Name_____

FALL 2016

ECON 501 - MICROECONOMIC THEORY I

Answer only 5 of the following 6 questions. Each question worths 20 points.

1) Suppose the table below lists the price and consumption levels of food and clothing during 1990 and 2000. Calculate a Laspeyres index using 1990 as the base year.

Year	Prices		Consumption	
	Food	Clothing	Food	Clothing
1990	5.00	3.00	100	75
2000	6.25	3.35	110	87

2) Janice Doe consumes two goods, X and Y. Janice has a utility function given by the expression:

$U = 4X^{0.5}Y^{0.5}$.

The current prices of X and Y are 25 and 50, respectively. Janice currently has an income of 750 per time period.

a. Write an expression for Janice's budget constraint.
b. Calculate the optimal quantities of X and Y that Janice should choose, given her budget constraint.
c. Suppose that the government rations purchases of good X such that Janice is limited to 10 units of X per time period. Assuming that Janice chooses to spend her entire income, how much Y will Janice consume?
d. Calculate the impact of the ration restriction on Janice's utility.

3) The demand curves for steak, eggs, and hot dogs are given in the table below. The current price of steak is $5. The price of eggs is $2.50, and the price of hot dogs is $0.75. Fill in the first column of the table using this information. Indicate which goods are substitutes and which goods are complements.

Good	Demand Equation	Steak Price Elasticity of Demand	Egg Price Elasticity of Demand	Hotdog Price Elasticity of Demand
Steak	$D_S = 500 - 2P_S - \frac{1}{10}P_E + P_H$			
Egg	$D_E = 75 - 3P_E - P_S + \frac{1}{10}P_H$			
Hotdog	$D_H = 300 - \frac{1}{2}P_H + P_S + \frac{1}{10}P_E$			

4) In a city with a medium sized population, the equilibrium price for a city bus ticket is $1.00, and the number of riders each day is 10,800. The short-run price elasticity of demand is -0.60, and the short-run elasticity of supply is 1.0.

a. Estimate the short run linear supply and demand curves for bus tickets.
b. If the demand for bus tickets increased by 10% because of a rise in the world price of oil, what would be the new equilibrium price of bus tickets?
c. If the city council refused to let the bus company raise the price of bus tickets after the demand for tickets increases (see (b) above), what daily shortage of tickets would be created?

5) The U.S. Department of Agriculture is interested in analyzing the domestic market for corn. The USDA's staff economists estimate the following equations for the demand and supply curves:

$Q_d = 1{,}600 - 125P$

$Q_S = 440 + 165P$

Quantities are measured in millions of bushels; prices are measured in dollars per bushel.

a. Calculate the equilibrium price and quantity that will prevail under a completely free market.
b. Calculate the price elasticities of supply and demand at the equilibrium values.
c. The government currently has a $4.50 bushel support price in place. What impact will this support price have on the market? Will the government be forced to purchase corn under a program that requires them to buy up any surpluses? If so, how much?

6) Explain why two indifference curves cannot intersect.

1) The Laspeyres Index is calculated as follows:

$$LI = \frac{P^{F}_{2000} F_{1990} + P^{C}_{2000} C_{1990}}{P^{F}_{1990} F_{1990} + P^{C}_{1990} C_{1990}} = \frac{(6.25)100 + (3.35)75}{(5)100 + (3)75} = \frac{876.25}{725} = 1.209.$$

The Paasche Index is calculated as follows:

$$PI = \frac{P^{F}_{2000} F_{2000} + P^{C}_{2000} C_{2000}}{P^{F}_{1990} F_{2000} + P^{C}_{1990} C_{2000}} = \frac{(6.25)110 + (3.35)87}{(5)110 + (3)87} = \frac{978.95}{811} = 1.207.$$

2) *a.*

$I = P_X X + P_Y Y$

$750 = 25X + 50Y$

b.

Optimal Combination:

$$MRS = \frac{P_X}{P_Y}$$

$$MRS = \frac{MU_X}{MU_Y} = \frac{2}{2} \qquad \frac{\frac{Y^{.5}}{X^{.5}}}{\frac{X^{.5}}{Y^{.5}}}$$

$$MRS = \frac{Y}{X}$$

$$\frac{P_X}{P_Y} = \frac{25}{50} = \frac{1}{2}$$

Equating MRS to $\frac{P_X}{P_Y}$:

$$\frac{Y}{X} = \frac{1}{2}, \; Y = \frac{1}{2}X$$

Janice should buy 1/2 as much Y as X.

Recall $750 = 25X + 50Y$

Substitute $(1/2)X$ for Y

$750 = 25X + 50(1/2)X$

$750 = 25X + 25X$

$750 = 50X$

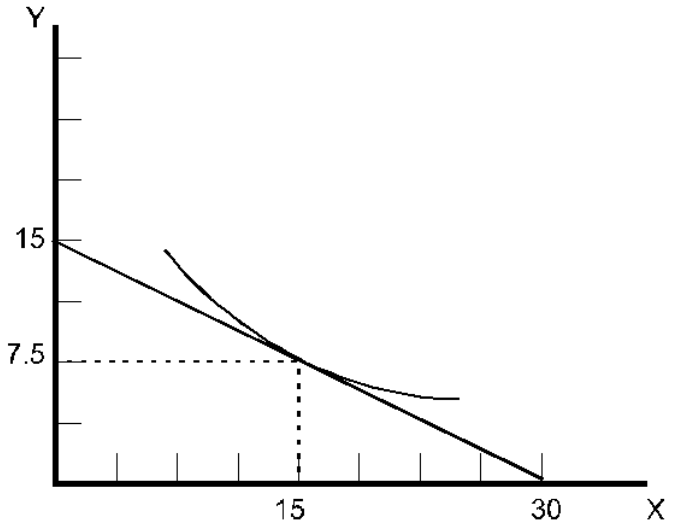
$X = 15$

$Y = (1/2)X$

$Y = (1/2)(15)$

$Y = 7.5$

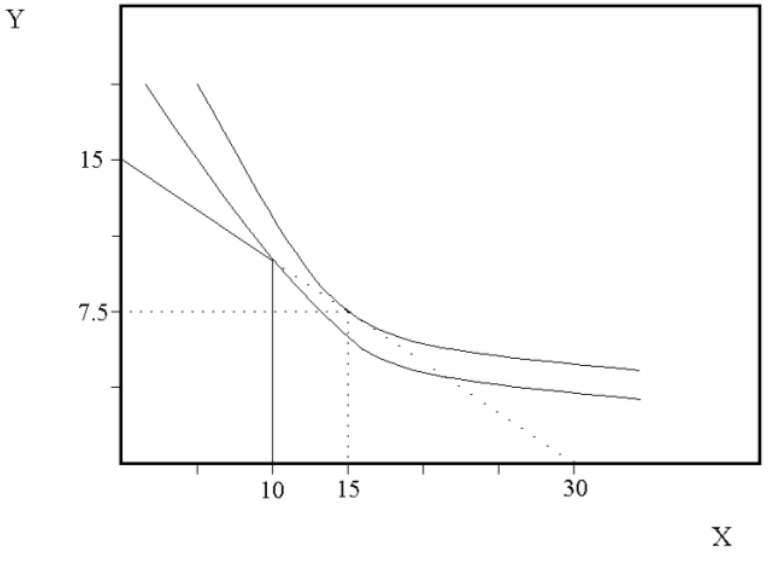
Janice should consume 7.5 units of Y and 15 units of X.



c.

750 = 25X + 50Y
X = 10
750 = 25(10) + 50Y
500 = 50Y
Y = 10

As indicated in the graph below, at Janice's optimal bundle with the restriction, $\frac{MU_X}{P_X} > \frac{MU_Y}{P_Y}$. This implies Janice should consume more *X* to increase utility. However, the ration restriction prevents her from doing so. Given the restriction, this is the best Janice can do.



d.

Janice's utility without the restriction is: $U(x = 15, y = 7.5) = 4(15)^{0.5}(7.5)^{0.5} = 42.43$. Janice's utility with the restriction is: $U(x = 10, y = 10) = 4(10)^{0.5}(10)^{0.5} = 40$. The ration restriction results in a utility loss of 2.43 utils for Janice.

3)

Good	Demand Equation	Steak Price Elasticity of Demand	Egg Price Elasticity of Demand	Hotdog Price Elasticity of Demand
Steak	$D_S = 500 - 2P_S - \frac{1}{10}P_E + P_H$	-0.020	-0.00051	1.53
Egg	$D_E = 75 - 3P_E - P_S + \frac{1}{10}P_H$	-0.079	-0.24	1.20E-4
Hotdog	$D_H = 300 - \frac{1}{2}P_H + P_S + \frac{1}{10}P_E$	0.016	0.00082	-0.0012

Steak and eggs are complements. Steak and hotdogs and eggs and hotdogs are substitutes.

4) Given: $P^* = \$1.00$ per ticket $Q^* = 10{,}800$
$E_d = -0.60$ $E_S = 1.0$

a.

Demand: $Q_d = a_0 + a_1P$ Supply: $Q_S = b_0 + b_1P$

Use: $E = \frac{P}{Q} \times \frac{\Delta Q}{\Delta P}$ to compute a_1 and b_1.

$E_d = \frac{1}{10{,}800}a_1$ $E_S = \frac{1}{10{,}800}b_1$

$-0.60 = \frac{1}{10{,}800}a_1$ $1.0 = \frac{1}{10{,}800}b_1$

$a_1 = -6{,}480$ $b_1 = 10{,}800$

Solve for a_0 from $Q_d = a_0 + a_1P$

$10{,}800 = a_0 - 6{,}480.00(1.0)$

$a_0 = 17{,}280$

$Q_d = 17{,}280 - 6{,}480P$

Solve for b_0 from $Q_S = b_0 + b_1P$

$10{,}800 = b_0 + 10{,}800.00(1.0)$

$b_0 = 0.0$

$Q_S = 0.0 + 10{,}800P$

b.

New demand = $(1.10)Q_d = (17{,}280 - 6{,}480P)(1.10)$

$Q_d' = 19{,}008.00 - 7{,}128P$

Equate Q_d' to Q_S to get new equilibrium price.

$19{,}008 - 7{,}128P = 0.0 + 10{,}800P$

$P^* = \$1.06$ per ticket

c.

The shortage would be the quantity demanded at P = \$1.00 minus the quantity supplied at P=\$1.00.

$Q_d = 19{,}008 - 7{,}128(\$1.00) = 11{,}880$

$Q_S = 0.0 + 10{,}800(\$1.00) =$ 10,800
Shortage = 11,800 - 10,800 = 1,080 rides per day

d.
No. The bus company has no incentive to supply more than 10,800 rides per day, as long as the price is restricted at $1.00.

5) *a.*
Set $Q_d = Q_S$ to determine price.

$1600 - 125P = 440 + 165P$
$1160 = 290P$
$P = 4$

Obtain Q by substituting into either expression.

$Q_d = 1600 - 125(4)$
$Q_d = 1600 - 500$
$Q = 1100$
$P^* = \$4$, $Q^* = 1100$

b.
For the Own Price Elasticity of Demand $E = -125 \times \frac{4}{1100} = -0.45$ (approximately)

For the Own Price Elasticity of Supply $E = -165 \times \frac{4}{1100} = 0.60$

c.
Calculate Q_d and Q_S at the $4.50 price.

$Q_d = 1600 - 125(4.5)$
$Q_d = 1037.5$
$Q_S = 440 + 165(4.5)$
$Q_S = 1182.5$
surplus = $Q_S - Q_d = 1182.5 - 1037.5 = 145$

The support price would create an excess supply of 145 million bushels that the government would be forced to buy.

6)