SUID:

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Exam 2
Fall 2018

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 75 points possible on the exam and you'll have 80 minutes to work on it. Budget your time accordingly.

4. Do all your work on this exam. If you need extra space, write on the backs of the pages. However, if you do write an answer on the back of a page, be sure you've **NOTED THAT NEAR THE QUESTION**.

5. Some formulas for areas:

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

6. Some algebraic relationships for exponents:

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

7. The general form of the Cobb-Douglas utility function, its demand equations, and its expenditure function:

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

Question 1 (15 points)

A number of US political figures have recently called for price controls on prescription drugs. Price controls would have two kinds of effects: (1) immediate impacts on the markets for existing drugs, and (2) long term impacts on drug development. This question focuses on the immediate impacts; we'll talk about the long term issue later in the semester.

Suppose that the market for a particular drug is initially in equilibrium with $P = \$200$ per prescription and $Q = 1M$ (one million) prescriptions. The government is considering policy that would limit the price to $100. The demand and supply are both very inelastic (typical of drug markets): the elasticity of demand is -0.2 and the elasticity of supply is 0.1.

(a) Please determine: ☐ the new quantity of prescriptions under the policy; ☐ the changes in CS and PS; and ☐ the DWL the policy would create. Finally, briefly discuss the size of the transfer caused by the policy relative to the DWL; why does it turn out that way?

Question 2 (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. Then calculate the amount of income the household would need to get a utility of 400 when $P_x = 10$ and $P_y = 15$.

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

Question 3 (10 points)

HH	Year	Income	Px	Py	X	Y
A	2017	4400	10	12	380	50
	2018	3800	12	10	300	20
B	2017	1890	10	12	135	45
	2018	2300	12	10	150	50
C	2017	3300	10	12	180	125
	2018	3960	12	10	150	216
D	2017	2400	10	12	180	50
	2018	2000	12	10	125	50

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

(a) Please: ☐ determine which one is the CD household and calculate its value of *b*; ☐ draw a diagram illustrating the CD household's 2018 equilibrium. Please note that information about the key functions associated with CD preferences is given on the cover of the exam.

HH	Year	Income	Px	Py	X	Y
A	2018	3800	12	10	300	20
B	2018	2300	12	10	150	50
C	2018	3960	12	10	150	216
D	2018	2000	12	10	125	50

Question 3, continued

Now suppose that in 2018 the government wants to revise the tax system. It wants to shift the CD household's consumption toward X and away from Y by imposing a $2 subsidy on X and a $2 tax on Y. In addition, an analyst has recommended that the government impose a $200 lump sum income tax on the household to make the policy close to revenue-neutral (zero impact on the budget). 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. For convenience, the data for 2018 are repeated above.

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

Question 4 (15 points)

One of the households in the table to the right regards X and Y as perfect complements and always buys h units of good X for each unit of good Y. In the remainder of the exam, this will be referred to as the PC household.

HH	Year	Income	Px	Py	X	Y
A	2017	4400	10	12	380	50
	2018	3800	12	10	300	20
B	2017	1890	10	12	135	45
	2018	2300	12	10	150	50
C	2017	3300	10	12	180	125
	2018	3960	12	10	150	216
D	2017	2400	10	12	180	50
	2018	2000	12	10	125	50

(a) Please: ☐ *derive* the PC household's demand equations for X and Y in terms of h, P_x, P_y and income M (be sure to show the steps involved, don't just write down the demand equations); and ☐ determine which one of the households in the table has perfect complements preferences and calculate the value of h.

HH	Year	Income	Px	Py	X	Y
A	2018	3800	12	10	300	20
B	2018	2300	12	10	150	50
C	2018	3960	12	10	150	216
D	2018	2000	12	10	125	50

Question 4, continued

Now suppose that in 2018 government imposes a slight variation on the policy from Question 3: a $2 subsidy on X and $2 tax on Y (both the same as before), but imposes a $242 lump sum income tax on the PC household (slightly more than before).

(b) Please compute: ☐ the PC household's new equilibrium; ☐ the overall effect on the government's budget, and indicate whether the policy is close to being revenue neutral; ☐ the CV; and ☐ indicate whether the household is better or worse off. Finally, show the new equilibrium in a well-labeled diagram.

Question 5 (15 points)

A household buys two goods, X and Y, and its preferences can be represented by the utility function shown below (this is a generalization of Cobb-Douglas known as Stone-Geary). Also shown are the household's demand equations and its expenditure function.

$U = (X - 20)^{0.5}(Y + 20)^{0.5}$	$X = 10 + \dfrac{0.5M + 10P_y}{P_x}$
$M = 20\left(P_x - P_y\right) + 2UP_x^{0.5}P_y^{0.5}$	$Y = -10 + \dfrac{0.5M - 10P_x}{P_y}$

Initially, $P_x = \$40$, $P_y = \$80$, and M = \$60,000. The government is considering a policy that would impose a \$16 tax on X. The supply of X is perfectly elastic and its price would rise to $P_x = \$56$.

(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 total government revenue raised by the tax; ☐ 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_0 and C_1, are given by a Cobb-Douglas utility function with the form: $U = C_0^{0.5} C_1^{0.5}$. In period 0 her income is \$50,000, and in period 1 it will rise to \$84,000. However, she has an opportunity to enroll in a training program that would cost \$20,000 in period 0 but raise her income in period 1 by \$36,000. She can borrow or save at an interest rate of 20%.

(a) Please determine: ☐ whether or not she should take the training program; ☐ how much she consumes in each period; and ☐ the amount she borrows or saves in period 0. Finally: ☐ illustrate your results with an appropriate diagram showing her intertemporal budget constraint after she decides whether or not to take the training program, an indifference curve, and her equilibrium.

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