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Exam 2
Fall 2023

DO NOT OPEN THIS EXAM UNTIL YOU ARE TOLD TO DO SO.

Instructions

1. Write your SUID in the upper right corner of this exam. **DO NOT** write your name.

2. **SHOW ALL YOUR WORK**. Answers without supporting work will receive little or no credit.

3. There are 80 points possible on this exam and you will have 80 minutes to complete it. Be sure to budget your time accordingly.

4. You may write on the backs of pages, on the extra page at the end, or on extra sheets of paper but **BE SURE TO NOTE THAT NEAR THE QUESTION**.

5. If you use extra sheets of paper, please number them so you can do step 4 above.

6. Some formulas for areas:

$$A = \frac{1}{2}bh \qquad A = \left(\frac{b_1 + b_2}{2}\right)h$$

7. Some algebraic relationships for exponents:

$$(AB)^c = A^c B^c \qquad A^c A^d = A^{c+d} \qquad \frac{1}{\left(\frac{A}{B}\right)^c} = \left(\frac{B}{A}\right)^c \qquad (A^c)^d = A^{cd}$$

8. Some functions relevant for Cobb-Douglas preferences:

$$U = X^b Y^{1-b} \qquad X = \frac{bM}{P_x} \qquad Y = \frac{(1-b)M}{P_y} \qquad M = U * \left(\frac{P_x}{b}\right)^b \left(\frac{P_y}{1-b}\right)^{1-b}$$

Question 1 (15 points)

In much of the US, homes in federally-designated areas at risk of flooding ("floodplains" for short) are required to have flood insurance. Within a given floodplain, people with similar houses are typically charged similar prices for insurance. However, their chances of actually being flooded can vary a lot, so there can be substantial cross-subsidies.

To explore the issue, suppose that a given floodplain has two types of houses, low risk (L) and high risk (H), and owners in both groups are currently charged $2,500 a year for insurance. Additional data is given below, where WTA shows the true cost of providing insurance. To keep things simple, you can assume that everything about the houses other than their flood insurance costs has been built into the demand elasticities in the table (i.e., the elasticities show the responsiveness of the demand for houses to the cost of flood insurance). Finally, suppose climate change has recently raised the cost of insuring the H homes. The agency is now running a deficit of $4 million on the program and is considering eliminating the cross subsidy.

Variable	**Type L**	**Type H**
Houses	14,000	2,000
WTA per house	$2,000	TBD
Demand elasticity	-0.2	-0.2

(a) Please determine: ☐ the amount of extra revenue the agency is earning from the L houses; ☐ the agency's WTA for H houses; ☐ the new number of houses in each market if the cross subsidy is eliminated; ☐ the change in CS in each of the markets; and ☐ the overall change in social surplus for both markets together.

Question 2 (15 points)

High prescription drug prices have been a long-standing concern of US policymakers. The recent Inflation Reduction Act attempts to address the issue by allowing Medicare to negotiate prices on a small number of drugs that account for a large share of Medicare spending. In effect, the negotiated prices would be price ceilings. This question examines a stylized version of the policy.

Suppose that the market for a particular drug is initially in equilibrium with P = \$500 per prescription and Q = 1 M (one million) prescriptions. The government's goal is to lower the price of the drug as much as possible without reducing the quantity by more than 5%. The demand and supply are both very inelastic (typical of drug markets): the elasticity of demand is -0.5 and the elasticity of supply is 0.25.

(a) Please determine: ☐ the lowest price the government could choose consistent with its quantity goal; ☐ the change in CS and PS resulting from the policy; and ☐ the DWL it would create. Finally, ☐ briefly discuss who gains and who loses from the policy taking into account that the government itself pays for the drug on behalf of Medicare recipients.

Question 3 (5 points)

A household has the utility function and demand equations shown below (an unusual form known as quasilinear preferences since U is linear in Y). Please derive its expenditure function. Be sure to show the steps, not just the final result.

$U = Y - (100 - X^{0.5})^2$	$X = \frac{100^2 P_y^2}{\left(P_x + P_y\right)^2}$	$Y = \frac{M}{P_y} - \frac{100^2 P_x P_y}{\left(P_x + P_y\right)^2}$

Question 4 (15 points)

One of the households in the table to the right has perfect complements preferences and likes to have exactly *b* units of the X good for each unit of Y. In the remainder of Question 4, it will be referred to as the PC household.

Year	Px	Py	HH	Income	X	Y
2022	8	20	A	7800	600	150
			B	4800	300	120
			C	6400	300	200
			D	4200	375	60
2023	10	12	A	8320	496	280
			B	3600	180	150
			C	6750	375	250
			D	4600	250	175

(a) Please: ☐ determine which one is the PC household and calculate its value of *b*; ☐ derive the household's demand curves for X and Y (be sure to show the steps); and ☐ draw a diagram illustrating the household's 2023 equilibrium.

Year	Px	Py	HH	Income	X	Y
2023	10	12	A	8320	496	280
			B	3600	180	150
			C	6750	375	250
			D	4600	250	175

Question 4, continued

Now suppose that in 2023 the government decides to impose a $4 tax on X, a $2 subsidy on Y, and also gives the PC household a $690 lump sum subsidy. For convenience, the data for 2023 are repeated above. You may assume the supplies of X and Y are perfectly elastic so P_x would rise to $14 and P_y would fall to $10.

(b) Please calculate: ☐ the PC household's new values of X and Y under the policy; ☐ the overall effect of the policy on the government's budget; ☐ the CV, and indicate whether the household is better or worse off; and ☐ the net impact of the policy on social surplus.

Question 5 (15 points)

A household buys two goods, X and Y, and its preferences can be represented by the utility function below. Also shown are the household's demand equations and its expenditure function.

$U = (X^{0.5} + Y^{0.5})^2$	$X = \frac{M * P_y}{P_x(P_x + P_y)}$	$Y = \frac{M * P_x}{P_y(P_x + P_y)}$	$M = U * \left(\frac{P_x * P_y}{P_x + P_y}\right)$

Initially, $P_x = \$25$, $P_y = \$35$, and M = \$42,000. The government is considering a policy that would impose a \$10 tax on X. The supply of X is perfectly elastic and its price would rise to $P_x = \$35$.

(a) Please calculate: ☐ the initial equilibrium before the policy is enacted (both X and Y); ☐ the new value of X with the policy in place (it's OK to skip the new value of Y); ☐ the CV for the policy; and ☐ the policy's income and substitution effects for the X good.

Question 6 (15 points)

An individual's preferences about consumption in two periods, C_o and C_1, are given by a Cobb-Douglas utility function with the form: $U = C_0^{0.6} C_1^{0.4}$. In period 0, their income is \$100,000, and in period 1 it will fall to \$60,000. However, they also have an opportunity to enroll in either of the two training programs in the table below (one program at most). They can borrow or save at an interest rate of 20%.

Program	Tuition in 0	Raise in 1
A	\$25,000	\$60,000
B	\$42,000	\$72,000

(a) Please determine: ☐ which training program, if any, they should take; ☐ how much they consume in each period; and ☐ the amount they borrow or save in period 0. Finally: ☐ illustrate your results with an appropriate diagram showing their intertemporal budget constraint after they decide whether or not to take a training program, an indifference curve, and their equilibrium.

Additional page for calculations
If you use this, please remember to indicate near the question that part of the answer is here.