeley (you) and asks them to design a matching grant proposal that would achieve this goal. A matching grant at rate  $g$  adds  $g$  dollars to any dollar of private contributions by Animateley and Berkeley. Therefore, we now have  $F = (1 + g) \cdot (f_A + f_B)$ . Derive the private equilibrium level of contributions for each city,  $f_A$  and  $f_B$  when the matching grant at rate  $g$  is in place. Derive the matching grant rate  $g$  that can deliver the social optimal level of fire services. (4 points)

For the rest of the problem, suppose that Animaley and Birdeley do not share their fire departments. Each city has 2 types of individuals, M and W. Type Ms want fire department contributions in their city to equal  $F = 60$ , while type Ws want contributions to equal  $F = 20$ . The population of Animaley has 60% type Ms, whereas the population of Birdeley has 60% type Ws.

(f) Explain (without maths) what mechanism for local public good provision could generate the socially optimal level of fire department services being provided in both cities and such that **all** type M and W individuals will be satisfied. *(3 points)*

(g) Why might the mechanism in (f) not work in the real world? **In no more than three sentences**, discuss all possible reasons you can think of. *(2 points)*

### 3. Disability Insurance (20 points)

In the country called Communalia, society consists of identical people each earning a wage  $W$  ( $W > \$10$ ) when they are employed. Each worker faces a probability  $q$  of sustaining a workplace injury. If injured, they become disabled, they cannot work and their total income goes down to \$10. All people have the same utility function of consumption  $C$ :

$$U(C) = \log(C),$$

where  $C$  equals to worker's total income.

- (a) What is the expression for the expected utility of each worker? (2 points)

Now, suppose that the government of Communalia introduces a disability compensation program. Under this system, individuals pay a tax  $t$  when they are employed (but not when they are injured as they can't work then) and get a benefit  $b$  when they are injured. The system must break even *in expectation*, that is, the benefits paid to injured workers must be equal to the taxes collected from employed workers.

- (b) Write down the government's break-even constraint and the expression for each worker's expected utility under this program. *Hint:  $t$  is a dollar tax, not a tax rate.* (2 points)

(c) What is the optimal worker compensation system? That is, what is the system that, subject to the government's break-even constraint, maximizes worker utility? Derive both the optimal benefit level  $b^*$  and the optimal tax  $t^*$ . (2 points)

(d) Without any calculations, can you say if the government compensation program from (c) beneficial for the workers? Would your answer change if worker preferences were of the  $U(C) = C$  form? If preferences were  $U(C) = \sqrt{C}$  instead, would the optimal program derived in (c) be the same or different? (3 points)

(e) Suppose now that the government of Communalialia wants to maximize its *expected* profit from the program instead of just breaking-even. Assuming the government decides to keep the benefits at the same level as  $b^*$  you found in (c) and assuming the workers would choose to stay in the program if they are indifferent, what is the highest possible amount of the tax,  $t^{max}$ , the government can charge? Simplify the resulting expression as much as you can. *Hint: you are asked to derive the worker individual rationality aka participation constraint.* (4 points)

(f) **For this question only**, assume that the wage is  $W = \$90$  and the probability of becoming disabled is  $q = \frac{1}{2}$ . Using your answer in (e), calculate the  $t^{max}$  that a profit-maximizing government would set. What would be its *expected* per-worker profit from this program assuming it still pays out the disability benefit  $b^*$  that you found in (c)? (2 points)

- (g) The workers of Communalia, astonished by the overt rent-seeking behavior of their government, overthrow it. The new government lifts the ban on private disability insurance and soon the country's insurance market becomes perfectly competitive, with private insurers offering disability plans at actuarially fair price. Assuming that workers cannot simultaneously own private insurance and participate in the government program, will the new government be able to continue running its worker compensation program at a positive profit? Explain using **no more than three sentences**. (2 points)
- (h) Suppose that the new government of Communalia decides to keep its worker compensation program and switches back to the break-even regime. Show that under actuarially fair price of private insurance plans, the workers will be indifferent between staying in the government program and buying private insurance. *Hint: under actuarially fair price, the expected utility of being privately insured is  $EU^{insurance} = U(W - p)$ , where  $p$  is the price of insurance, and the optimal private insurance benefit is  $b^* = W - 10$  (full insurance).* (3 points)

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