TOTAL OF 3 EXAMS
88
+59
+70
72.3%

Massachusetts Institute of Technology
Department of Economics

14.01 Principles of Microeconomics
Final Exam
Wednesday, December 19th, 2007

Last Name (Please print): YOUNG

First Name: SCOTT

MIT ID Number: _____

Instructions. Please read carefully.

The exam has a total of 100 points. Answers should be as concise as possible. This is a closed book exam. You are not allowed to use notes, equation sheets, books or any other aids. You are not allowed to use calculators. You must write your answers in the space provided between questions. DO NOT attach additional sheets of paper. This exam consists of (18) sheets (14 pages + 4 blank pages for scratch work).

0. Circle Your Section/Recitation (1 point):

Please circle the section or recitation which you are attending below. The marked exam will be returned to you, in the section or recitation that you indicate. You will loose 1 point if you leave it unselected.

S01: MWF9	(Peter Schnabl)	R01: F10	(Rongzhu Ke)
S02: MWF10	(Chia-Hui Chen)	R02: F11	(Rongzhu Ke)
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S04: MWF1	(Monica Martinez-Bravo)	R04: F12	(Marco Migueis)
		R05: F1	(Marco Migueis)
		R06: F2	(Marco Migueis)

DO NOT WRITE IN THE AREA BELOW:

Question 1 5/25	Question 2 5/5
Question 3 25/25	Question 4 15/25
Question 5 19/19	Question 0 1/1

Total 70/100

1. True/False Questions (*TOTAL: 20 points*)**:**

In this section, write whether each statement is True or False. Please fully explain your answer, using a diagram if appropriate. No credit will be given for an answer without an explanation.

(a) (*5 points*) After Professor Wheaton promises that no one would fail, students never study and turn in problem sets again. This is an example of adverse selection problem.

True. By promising no failures students aren't incentivized to study.

X

(b) (*5 points*) When a firm chooses among different projects, the one which has the highest present value is always the one with the highest yield rate.

False. Yield rate is return over time as a percentage. PV could be higher if the discount rate is steep.

✓

(c) (*5 points*) If the government guarantees a binding price floor for agricultural output by purchasing any surplus, then the demand for farm labor will be more elastic.

False. As producer surplus increases, demand for labor should become more inelastic as producers are more willing to pay higher to hire work.

X

(d) (5 points) Exploitation Mining Co. is the only employer in the remote town of Uranium City and pays its workers $10.00/hour. If the government forces the company to raise its wage by a small amount—say to $10.10/hour—then it will hire more workers.

False. Higher wages reduce the demand for labor in the production function.

X

(e) (*5 points*) A factory that pollutes a river has negative externalities on residents along the river. If the factory and residents can negotiate, an efficient result can be achieved only if the property right of the river is assigned to the residents.

True. By Coase's Theorem.

X

Short Question:

2. (*5 points*) A and B play rock, paper, scissors. Their payoffs are as follows (the first number is A's payoff and the second number is B's payoff):

		B		
		Rock	Paper	Scissors
A	Rock	0,0	-1,1	1,-1
	Paper	1,-1	0,0	-1,1
	Scissors	-1,1	1,-1	0,0

How many Nash equilibria are there in the game? Explain.

None. There are no choices which lead to an outcome for both players in which they wouldn't prefer to switch strategies. ✓

Long Questions:

3. *(25 points)* Suppose that Intel has a monopoly in the market for computer chips. In order to produce X computer chips, it costs Intel $C(X) = 2X^2$.

(a) (*2 points*) Find the marginal cost of producing a computer chip for Intel.

$MC = 4x$

✓

(b) (*6 points*) The demand for computer chips is $X_D = 12 - 0.25P$. Find the level of output that maximizes Intel's profits. What price is Intel charging?

$Q = 12 - \frac{1}{4}P$

$48 - 4Q = P$

$\underset{max}{\pi} = P \cdot Q - C(Q)$

$= (48 - 4Q)Q - 2Q^2$

$= 48Q - 4Q^2 - 2Q^2$

$0 = 48 - 12Q$

$Q = 4$

$P = 32$

✓

(c) (*4 points*) What level of output would maximize total surplus in the computer chip market?

Total surplus maximized when:

$P = MC$

$MC = 4Q$

$Q = 12 - (.25)(4)Q$

$Q = 12 - Q$

$\boxed{Q = 6}$

$P = 24$

(*d*) (*4 points*) Suppose the government knew the demand and production functions. Find a price regulation the government could impose that would induce Intel to maximize total surplus, i.e., produce the efficient quantity from part (c).

Set a price ceiling at $P = 24$.

(e) (*6 points*) If the government subsidized Intel s for every unit of computer chips produced, what quantity would Intel choose? Find the choice of subsidy that maximizes total surplus, i.e., induces Intel to produce the efficient quantity from part (c).

$$\begin{aligned}
\underset{max}{\Pi} &= PQ - C(Q) \\
&= (P+s)Q - C(Q) \\
&= (48 - 4Q + s)Q - C(Q) \\
&= 48Q - 4Q^2 + sQ - 2Q^2 \\
0 &= 48 + s - 12Q \\
Q &= \frac{48+s}{12} \\
6 &= 4 + \frac{s}{12}
\end{aligned}$$

$s = 24$ ✓

(f) (*3 points*) Both the price regulation policy from part (d) and the subsidy policy from part (e) maximize total surplus. Is there any reason someone might prefer one policy over the other?

The policy in (e) requires 48 in government revenue, making it less attractive to taxpayers. The policy in (d) is less profitable so it would be less favored by Intel.

4. (*25 points*) Firm 1 and firm 2 are the only producers of spring water in the market. The market demand for spring water is given by $P = 70 - Q_1 - Q_2$. Firm 1 and firm 2 compete by choosing quantities Q_1 and Q_2 respectively. Each firm has a marginal cost of 10 and no fixed cost.

(a) *(5 points)* Find out firm 1's and firm 2's reaction functions.

$$Q_1(Q_2) = Q_2(Q_1)$$

$$30 - \frac{Q_1}{2} = Q_2$$

$\max \Pi_1(Q_2) =$

$\max \Pi_1 = PQ_1 - 10Q_1$

$(70 - Q_1 - Q_2)Q_1 - 10Q_1$

$= (70 - Q_1 - Q_2)Q_1 - 10Q_1$

$= 60Q_1 - Q_1^2 - Q_1Q_2 - 10Q_1$

$Q_1 = \frac{60 - Q_2}{2} = 30 - \frac{1}{2}Q_2$

$0 = 60 - 2Q_1 - Q_2$

$Q_2 = \frac{60 - Q_2}{2} = 30 - \frac{1}{2}Q_1$

$\frac{60 - Q_2}{2} = Q_1$

$30 - \frac{Q_2}{2} = Q_1$

$30 - \frac{30 - \frac{Q_2}{2}}{2} = Q_2$

$30 - 15 - \frac{Q_2}{4} = Q_2$

$15 = \frac{5}{4}Q_2$

$Q = 12$

(b) (*5 points*) Suppose the two firms choose quantities simultaneously. What are the equilibrium price, quantities, and profits of the two firms in this market?

$$Q_1 = 30 - \tfrac{1}{2}(30 - \tfrac{1}{2}Q_1)$$

$$Q_1 = 30 - 15 + \tfrac{1}{4}Q_1$$

$$\tfrac{3}{4}Q_1 = 15$$

$Q_1 = 20 = Q_2$

$P = 70 - 40 = 30$

$\Pi_1 = \Pi_2 = 400$

(c) (*5 points*) Suppose only firm 1 has a chance to bribe the government and get the right to choose the quantity first, what is the maximum amount of money that firm 1 is willing to pay? If firm 1 gets to move first, what are the equilibrium quantities and profits of firm 1 and firm 2? [*Hint: if firm 1 does not bribe the government, the two firms will choose quantities simultaneously as in (b).*]

Given $Q_2 = 30 - \frac{1}{2}Q_1$

$\max \Pi_1 = PQ_1 - 10Q_1$

$= (70 - Q_1 - Q_2)Q_1 - 10Q_1$

$= 70Q_1 - Q_1^2 - (30 - \frac{1}{2}Q_1)Q_1 - 10Q_1$

$= 70Q_1 - Q_1^2 - 30Q_1 + \frac{1}{2}Q^2 - 10Q_1$

$= -\frac{1}{2}Q_1^2 + 30Q_1$

$0 = 30 - Q_1$

$Q_1 = 30, \quad Q_2 = 15, \quad P = 25$

$\Pi_1 = 500 \quad \therefore$ max bribe = 100 50

(d) (*5 points*) Now back to the situation that the two firms choose quantities simultaneously. Suppose the two firms decide to collude and share the profit equally. Assume that both firms value their reputation and will behave according to their agreement. What are the quantities they will choose for each firm? What is the profit of each firm?

$P = 70 - Q$

$\max \Pi = PQ - 10Q$

$= (70 - Q)Q - 10Q$

$= 70Q - Q^2 - 10Q$

$0 = 60 - 2Q$

$30 = Q, \quad P = 40$

$\therefore$ each firm will produce 15, with a profit of 450.

(e) (*5 points*) Suppose the two firms decide to collude and share the profit equally, but both firms do not care about their reputation and might try to take advantage of the other. Foreseeing this, they make a legally enforceable contract saying that if a firm does not produce the quantity agreed, it has to pay some penalty to the other firm. What is the minimum amount of penalty that ensures each firm producing the right quantity agreed in part (d).

50

Since defection profits are 500 and cooperative profits are 450, the price of defecting must be at least 50.

56.25

5. (*19 points*) The country of Economia has two industries. In the Clothing industry, the marginal product of labor is always 1. In the Steel industry, the marginal product of labor is $12L_S^{-1/2} - 2$, where L_S is the total number of workers employed in the Steel sector. The total supply of labor in Economia is fixed at $L_C + L_S = 25$, and the output price is 1 for both Clothing and Steel.

   (a) (7 points) Suppose that the labor market is competitive. How many workers will be employed in the Clothing sector, and how many in the Steel sector? What wage rate will workers in each sector receive? *[Hint: Workers can switch sectors at will. What does that imply about wages in the two sectors?]*

$1 = \frac{12}{\sqrt{L_S}} - 2$

$3\sqrt{L_S} = 12$

$\sqrt{L_S} = 4$

$L_S = 16$

$L_S = 16$

$L_C = 25 - 16 = 9$

wage (for both) = 1

(b) (8 points) Suppose that workers in the Steel sector form a union, which acts as a monopolist in supplying labor to the Steel industry. The union chooses a level of employment that maximizes the total wages of its members (i.e., it maximizes $w_S L_S$). How many workers will the union allow to be employed in the Steel sector? How many will now be employed in the Clothing sector? What wage rate will workers in each sector receive? [*You should assume that the prices of Clothing and Steel remain 1.*]

$$\max w_S L_S = \left(\frac{12}{\sqrt{L_S}} - 2\right) L_S$$

$$= 12\sqrt{L_S} - 2L_S$$

$$0 = \frac{6}{\sqrt{L_S}} - 2$$

$$2 = \frac{6}{\sqrt{L_S}}$$

$L_S = 9$, $w_S = 2$

$L_C = 16$, $w_C = 1$

(c) (4 points) If workers in Clothing had unionized in order to increase their wage rate instead of workers in Steel, what would have happened to employment and wages in each sector? Explain why. [*No calculations necessary; just describe the outcome qualitatively.*]

No changes would have occurred because MPL is constant so restricting labor supply won't change wages

Massachusetts Institute of Technology
Department of Economics

14.01 Principles of Microeconomics
Exam 2
Tuesday, November 6th, 2007

Last Name (Please print): YOUNG

First Name: SCOTT

MIT ID Number: _____

Instructions. Please read carefully.

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DO NOT WRITE IN THE AREA BELOW:

Question 1	15/20	Question 2	8/15
Question 3	10/10	Question 4	18/24
Question 5	0/15	Question 6	7/15
Question 0	1/1	**Total**	**59/100**

1. True/False Questions (*TOTAL: 20 points*)**:**

In this section, write whether each statement is True or False. Please fully explain your answer, using a diagram if appropriate. No credit will be given for an answer without an explanation.

(a) (*5 points*) As long as the marginal cost of production is greater than the average variable cost, the average variable cost is increasing.

True. If $MC > AVC$ then $AVC' = \frac{AVC}{n-1} + \frac{MC}{n-1} > AVC$

✓

(b) (*5 points*) In a perfectly competitive market with constant long run marginal cost, the consumer will bear all the taxation burden.

False. Relative taxation burden is based on relative elasticity of demand/supply.

✗

(c) (*5 points*) In a perfectly competitive market, firms take the market price as a given, which implies that the market demand is infinitely elastic.

False. Consider production of a food staple in a ~~poorer~~ country with few substitutes. Farmers are price-takers, yet, demand is relatively inelastic.

(d) (*5 points*) In an exchange economy, no individual will ever prefer a point inside the utility possibilities frontier to a point on the utility possibilities frontier.

False. The utility possibilities frontier designates an area of acceptable trades. A point within may have higher utility:

Long Questions:

2. *(15 points)* Ricardo produces widgets, using as inputs labor (L) and machines (K). His production function is given by the following equation:

$q = 10K^{2/3} + L^{1/2}$

(a) (*4 points*) What type of returns to scale (increasing/constant/decreasing) does Ricardo's production function exhibit? Explain.

Decreasing. Each unit of labor and capital produces sub-linear increases to quantity produced.

At the end of last year, Ricardo bought his only machine for $1,000. He will use this machine for 5 years, after which the machine will have no value. Ricardo will calculate depreciation linearly (depreciation will be 20% of the total value of the machine per year). This machine has no other use besides Ricardo's production of widgets, and, at this moment, Ricardo cannot buy any more machines.

(b) (*4 points*) What is Ricardo's annual fixed cost of production? Is the fixed cost sunk or not? Explain.

Fixed cost = $200
(accounting)

Yes, it is a sunk cost. The cash outflow is upfront and cannot be recovered as the machine has no resale/rental value.

(c) (*4 points*) What is Ricardo's demand for labor as a function of the quantity he wants to produce annually?

$L(Q) = \quad L(Q) = \begin{cases} (q-10)^2, q \geq 10 \\ 0, q < 10 \end{cases} \quad Q^2 = \left(\frac{40}{3}\right)^6 L^3 + L$

$= L^2 + \left(\frac{3}{40}\right)^6$

X

$\frac{\partial Q}{\partial K} = \frac{\partial Q}{\partial L}$ $\qquad \frac{\partial Q}{\partial k} = \frac{\left(\frac{2}{3}\right)(10)}{\sqrt[3]{K}}$ $\qquad \frac{1}{2\sqrt{L}} = \frac{20}{3\sqrt[3]{K}}$

$3\sqrt[3]{K} = 40\sqrt{L}$

$\frac{\partial L}{\partial k} = \frac{1}{2\sqrt{L}}$ $\qquad K = \left(\frac{40}{3}\sqrt{L}\right)^3$

$\frac{40^6 Q^2}{3^6} = L^3 + \left(\frac{3}{40}\right)^6 L$

$= L\left(L^2 + \left(\frac{3}{40}\right)^6\right)$ $\qquad Q = \left(\frac{40}{3}\sqrt{L}\right)^3 + \sqrt{L}$

$\frac{40^6 Q^2}{3^6} = L\left(\left(L + \left(\frac{3}{40}\right)^3\right)\left(L - \left(\frac{3}{40}\right)^3\right)\right)$ $\longrightarrow L =$

(d) (*3 points*) Assuming that wage equals 1, what is Ricardo's annual total cost function?

X $\qquad TC = \begin{cases} q^2 - 20q + 300, q \geq 10 \\ 200, q < 10 \end{cases}$

3. (*10 points*) Sally's firm produces granola bars with a fixed cost of 10 (this cost is already sunk). Her variable cost function is $VC = q^2 + 2q$.

(a) (*4 points*) Assuming the market for granola bars is competitive, derive Sally's supply function?

$MC = MR$

$Q(P) = Q(MR) = \boxed{\frac{1}{2}P - 1}$

$MC = 2q + 2$

$\frac{MC - 2}{2} = \frac{1}{2}MC - 1 = Q$

(b) (*6 points*) What is Sally's surplus if the market price is 6? What is her profit? Does she want to stay in this market? Explain.

$Q = \frac{1}{2}(6) - 1 = 2$

Surplus = Revenue − VC

$= 12 - 8 = 4$

profit = −6

Yes, since the fixed costs are already sunk a profit of −6 is preferrable to a profit of −10 from leaving the market.

4. (*24 points*) Suppose the demand function for corn is $Q_d = 10 - 2p$, and supply function is $Q_s = 3p - 5$. The government is concerned that the market equilibrium price of corn is too low and would like to implement a price support policy to protect the farmers. By implementing the price support policy, the government sets a support price and purchases the extra supply at the support price. In this case, the government sets the support price $p_s = 4$.

(a) (*4 points*) Calculate the original market equilibrium price and quantity in absence of the price support policy.

$10 - 2p = 3p - 5$

$15 = 5p$

$p = 3, \quad q = 4$

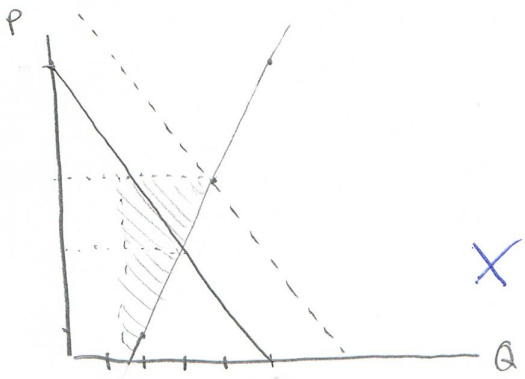
(b) (*3 points*) At the support price $p_s = 4$, find the quantity supplied by the farmers, the quantity demanded by the market, and the quantity purchased by the government.

$Q_S = 3(4) - 5 = 7$

$Q_D = 10 - 2(4) = 2$

$Q_{GOV} = 7 - 2 = 5$

(c) (*3 points*) Draw a diagram to show the change in the producer surplus due to the implementation of the price support policy. Calculate the change in the producer surplus.

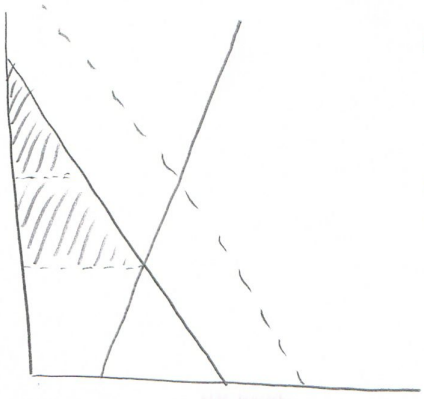


$\Delta PS = \left(4 - \frac{5}{3}\right) \cdot (7)\left(\frac{1}{2}\right)$

$-\left(3 - \frac{5}{3}\right) \cdot (4) \cdot \left(\frac{1}{2}\right)$

$= \frac{53}{6}$

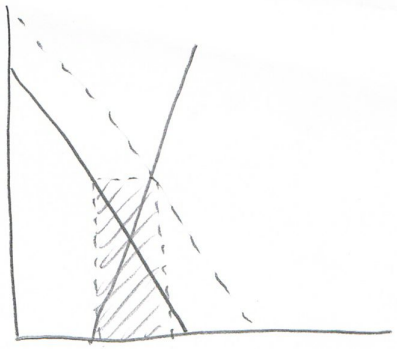
(d) (*3 points*) Draw a diagram to show the change in the consumer surplus due to the implementation of the price support policy. Calculate the change in the consumer surplus.



$\Delta CS = -(7)(4)(1/2) + (6)(2)\left(\frac{1}{2}\right)$

$6 - 14 = \boxed{-8}$

(e) (*3 points*) Calculate the cost to the government to implement the price support policy. Draw a diagram to show the government cost.



$Q_{Gov} \cdot P = 5 \cdot 4 = \boxed{20}$

(f) (*8 points*) Suppose now the government switches from price support policy to subsidy policy. For each unit of corn produced, the government subsidizes the farmer $s = \frac{5}{3}$. Find the new equilibrium price under this subsidy policy. How much money will the government have to spend in order to implement this subsidy policy?

$Q_S = 3(P + 5/3) - 5$

$= 3P$

$3P = 10 - 2P$

$P = 2$

$Q = 6$

$\Delta Gov = \left(\frac{5}{3}\right) \cdot 6 = 10$

5. (*15 points)* Molly's company produces knee warmers according to the following production function:

$q = (K-8)^{1/4}L^{1/4}$

(a) (*4 points*) Assuming that the unit cost of capital (r) and the unit wage (w) are both equal to 1, derive Molly's demand for inputs—capital and labor, respectively—as a function of her choice of output (q).

$k(Q) =$

$L(Q) =$

$$\frac{\partial Q}{\partial k} = \frac{\partial Q}{\partial L}$$

$$\begin{cases} \frac{K-8}{L} = \frac{1}{1} \\ q = (K-8)^{1/4} L^{1/4} \end{cases} \Leftrightarrow \begin{cases} L = q^2 \\ k = 8 + q^2 \end{cases}$$

X

(b) (*2 points*) Show that Molly's long run total cost function is given by $C(q) = 8 + 2q^2$.

X

The demand for knee warmers is given by $P = 40 - Q^d$. There are no costs of entry or exit for a firm on the market for knee warmers. Any firm in this market will have access to the same technology as Molly.

(c) (*6 points*) What will the price be in the long run in this market? How much will each firm produce in this market in the long run.

Given $TC = 8 + 2q^2$

$P = MC = 4q$

$4q = 40 - q$

$q = 8$

$P = 32$ X

Each firm will produce

$\max \pi = 32 \cdot q - (8 + 2q^2)$

$32 - 4q = 0$

$q = 8$

(d) (*3 points*) How many firms will there be in this market in the long run?

One

X

6. *(15 points)* Consider a two-person economy consists of Ann and Bob. Both of them only consume x and y. Ann's utility over these two goods is $U_A(x_A, y_A) = x_A y_A^2$ and Bob's utility is $U_B(x_B, y_B) = x_B^2 y_B$. Initially, Ann is endowed with 9 units of x and zero units of y; Bob is endowed with 6 units of y and zero units of x.

(a) (*2 points*) Write Ann's marginal rate of substitution in terms of x_A and y_A and Bob's marginal rate of substitution in terms of x_B and y_B.

$$MRS_{ANN} = -\frac{dy}{dx} = \frac{\frac{\partial y}{\partial u}}{\frac{\partial x}{\partial u}} = \frac{2x_a y_a}{y_a^2} = \boxed{\frac{2x_a}{y_a}}$$

$$MRS_{BOB} = -\frac{dy}{dx} = \frac{x_B^2}{2x_B y_B} = \boxed{\frac{x_B}{2y_B}}$$

(b) (*5 points*) Derive the equation for the contract curve.

Let $x = x_a = 9 - x_b$

$y = y_a = 6 - y_b$

$MRS_{ANN} = MRS_{BOB}$

$$\frac{2x}{y} = \frac{(9-x)}{2(6-y)}$$

$$4x(6-y) = y(9-x)$$

$$24x - 4xy = 9y - xy$$

$$0 = 9y + 3xy - 24$$

(c) (*8 points*) Find the general equilibrium allocation of x and y among Ann and Bob of the above economy.

	x	y
Ann	5	4
Bob	4	2

Massachusetts Institute of Technology
Department of Economics

14.01 Principles of Microeconomics
Exam #1
Wednesday, October 10th, 2007

Last Name (Please print): YOUNG

First Name: SCOTT

MIT ID Number: _____

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DO NOT WRITE IN THE AREA BELOW:

Question 1 12/20	Question 2 7/10
Question 3 15/15	Question 4 25/25
Question 5 29/29	Question 0 1/1

Total 88/100

1. True/False Questions (*TOTAL: 20 points*)**:**

In this section, write whether each statement is True or False. Please fully explain your answer, using a diagram if appropriate. No credit will be given for an answer without an explanation.

(a) (*5 points*) A risk averse individual that has to decide between two different lotteries will always prefer a lottery with less risk.

False. Risk aversion is merely a preference for lower σ given equivalent $E[\,]$. Even a risk averse person would prefer a lottery with a 50.1% chance for \$1,000,000 and 50.1% chance for \$1000, than one with a 100% chance of \$1000.

(b) (*5 points*) Steven only consumes two goods: X and Y. If X is a Giffen good for Steven, then Y must be a normal good for Steven.

True. A Giffen good is an inferior good for which the income effect is larger than substitution, therefore in order to be a Giffen good, Steven must prefer Y to X when he has more money.

(c) (*5 points*) Ann and Bob consume clothes (C) and food (F) only. Ann's utility function is $U(C,F) = a_A \ln C + b_A \ln F$, and Bob's utility function is $U(C,F) = a_B \ln C + b_B \ln F$. $a_A, b_A, a_B, b_B > 0$. The price of clothes is P_C, and the price of food is P_F. Ann and Bob must have the same marginal rates of substitution (*MRS*) of clothes for food at the optimal level of consumption.

True. At optimum consumption MRS = -3 for both regardless of specific utility function.

-3

price ratio!

✓

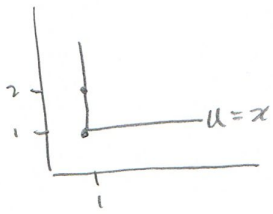
(d) (*5 points*) If S and F are perfect complements you must be indifferent between these two bundles:

i. One unit of S and one unit of F
ii. Two units of S and one unit of F

True. The indifference curve for perfect complements is a right angle:

✗

False



Both have the same utility curve value

2. Short Answer Questions (*TOTAL: 10 points*)**:**

(a) (*4 points)* Mary's demand curve for food is $Q = 10 - 2P$. Her price elasticity of demand for food at price P^* equals $-\frac{2}{3}$. How much is P^*?

$$E_P^D = \frac{P}{Q}\frac{\partial Q}{\partial P} = -2/3$$

$$Q = 10 - 2P$$

$$\frac{\partial Q}{\partial P} = -2$$

$$-2 \cdot \frac{P^*}{Q} = -2/3$$

$$\frac{P^*}{Q} = 1/3$$

$$\frac{P^*}{10 - 2P^*} = 1/3$$

$$P^* = 1/3\,(10 - 2P^*)$$

$$5P^* = 10$$

$$\boxed{P^* = 2}$$

4/4

✓

(b) (*6 points)* Ann and Bob are a couple. They are the only people in the family. Bob's inverse demand curve for shirts is $P = 5 - \frac{1}{2}Q_B$. Ann's inverse demand curve for shirts is $P = 10 - 2Q_A$. What is their family demand function for shirts? What is their family consumption of shirts when the price is 4? What's their family consumption of shirts when the price is 6?

$P = 5 - .5Q_B$

$\frac{P-5}{-.5} = Q_B = 10 - 2P$ ✓

$P = 10 - 2Q_A$

$\frac{P-10}{-2} = Q_A = 5 - .5P$

$Q = \begin{cases} 15 - 2.5P \\ 5 - \frac{1}{2}P \end{cases}$ ← Family demand for shirts

$Q = 15 - 2.5(4) = 5$ ✓ ← @ P=4

$Q = 15 - 2.5(6) = 0$ ✗ ← @ P=6

3/6

Long Questions:

3. (*15 points)* Jane has utility function over her net income $U(I) = \sqrt{I}$

(a) (*2 points*) What are Jane's preferences towards risk? Is she risk averse, risk neutral or risk loving? [Explain briefly your answer]

risk averse. Because $E[u(x)] \leq u(E[x])$ ✓

(b) *(6 points)* Jane drives to work every day and she spends a lot of money in parking meters. Many days the thought of cheating and not paying for parking crosses her mind. However she knows that there is a ¼ probability of being caught in a given day if she cheats, and that the cost of the ticket is $36. Her daily income is $100. What is the maximum amount of she will be willing to pay for one day parking? *[Hint: by paying that amount she avoids the risk of getting a ticket!].*

doesn't pay: $u(I) = \sqrt{100-36} \cdot 1/4 + \sqrt{100} \cdot 3/4 = 9.5$

does pay: $u(I) = 9.5 = \sqrt{100 - x}$

$90.25 = 100 - x$

$x = \$9.75$ ✓

$\$$
9.5
9.5
.475
8550
90.25

(c) *(2 points)* Paul also faces the same dilemma every single day. But he has a utility function $U(I)=I$. His daily income is also \$100. What are Paul's preferences towards risk? Is he risk averse, risk neutral or risk loving?

risk neutral b/c $u(E[x]) = E[u(x)]$

✓

(d) *(5 points)* If the price of one day parking is 9.25, will Paul cheat or pay the parking meter? Will Jane cheat or pay the parking meter under this price?

Jane will pay because $9.25 < 9.75$ which is her indifference level.

Paul's utility expected for not paying is:

✓

$$\frac{100-36}{4} + \frac{100 \cdot 3}{4} = 91$$

when paying 9.25:

$$100 - 9.25 = 90.75$$

$\therefore$ Paul won't pay.

4. (*25 points)* In Country Faraway, cigarettes are forbidden, so people trade cigarettes in a black market. The cigarette demand is $Q_D = 12 - P$, and the cigarette supply is $Q_s = 2P$.

(a) *(3 points)* Find the equilibrium price and quantity in the black market.

$Q = 12 - P = 2P$

$P = 4$

$Q = 8$

✓ 3/3

(b) *(6 points)* The government becomes aware of the black market and reinforces the police so that half of the cigarette supply would be seized and destroyed. Under this circumstance, what are the demand and supply functions? What is the new equilibrium price and quantity? Show the change by using a supply and demand diagram.

$Q_s = 2P$

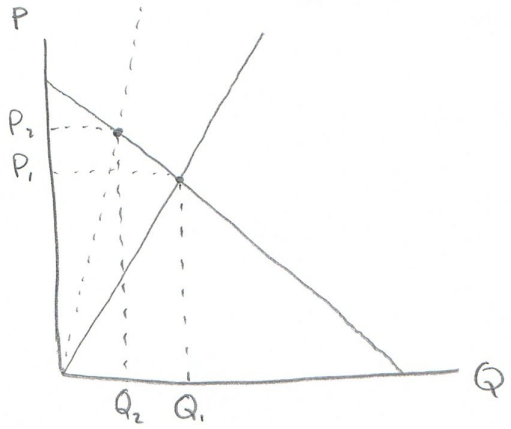
$Q_D = 12 - P$

$\frac{1}{2} Q_s = Q_D$ because other half is seized

$12 - P = \frac{1}{2} P$

$6 = P \quad Q = 6$

✓ 6/6



(c) *(4 points)* How does the consumer surplus change between (a) and (b)?

CS in (a) $= \frac{8 \cdot 8}{2} = 32$ 4/4

CS in (b) $= \frac{6 \cdot 6}{2} = 18$ ✓

$32 - 18 = 14$

$\boxed{-14}$

(d) (*8 points*) Suppose that the government changes the policy and legalizes cigarette trade. Now cigarettes are traded in an open market. However, for every unit of cigarette purchased, the buyer has to pay tax T to the government. T is equal to the pre-tax price P. What are the demand and supply functions under this circumstance? What are the equilibrium (pre-tax) price and quantity? What is the after-tax price paid by buyers?

$Q_S = 2P_S$ $\quad P_D = 2P_S$

$Q_D = 12 - P_D$ 8/8 ✓

$2P_S = 12 - 2P_S$

$4P_S = 12$

$P_S = 3, \; P_D = 6, \; Q = 6$

equilibrium pre-tax P & Q

after-tax price

(e) (4 points) Compare (b) and (d). Which policy do consumers prefer? Which policy does the government prefer? Why?

Consumers are indifferent since in both cases CS = 18.

Government prefers (d) because it gains revenue while it does not in (b)

(Assuming legality and non-economic motivations do not apply to preferences of gov. or consume

4/4

5. *(29 points)* Eric receives utility from days spent traveling on vacation domestically (D) and days spent traveling in a foreign country (F) as given by the utility U(D, F) = DF. The price of a day spent traveling domestically is $160 and in a foreign country $200. Eric's annual budget for traveling is $8,000.

(a) (5 points) Find Eric's utility maximizing choice of days traveling domestically and in a foreign country. Find also his utility level from consuming that bundle.

$\max U = DF \quad s.t. \quad 160D + 200F \leq 8000$

$160D + 200F = 8000$

$F = \frac{8000 - 160D}{200}$

$U = D\left(\frac{8000 - 160D}{200}\right)$

$U = D(40 - .8D) = -.8D^2 + 40D$

$U' = -1.6D + 40 = 0$

$40 = 1.6D$

$\frac{40}{1.6} = D$

25

$14 \overline{)400}$

32

80

Solution:
$D = 25$
$F = 20$
$U = 500$

✓

5/5

(b) (6 points) Suppose that the price of domestic traveling increases to $250 per day. Calling his budget for traveling x, (suppose by now that it is unknown) find the demand for D and F under the new prices as a function of x.

$250D + 200F = x$

$F = \frac{x - 250D}{200}$

$U = D\left(\frac{x - 250D}{200}\right) = \frac{x}{200}D - \frac{5}{4}D^2$

$\frac{\partial U}{\partial D} = \frac{x}{200} - 2.5D = 0$

$D = \frac{x}{500}$

✓

$F = \frac{x - \frac{250}{500}x}{200} = \frac{x}{400}$

6/6

(c) (4 points) Find the income necessary to make Eric reach the same utility level as before the price change.

$$U = 500 = DF = \frac{x}{500} \cdot \frac{x}{400}$$

4/4

$$500 = \frac{x^2}{200000}$$

✓ $100\,000\,000 = x^2$

$$\sqrt{100\,000\,000} = x$$

$\boxed{\$\,10\,000}$

(d) (2 points) Compute the quantities demanded with the new prices and the income you found in section c.

✓ $D = \frac{10000}{500} = 20$

2/2 $F = \frac{10000}{400} = 25$

(e) (2 points) Compute the quantities demanded with the new prices and the original income.

2/2 ✓ $D = \frac{8\,000}{500} = 16$

$F = \frac{8\,000}{400} = 20$

(f) (*6 points*) Using your previous answers tell us what is the total change in quantity of D due to the price increase in P_D that the consumer experiences and what part of that change is due to income or substitution effects. Give definitions of what income and substitution effects mean.

substitution effect: holding utility constant, the change in quantity due to change in relative price.

income effect: the change in quantity due to greater purchasing power, resultant from the decrease in price of one or more goods.

Total change = 25 - 16 = 9 units of D due to ΔP_D

Substitution Effect = 25 - 20 = 5 units less of D

Income Effect = 20 - 16 = 4 units less of D

(g) (*4 points*) Draw a graph showing the income and substitution effects you found.