SUID:

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Exam 2
Fall 2024

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)

Older subway systems often charge a single fare even though longer trips cost more to provide. This question explores a stylized example. Suppose a city operates a subway that charges $2 per ride but serves two kinds of passengers: low cost riders (L) who are only traveling short distances, and high cost riders (H) who are traveling longer distances. The table below provides information about the number of daily passengers of each type, their demand elasticities, and the subway's underlying WTA to serve them. The subway is currently running a deficit of $40,000 per day and is considering raising the price to $2.25 for all riders.

Variable	**Type L**	**Type H**
Passengers	200,000	80,000
Demand elasticity	-0.4	-0.2
WTA per rider	$1	TBD

(a) Please determine: ☐ the amount of extra revenue the subway is currently earning each day from the L riders; ☐ the subway's WTA for H riders; ☐ the new number of daily riders in each market if the subway goes ahead with the price increase; and ☐ the change in daily revenue in each market. Finally, ☐ does the new price eliminate the deficit?

Question 2 (15 points)

An EpiPen is a prescription device for patients with severe allergies. When used, it injects a dose of epinephrine (commonly known as adrenalin) that can save the life of someone having an acute allergic reaction. The market for EpiPens is unusual because both demand and supply are very inelastic. EpiPens used to sell for around $30 each but about a decade ago, the company that makes them was sold to a new owner who took advantage of the inelastic demand by raising the price to about $300 each. In response, several states have recently passed laws effectively imposing a price ceiling of $30 on EpiPens.

Starting from the $300 market price, please analyze the impact of a national $30 price ceiling on EpiPens. In the absence of the price control, about 3 million EpiPens are sold each year. You may assume that the demand elasticity is -0.1 (small) and the supply elasticity is 0.02 (very small).

(a) Please determine: ☐ the new quantity of EpiPens sold; ☐ the change in CS and PS resulting from the policy; and ☐ the DWL the policy would create. Finally, ☐ briefly discuss the transfer caused by the policy.

Question 3 (5 points)

A household has the utility function and demand equations shown below. Please derive its expenditure function. Be sure to show the steps, not just the final result.

$U = (X + 20)^{0.4}(Y - 60)^{0.6}$	
$X = -20 + \frac{0.4(M + 20P_x - 60P_y)}{P_x}$	$Y = 60 + \frac{0.6(M + 20P_x - 60P_y)}{P_y}$

This is an example of a Stone-Geary utility function, which is an enhanced version of Cobb-Douglas.

Year	Px	Py	HH	Income	X	Y
2023	10	10	A	3360	273	63
			B	3900	260	130
			C	5000	400	100
			D	3200	160	160
2024	12	8	A	3520	250	65
			B	4000	250	125
			C	4800	320	120
			D	3360	112	252

Question 4 (15 points)

One of the households in the table to the right has Cobb-Douglas preferences. In the remainder of Question 4, it will be referred to as the CD household.

(a) Please: ☐ determine which one is the CD household and calculate its value of *b*; then ☐ draw a diagram illustrating the household's 2024 equilibrium. Please note that information about the key functions associated with Cobb-Douglas preferences is given on the cover of the exam.

Year	Px	Py	HH	Income	X	Y
2024	12	8	A	3520	250	65
			B	4000	250	125
			C	4800	320	120
			D	3360	112	252

Question 4, continued

Now suppose that in 2024 the government decides to impose a $2 subsidy on X, a $4 tax on Y, and also imposes a $600 lump sum tax. For convenience, the data for 2024 are repeated above. You may assume the supplies of X and Y are perfectly elastic so P_x would fall to $10 and P_y would rise to $12.

(b) Please calculate: ☐ the CD 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.

$U = X^{0.5}(Y + 100)^{0.5}$	$X = \frac{0.5M + 50P_y}{P_x}$	$Y = -50 + \frac{0.5M}{P_y}$	$M = -100P_y + 2UP_x^{0.5}P_y^{0.5}$

Initially, $P_x = \$100$, $P_y = \$100$, and M = \$100,000. 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 $P_x = \$110$.

(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 is concerned about consumption in two periods, 0 and 1. In period 0, their income is $100,000, and in period 1 it will rise to $120,000. 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 25% want to have exactly 2 units of consumption in period 0 for each unit of consumption in period 1.

Program	Tuition in 0	Raise in 1
A	$52,000	$100,000
B	$10,000	$58,000

(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.