

Answer all questions. 100 points possible.

1. [35 points] a) Consider a market with demand function $Q_D = 40 - P$ and supply function $Q_S = 3P$ where P denotes price (in dollars). Find the equilibrium price and quantity. Then compute the amount of consumer surplus (CS) and producer surplus (PS). [HINT: You are not required to plot the supply and demand curves, but it might make it easier for you to compute CS and PS.]

b) Suppose that the government now imposes a tax of \$4 per unit. Describe (in words) how will this affect the supply curve. Using the new supply function (and the initial demand function), compute the new equilibrium price and quantity. How much of the tax is “passed along” to consumers? How much is “absorbed” by producers? Further compute the amount of consumer surplus, producer surplus, and government tax revenue. Compute the sum (CS + PS + tax revenue). Is this sum greater than, less than, or equal to the sum (CS + PS) in part (a)? Explain why, commenting on the efficiency implications of the tax. [HINT: Again, you aren’t required to plot the supply and demand curves, but you might find it helpful for computing surplus.]

c) Compute the elasticity of demand at the equilibrium point from part (a).

d) If the demand curve had been more elastic, how would that have altered tax incidence (i.e., the amount passed along to consumers vs. absorbed by producers) in part (b)? Further, if the demand curve had been more elastic, how would that alter the efficiency implications in part (b)? Use a supply-and-demand diagram to illustrate your answers. [HINT: I’m looking for qualitative answers. You don’t have enough information to give precise numerical answers.]

2. [15 points] Consider the labor-supply decision of an individual before and after she wins the lottery. Using a graph with leisure on the horizontal axis and income on the vertical axis, draw the individual’s constraint before and after winning the lottery. [HINT: Winning the lottery provides additional (non-labor) income but does *not* increase the total amount of time available. Assume that the individual’s hourly wage does not change after she wins the lottery. Obviously, you don’t have precise numerical information, but should be able to draw a graph with the correct qualitative features.]

Then, adding indifference curves to your graph, illustrate the case where the individual chose to work a positive number of hours before winning the lottery, but chooses to work no hours after winning the lottery. If leisure is a normal good, is it theoretically possible that the individual would choose to *increase* hours of work after winning the lottery? Explain, discussing the relevant income and substitution effects.

3. [30 points] A factory produces output (Q) using capital (K) and labor (L) according to the production function $Q(K,L) = K^{1/5} L^{4/5}$. Let r denote the price per unit capital, and w denote the price per unit labor, so that the total expenditure on these factors is $rK + wL$. As the factory manager, you have been told to produce 625 units of output.

a) Give the equation for the relevant isoquant, written with L as a function of K .

b) If $r = 80$ and $w = 20$, what is the least-cost method of production? Give the optimal factor choices (K^* , L^*) as well as the total expenditure. [HINT: If you're solving this problem by constructing a table, you can assume that K is purchased in increments of 10. If you're using calculus, you can assume that K and L are continuous.]

c) If $r = 120$ and $w = 20$, what is the least-cost method of production? Again give the optimal factor choices (K^* , L^*) as well as the total expenditure.

d) Draw an isoquant / isocost diagram to illustrate your answers to parts (b) and (c). [HINT: Your graph doesn't need to be perfect, but should be properly labeled, reflect the appropriate shapes of the relevant curves, and indicate the optimal solution.]

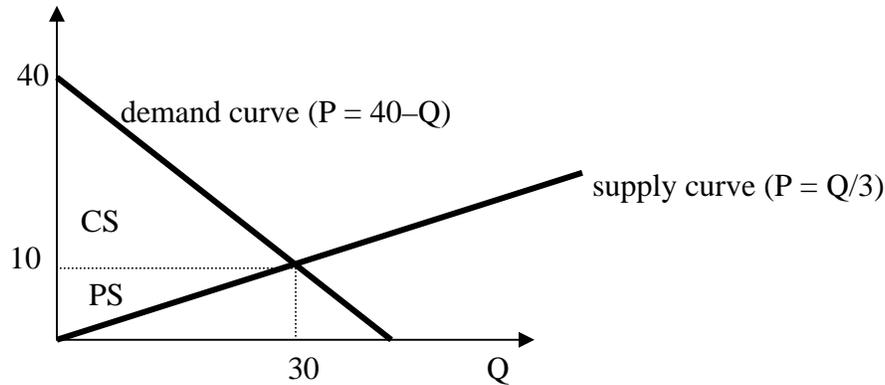
e) On your diagram from part (d), add another isocost curve which reflects the initial expenditure level (from part b) but the new factor prices (from part c). For the consumer's problem (where K and L become goods 1 and 2), this curve would be relevant. What is this curve *not* relevant for the firm's cost-minimization problem?

4. [20 points] Consider a firm in Madison that manufactures widgets using capital and labor. The firm has already spent \$25,000 to rent capital for month of March. This is a fixed cost that cannot be recovered. The firm now needs to determine the number of workers to hire for March. For each of the first 30 workers, the marginal product of labor is 100 widgets. For each of the next 10 workers, the marginal product of labor is 50 widgets. If the firm hired more than 40 workers in total, the marginal product of additional workers would be zero (because all of the firm's capital would already be in use). Finally, assume that widgets can be sold by the firm at a price of \$20 each.

a) Plot the firm's labor-demand curve. Suppose that the current monthly wage in Madison is \$800 per worker. How many workers should the firm hire? If Madison imposes a minimum wage so that the monthly wage rises to \$1200 per worker, and assuming that the firm is not permitted to close down (i.e., cannot "exit" from the widget market), how many workers should the firm hire? Illustrate your answers using the labor-demand graph.

b) Assuming that the monthly wage does rise to \$1200 per worker, determine the firm's profit (given that it hires the optimal number of workers determined in part a). Should the firm close down (hiring no workers) for March? Briefly explain, giving the relevant computations.

1a) [10 pts] Given $Q_D = 40 - P$ and $Q_S = 3P$, the equilibrium price is determined by the equation $40 - P = 3P$ which implies $P^* = 10$ and hence $Q^* = 30$. Graphically,



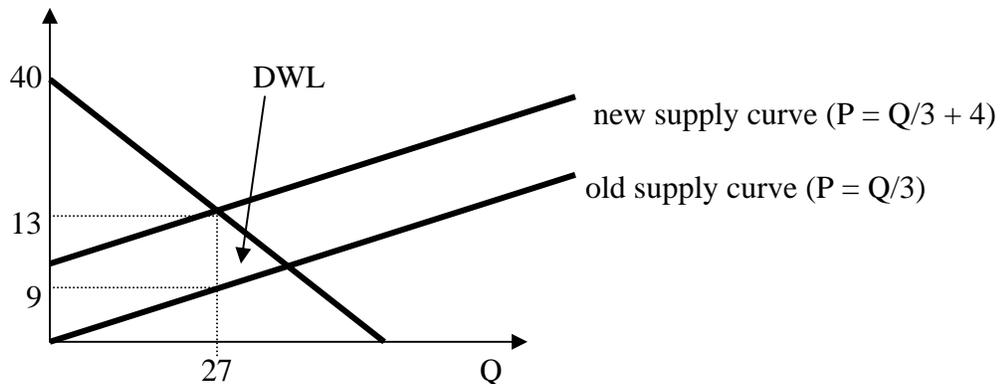
$$\text{Consumer surplus} = (40-10)(30)(1/2) = 450$$

$$\text{Producer surplus} = (10)(30)(1/2) = 150$$

3b) [16 pts] The tax shifts the supply curve upwards by \$4. Given the tax, suppliers now receive $P-4$ instead of P for each unit. Thus, the new supply function is $Q_S = 3(P-4)$ which can be rewritten so that Q is a function of P , yielding $P = Q/3 + 4$.

Given the original demand function and the new supply function, the equilibrium is given by the condition $40 - P = 3(P-4)$ which implies $P^* = 13$ and hence $Q^* = 27$. Thus, \$3 of the tax is “passed along” to consumers, while \$1 of the tax is “absorbed” by producers.

Graphically,



$$\text{Now, consumer surplus} = (40-13)(27)(1/2) = 364.5$$

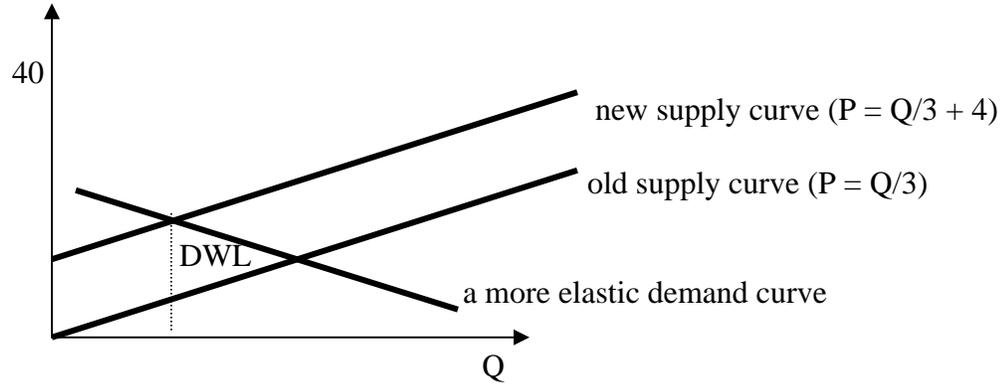
$$\text{producer surplus} = (9)(27)(1/2) = 121.5$$

$$\text{tax revenue} = (4)(27) = 108$$

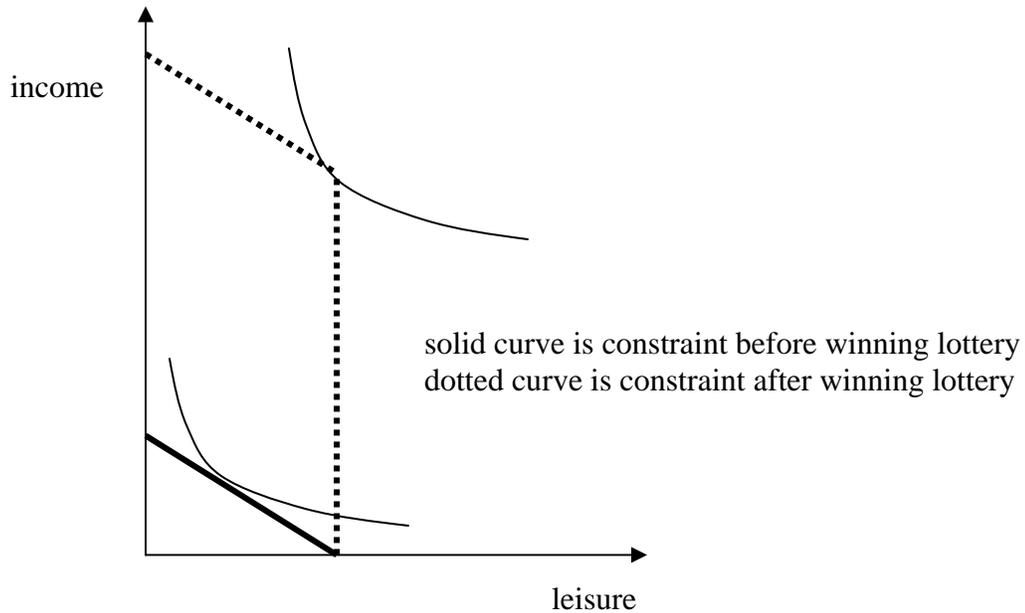
Thus, $CS + PS + \text{tax} = 594$, which is lower than in part (a) because the tax creates inefficiency, imposing a *deadweight loss* equal to $(13-9)(30-27)(1/2) = 6$.

c) [3 pts] $\epsilon = |(\% \Delta Q) / (\% \Delta P)| = |(\Delta Q / Q) / (\Delta P / P)| = |(\Delta Q / \Delta P) / (Q / P)| = |-1 / (30 / 10)| = 1/3$.

d) [6 pts] If the demand curve had been more elastic (flatter), there would have been a larger drop in quantity and a smaller increase in price. Less of the tax would have been passed along to consumers; more of it would have been absorbed by producers. There would have been a larger deadweight loss. Graphically,



2) [15 pts]



If leisure is a normal good, it is *not* possible that the individual would increase hours of work. After winning the lottery, there is an income effect which causes the individual to consume more leisure. (Graphically, the constraint shifts upwards.) But there is no substitution effect. (Graphically, the slope of the downward sloping portion of the constraint does not change.) Thus, if leisure is a normal good, hours of work cannot rise.

3a) [6 pts] $K^{1/5} L^{4/5} = 625 \rightarrow L^{4/5} = 625 K^{-1/5} \rightarrow L = (625)^{5/4} K^{-1/4} \rightarrow L = 3125 K^{-1/4}$

b,c) [16 pts] *using a table:*

<i>K</i>	<i>L</i>	(part b) $80K+20L$	(part c) $120K + 20L$
10	1757	35,940	36,340
20	1478	31,160	31,960
30	1335	29,100	30,300
40	1243	28,060	29,660
50	1175	27,500	29,500
60	1123	27,260	29,660
70	1080	27,200	
80	1045	27,300	
90	1015		
100	988		

lowest expenditures in boldface (note that you don't need to continue computations beyond point where expenditures start rising)

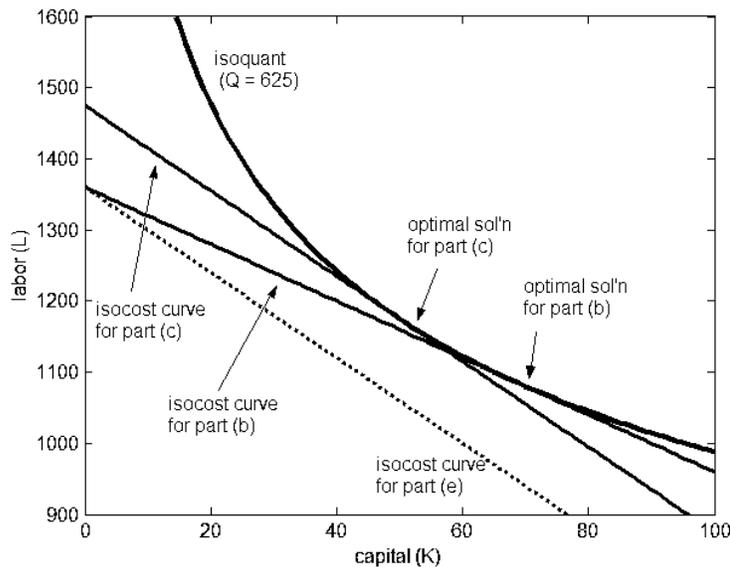
thus, $K^* = 70, L^* = 1080, TC = 27,200$ for part b
 $K^* = 50, L^* = 1175, TC = 29,500$ for part c

using calculus: $E = \text{expenditures} = wL + rK = (w)(3125 K^{-1/4}) + rK$

$$dE/dK = (w)(3125)(-1/4)(K^{-5/4}) + r = 0 \rightarrow K^* = [(4r) / (3125w)]^{-4/5}$$

thus, for part b, $K^* = [(4 \times 80)/(3125 \times 20)]^{-4/5} \approx 68, L^* \approx 1088, TC \approx 27,200$
 for part c, $K^* = [(4 \times 120)/(3125 \times 20)]^{-4/5} \approx 49, L^* \approx 1181, TC \approx 29,500$

d,e) [8pts] Isocost curve irrelevant in (e) because firm must stay on $Q = 625$ isoquant



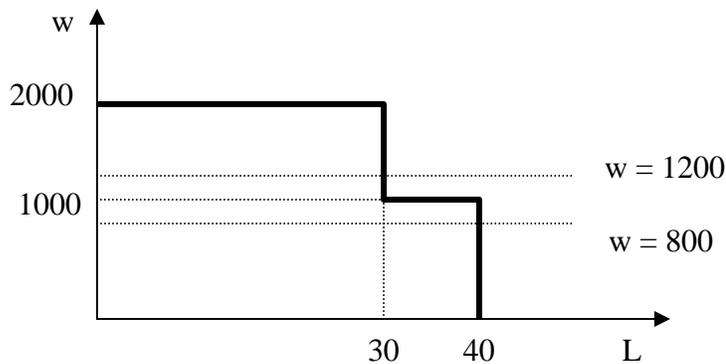
4a) [11 pts] The labor demand curve is the value of marginal product of labor (VMPL) curve. In turn, $VMPL = P \times MPL$ where MPL denotes the marginal product of labor. In this problem,

for the first 30 workers, $VMPL = 20 \times 100 = 2000$

for the next 10 workers, $VMPL = 20 \times 50 = 1000$

for any additional workers, $VMPL = 20 \times 0 = 0$

Thus, the labor demand curve is



As depicted above, at a wage of 800, the firm would hire 40 workers. If the wage rises to 1200, the firm would hire 30 workers.

b) [9 points]

profit = revenue – variable costs – fixed costs

Given $w = 1200$, the firm hires 30 workers who produce $Q = 3000$ widgets. Thus,

$$\begin{aligned} \text{profit} &= (20 \times 3000) - (30 \times 1200) - 25,000 \\ &= 60,000 - 36,000 - 25,000 = -1,000 \end{aligned}$$

Thus, the firm makes a negative profit (i.e., has a loss) of 1,000. However, the firm should ignore sunk costs when deciding whether to exit. In other words, the firm should exit only if it cannot cover its variable costs. Here,

$$\text{revenue} (= 60,000) > \text{variable cost} (= 36,000)$$

Equivalently,

$$\text{price} (= 60,000/3,000 = 20) > \text{average variable cost} (= 36,000/3,000 = 12)$$

Thus, the firm should *not* shut down for March.

Answer all questions. 100 points possible.

1) [30 points] A monopolist has total costs $TC = 200 + 2Q$ and faces a demand curve that may be written as $P = 20 - (1/4)Q$ where Q denotes quantity and P denotes price.

a) What condition determines the profit-maximizing level of output? Compute the optimal quantity chosen by the firm. Given this quantity, what price is charged by the firm? What is the firm's profit?

b) Derive the firm's average cost function (AC as a function of Q). What is the firm's average cost given the optimal quantity from part (a)?

c) On a graph (with price on the vertical axis and quantity on the horizontal axis), plot the firm's demand, marginal revenue, average cost, and marginal cost curves. What region on this graph corresponds to the firm's profit derived in part (a)? [HINT: Your graph does not need to be drawn exactly to scale, but all curves and the profit region should be clearly labeled, all curves should have the correct shape and relative positions, and you should add numerical labels so that it is possible to compute the firm's profit directly from your graph.]

d) Is this firm a natural monopoly? How can you tell? If government regulators attempt to impose the "perfect competition" outcome, what price would they require the firm to set? Given this price, what is the firm's quantity and profit? What is the problem with this outcome? In light of this problem, what price would regulators allow the firm to set? What is the firm's quantity at this price?

2) [20 points] A beekeeper lives adjacent to an apple orchard. The orchard owner benefits from the bees because each hive pollinates about one acre of apple trees. The orchard owner pays nothing for this service, however, because the bees come to the orchard without his having to do anything. Because there are not enough bees to pollinate the entire orchard, the orchard owner must complete the pollination by artificial means, at a cost of \$10 per acre of trees. Beekeeping has a marginal cost $MC = 10 + 2Q$ where Q is the number of beehives. Each hive yields \$20 worth of honey.

a) Briefly describe the externality in this problem.

b) Assuming that the beekeeper maximizes her own profit, how many beehives will the beekeeper maintain? Give the relevant computation.

c) What number of hives would be (socially) efficient? Briefly explain.

d) Does the externality in this problem require government intervention, or is there potentially a "free market" solution? Briefly discuss.

3) [30 points] A large lake is used by two fishing companies. Let B_1 denote the number of fishing boats chosen by company 1; let B_2 denote the number of fishing boats chosen by company 2. The number of fish caught by each boat depends on the total number of boats on the lake. In particular, assume that fish caught per boat is equal to $200 - B_1 - B_2$. Further assume that fish sell for \$1 each and the marginal cost of an additional boat is constant at \$20. Thus, given the number of boats chosen by each company,

$$\begin{aligned} \text{profit for firm 1} &= (200 - B_1 - B_2) B_1 - 20 B_1 \\ \text{profit for firm 2} &= (200 - B_1 - B_2) B_2 - 20 B_2 \end{aligned}$$

a) Compute the best-response (reaction) function for each firm. Then, assuming that the firms simultaneously choose the number of boats, find the Nash equilibrium. [HINT: Looking at the profit functions, you should see an analogy to the Cournot model.]

b) From the perspective of joint profit maximization, will the lake be underfished, overfished, or fished at the optimal level? Give the relevant computations, comparing profits given Nash equilibrium to the maximum possible joint profits.

c) The government is considering whether to tax fishing boats, increasing the marginal cost from 20 to $20 + \tau$. Given the tax τ , compute the new reaction functions, and then the new Nash equilibrium. [HINT: Both the reaction functions and the Nash equilibrium will now depend on τ . Given $\tau = 0$, your answers should simplify to the answer you gave in part (a).] Would the firms *prefer* to have a small tax (say $\tau = 3$)? Briefly discuss, giving the relevant computations.

4) [20 points] Members of a family (composed of a husband, wife, and child) are trying to decide where to go on their next vacation. They are considering 4 options: Atlanta (A), Boston (B), Colorado (C), and Disney World (D).

a) Suppose that each member of the family has the following preference ordering:

husband's preferences are $A > B > C > D$
 wife's preferences are $C > A > D > B$
 child's preferences are $D > C > A > B$

where “>” denotes “is preferred to”. Suppose that the family attempts to construct a *family* preference ordering using the Condorcet procedure (i.e., through pairwise voting for A vs B, A vs C, etc). Does this procedure generate a clear family preference ordering? If so, give the family preference ordering. If not, explain why you can't.

b) Suppose that the wife and child have the preferences given in part (a), but the husband's preferences are now $B > A > D > C$. Again attempting to construct the family preference ordering through pairwise voting, does the family have a clear preference ordering? If so, give the preference ordering. If not, explain why you can't.

c) Briefly discuss the “Condorcet paradox” (your textbook calls it the “voting paradox”) and explain why it complicates governmental policymaking.

Econ 111 Exam 2 Fall 2009 Solutions

1a) [8 pts] To maximize profit, the monopolist sets Q so that $MR(Q) = MC(Q)$.

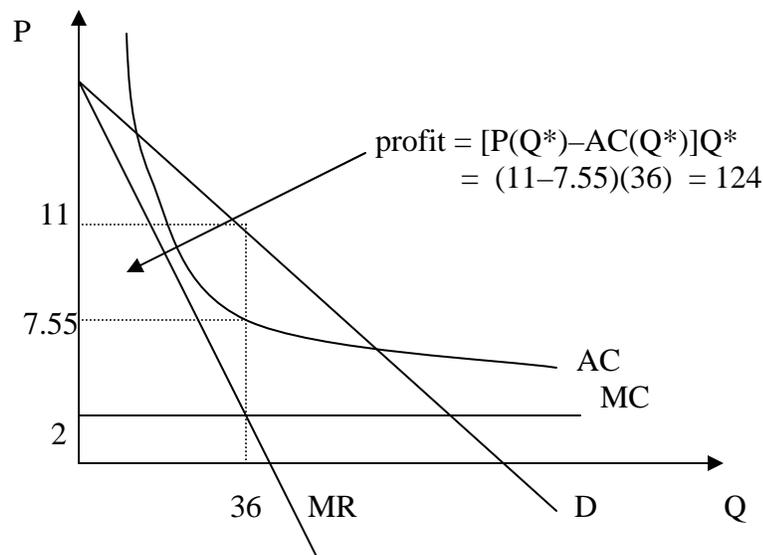
Here, $P = 20 - (1/4)Q$ and thus $MR = 20 - 2(1/4)Q = 20 - (1/2)Q$.

Setting $MR = MC$, we obtain $20 - (1/2)Q = 2$ which implies $Q = 36$ and hence $P = 11$.

Profit $\pi = PQ - TC = (11)(36) - [200 + (2)(36)] = 124$.

b) [3 pts] $AC(Q) = TC/Q = 200/Q + 2$. Thus, $AC(36) = 7.55$.

c) [6 pts] Plotting the D , MR , MC , and AC curves (not exactly to scale):



d) [13 pts] This firm is a natural monopoly because AC is falling for all Q .

If regulators attempt to impose the “perfect competition” outcome, they would require the firm to set $P = MC$. Graphically, this price and quantity are given by the intersection of the demand curve and the MC cost curve. In the present example, given the constant marginal cost, it is easy to see that $P = MC = 2$. Thus, $20 - (1/4)Q = 2$, and we obtain $Q = 72$ and $\pi = (2)(72) - [200 + (2)(72)] = -200$.

Because the firm would earn a negative profit, regulators typically allow natural monopolies to set $P = AC$, allowing the firm to break even (i.e., earn zero profit). Graphically, the price and quantity are given by the (lower) intersection of the demand curve and AC curve. Thus, $20 - (1/4)Q = 200/Q + 2$. Solving this (quadratic) equation, we obtain $Q \approx 58$ and thus $P \approx 5.5$. (From the graph in part (c), you can see that the other solution of the quadratic equation is not the relevant solution.)

2a) [3 pts] The hives generate direct benefits and costs for the beekeeper, but also indirect benefits – a *positive* externality – to the orchard owner.

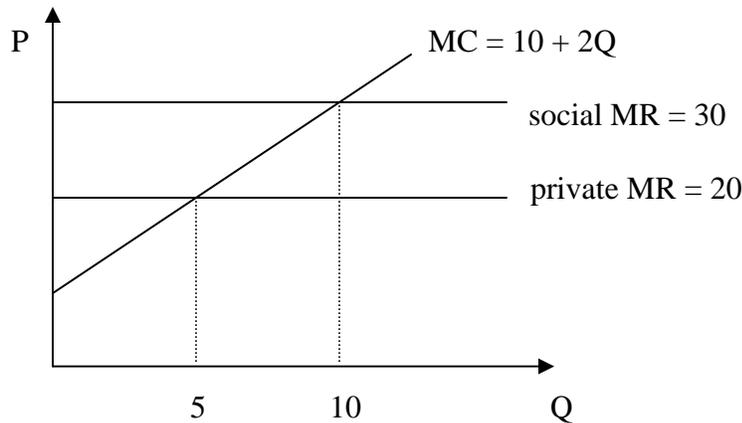
b) [6 pts] Focusing narrowly on her own profit, the beekeeper would set the number of beehives so that $MR = MC$. Here, MR is constant at 20. (Because the beekeeper can sell as much honey as desired at $P = 20$, the market for honey is competitive, and thus $MR = P = 20$.)

Thus, setting $MR = MC$ implies $10 + 2Q = 20$ which implies $Q = 5$.

c) [6 pts] To generate an efficient outcome, we need to take into account the externality, setting “social marginal revenue” equal to “social marginal cost.” Here, the social marginal revenue equals 20 (the beekeeper’s private MR) plus 10 (the orchard owner’s marginal benefit from an additional hive).

Thus setting social $MR = MC$ implies $10 + 2Q = 20 + 10$ which implies $Q = 10$.

You could have used a graph to illustrate the answers to parts (b) and (c),



d) [5 pts] The Coase Theorem suggests that government intervention is not necessary to solve externality problems when negotiation is costless and property rights are clearly assigned. In the present case, the beekeeper holds the “property right” to choose the number of hives, and there is no indication that bargaining costs would be high. Thus, it would seem that the beekeeper and orchard owner could simply negotiate an agreement between themselves, with the orchard owner making some payment to the beekeeper in exchange for increasing the number of hives from 5 to 10.

[To analyze this bargaining problem numerically: Increasing the number of hives from 5 to 10, the orchard owner’s profit would rise by $(5)(10) = 50$, while the beekeeper would lose $[MC(6) + MC(7) + MC(8) + MC(9) + MC(10)] - (5)(20) = [22+24+26+28+30] - 100 = 30$. Thus, the two parties should be able to agree on a payment somewhere between \$30 and \$50 from the orchard owner to the beekeeper.]

3a) [10 pts] If the profit functions were altered so that B was replaced with Q, this problem would become the Cournot model. Given this analogy, “price” is equal to $(200 - B_1 - B_2)$ and hence “marginal revenue” for each firm is equal to

$$\begin{aligned} MR_1 &= 200 - B_2 - 2B_1 \\ MR_2 &= 200 - B_1 - 2B_2 \end{aligned}$$

and $MC_1 = MC_2 = 20$. Setting $MR = MC$ for each firm, we obtain

$$\begin{aligned} \text{firm 1's reaction function: } B_1 &= 90 - (1/2)B_2 \\ \text{firm 2's reaction function: } B_2 &= 90 - (1/2)B_1 \end{aligned}$$

and the Nash equilibrium is determined by the condition

$$B_1 = 90 - (1/2)(90 - (1/2)B_1) \quad \text{which implies } B_1 = 60 \text{ and hence } B_2 = 60.$$

b) [8 pts] In this problem, the monopoly profit would be $\pi = (200-B)B - 20B$, so that the monopolist would have $MR = 200-2B$ and $MC = 20$. Setting $MR = MC$, we obtain

$$B = 90 \text{ and hence } \pi = 8100.$$

The duopoly outcome in part (a) entails $B_1 + B_2 = 120$ and hence $\pi_1 = \pi_2 = (200-60-60)(60) - (20)(60) = 3600$ so that $\pi_1 + \pi_2 = 7200$. Thus, compared to the joint-profit-maximizing outcome, the duopolists place too many boats on the lake.

c) [12 pts] The tax raises the marginal cost for each firm so that $MC_1 = MC_2 = 20 + \tau$. Setting $MR = MC$ for each firm, we now obtain

$$\begin{aligned} \text{firm 1's reaction function } B_1 &= 90 - (1/2)B_2 - (1/2)\tau \\ \text{firm 2's reaction function } B_2 &= 90 - (1/2)B_1 - (1/2)\tau \end{aligned}$$

The Nash equilibrium is determined by the condition

$$B_1 = 90 - (1/2)[90 - (1/2)B_1 - (1/2)\tau] - (1/2)\tau$$

which implies $B_1 = 60 - (1/3)\tau$ and similarly $B_2 = 60 - (1/3)\tau$.

If the tax was raised to $\tau = 3$, the firms would thus choose $B_1 = B_2 = 59$ and hence

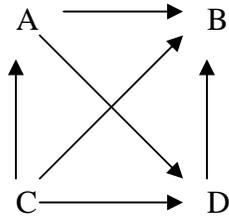
$$\pi_1 = \pi_2 = (200 - 59 - 59)(59) - (20 + 3)(59) = 3481$$

which is *lower* than the duopoly profit (= 3600) computed in part (b). (More generally, for arbitrary τ , you can show that firm profits will be $\pi_1 = \pi_2 = [60 - (1/3)\tau][60 - (2/3)\tau]$ which implies that π decreases as τ rises.) As shown in part (b), the firms would be better off if they could restrict output (holding marginal costs constant). But if this restriction occurs through a tax that increases marginal costs, profits will fall.

4a) [7 pts] The 6 pairwise elections would generate the outcomes:

A vs B → A wins	B vs C → C wins
A vs C → C wins	B vs D → D wins
A vs D → A wins	C vs D → C wins

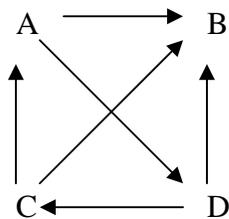
Letting each arrow denote “beats,” you could also represent these outcomes with the following diagram:



Note that C beats all other options; A beats everything but C; D beats everything but C and A; B beats no other option. Thus, the family does have a clear preference ordering: $C > A > D > B$.

b) [7 pts] Now, the 6 pairwise elections would generate the outcomes:

A vs B → A wins	B vs C → C wins
A vs C → C wins	B vs D → D wins
A vs D → A wins	C vs D → D wins [different than part (a)]



Now, we have a “voting cycle” in which $C > A$ and $A > D$ but $D > C$. Thus, the family does not have a clear preference ordering.

c) [6 pts] The “paradox of voting” is that, even if every individual has a clear personal preference ordering, pairwise voting among alternatives may not generate a clear collective preference ordering. Thus, while democracies might attempt to determine the will of the people through voting, collective preferences may be inherently unclear (and hence it would be impossible to construct a social welfare function). Without clear collective preferences, it becomes difficult for policy makers to judge the policies that would be most preferred by society.

Answer all questions. 100 points possible.

1. [20 points] Consider an economy that produces 3 final goods (X, Y, Z). The following table shows, for each good, the quantity and price for the years 2007 and 2008.

	<i>quantity</i>		<i>price</i>	
	2007	2008	2007	2008
<i>good X</i>	10	15	\$6.00	\$7.00
<i>good Y</i>	12	10	\$3.00	\$4.00
<i>good Z</i>	8	12	\$5.00	\$4.50

a) Compute nominal GDP for 2007 and 2008. Then, using 2007 as a baseline, compute the real GDP and GDP deflator for 2008.

b) The GDP deflator is one measure of inflation. Give two alternative measures of inflation that are often reported in the news. If the GDP deflator can be used to measure inflation, why do we need alternative measures?

c) If wages and benefits are indexed to inflation, why should we care about the inflation rate? List two groups of people that suffer when inflation is high.

2. [10 points] Define the “output gap” and the “natural rate of unemployment.” As of March 2009, the US unemployment rate is 8.5%. Assuming that the natural rate of unemployment is 5%, what is the current output gap? Give the name of the empirical regularity used to determine this answer.

3. [16 points] For this question, you should use the *full-employment* model with an open economy (i.e., a foreign-exchange market). To simplify the analysis, you should assume that private saving is not affected by the exchange rate or interest rate, and that net capital flows depend on the interest rate but not the exchange rate.

Suppose that a “Buy American” campaign encourages consumers to purchase fewer imports (and more domestic goods) at each possible exchange rate. (Because any decrease in imports is exactly offset by an increase in domestic consumption, there is no effect on private savings.)

a) Discuss the effect on the foreign-exchange market using a supply-and-demand graph. On your graph, indicate the *size* of the changes (before and after the campaign) in imports, exports, and net capital flows. Overall, how did the campaign affect the exchange rate? the trade deficit? net capital flows?

b) Will the campaign have any effect on the capital market? If not, explain why. If so, use a supply-and-demand graph to explain the relevant changes in that market.

4. [12 points] The full-employment model assumes that money is “neutral.”
- What is meant by the “neutrality of money”?
 - In the full-employment model, what equation determines the price level? Restate this equation so that it gives the relationship between percentage change (per unit time) in each of the variables.
 - Today, the US money supply is managed by the Federal Reserve. But historically, some countries (including the US) adopted a “gold standard” in which the money supply depends on the amount of gold that has been discovered. Using your answer from part (b), what happens if sudden discoveries of gold cause the money supply to rise faster than real GDP? What happens if there are no new discoveries, so that real GDP grows faster than the money supply? Why might it be better to have a “managed” money supply?
5. [30 points] Consider again the effects of a “Buy American” program, but now using the *unemployment* model. Suppose that

domestic consumption is	$C_d = 10 + (MPC - MPI)(1 - \tau)Y$
private savings are	$S_p = -10 + (1 - MPC)(1 - \tau)Y$
taxes are	$T = \tau Y$
investment is	$I = 40$
government spending is	$G = 50$
exports are	$EX = 15$
imports are	$IM = (MPI)(1 - \tau)Y$

where τ is the tax rate, MPC is the (overall) marginal propensity to consume, MPI is the marginal propensity to import, and thus $(MPC - MPI)$ is the marginal propensity to consume domestically. Further assume that $\tau = .2$, $MPC = .9$, and $MPI = .3$.

- Give the equation for (overall) consumption C as a function of Y .
- Compute the equilibrium level of Y .
- Now suppose that MPI falls from .3 to .2 (while the overall marginal propensity to consumer remains fixed at $MPC = .9$). What is the new equilibrium level of Y ?
- Given your answers to parts (b) and (c), compute the government’s budget surplus (or deficit) and the trade surplus (or deficit) both before and after the change in MPI . [HINT: Be sure to label each amount as a “surplus” or “deficit.”]
- Would government spending become a more effective or less effective fiscal policy tool after the change in MPI ? Briefly explain why.

6. [12 points] Suppose that the economy described in question (5b) was at its potential level of output \bar{Y} . A decrease in the MPI would have the short-run consequences that you derived in question (5c) above. Now discuss the longer-run consequences of this decrease in MPI using the ADI-AS analysis. What immediate action by the Fed would prevent these consequences? Discuss, using the ADI-AS diagram to illustrate. [HINT: You don’t need to do any computation; I’m merely looking for a qualitative, graphical analysis.]

Econ 111 Exam 3 Spring 2009 Solutions

1a) [10 pts] To compute nominal GDP, use current quantities and current prices:

$$\begin{aligned}\text{nominal GDP for 2007} &= (10)(6) + (12)(3) + (8)(5) = 136 \\ \text{nominal GDP for 2008} &= (15)(7) + (10)(4) + (12)(4.5) = 199\end{aligned}$$

To compute real GDP, use current quantities and base year prices:

$$\text{real GDP for 2008 (given 2007 base year)} = (15)(6) + (10)(3) + (12)(5) = 180$$

GDP deflator = (nominal GDP)/(real GDP) so that

$$\text{GDP deflator for 2008} = 199/180 = 1.1055.$$

b) [5 pts] Two alternative measure of inflation are given by the Consumer Price Index (CPI) and Producer Price Index (PPI). Different inflation measures use different “market baskets” reflecting the different combinations of goods purchased by different types of individuals or firms.

c) [5 pts] Not all payments are indexed to inflation. In particular, three groups hurt by inflation are lenders (assuming fixed-rate loans), taxpayers (because the tax system is not fully indexed), and holders of currency (since the real value of currency falls as the price level rises). [See your textbook, p 510, for more discussion.]

2) [10 pts] The *output gap* is the percentage difference between actual GDP and potential GDP. [Note that this gap is *positive* when the economy is operating above potential, and *negative* when the economy is operating below potential.]

The *natural rate of unemployment* is the unemployment rate when the output gap is zero (i.e., when actual GDP = potential GDP). [This rate is positive because it is generated by the “frictional” unemployment that always exists, even when the economy is operating at its full potential.]

According to *Okun’s Law*,

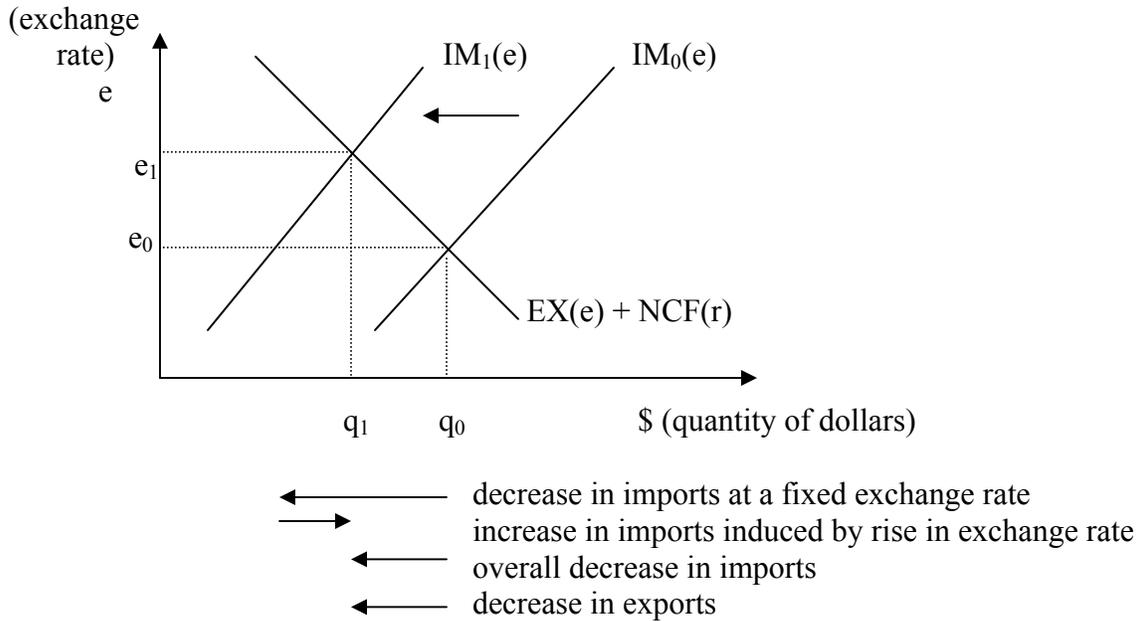
$$\text{output gap} = 2 [\text{natural unemployment rate} - \text{actual unemployment rate}]$$

Thus, for March 2009,

$$\text{output gap} = 2 [5\% - 8.5\%] = -7\%$$

[Note that the output gap is *negative* when unemployment is above the natural rate.]

3a) [12 pts] If Americans import less at each exchange rate, this decreases the supply of dollars in the foreign exchange market.



Both imports and exports fall by the amount $(q_0 - q_1)$. [Holding fixed the initial exchange rate e_0 , imports fall by the amount of the leftward shift in the supply curve. However, as the interest rate rises from e_0 to e_1 , imports rise as we move along the supply curve. Overall, the change in imports is thus $(q_0 - q_1)$. The change in exports is due to the movement along the demand curve as the interest rate rises from e_0 to e_1 .]

There is no change in net capital flows. [The movement along the demand curve is associated with the fall in exports. By assumption, net capital flows do not depend on the exchange rate, and so do not change as e rises.]

The exchange rate rises from e_0 to e_1 . Because imports and exports fall by the same amount, there is no change in the trade deficit.

b) [4 pts] The campaign has no effect on the capital market. Given the assumptions stated in the problem, neither private savings nor net capital flows are affected by the exchange rate. Thus, there is no change to supply (or demand) in the capital market.

4a) [3 pts] Money is “neutral” when changes in the money supply have no effect on the “real” economic variables (corresponding to the flows in the circular flow diagram). In particular, the money supply does not affect real GDP (which is fixed at potential output in the full-employment model).

4b) [5 pts] The price level is determined by the quantity equation: $MV = PY$

This equation can be rewritten as $\% \Delta M + \% \Delta V = \% \Delta P + \% \Delta Y$

Because the full-employment model assumes velocity is a constant, $\% \Delta V = 0$ and this equation becomes $\% \Delta M = \% \Delta P + \% \Delta Y$

c) [4 pts] Using the equation from part (b), $\% \Delta M > \% \Delta Y$ implies $\% \Delta P > 0$. Thus, if the money supply grows faster than GDP, the price level rises (i.e., there is *inflation*).

Alternatively, $\% \Delta Y > \% \Delta M$ implies $\% \Delta P < 0$. Thus, if GDP grows faster than the money supply, the price level falls (i.e., there is *deflation*).

Ideally, we would like to maintain zero inflation ($\% \Delta P = 0$). According to the full-employment model, the Fed can accomplish this by managing the money supply so it grows at the same rate as GDP (i.e., setting $\% \Delta M = \% \Delta Y$). Given a gold standard, changes in the money supply are independent of the growth in GDP. Thus, a gold standard could lead to inflation or deflation. [In the context of US economic history, the gold standard caused deflation in the 1890s, hurting borrowers (in particular, farmers). This prompted presidential candidate William Jennings Bryan to give his famous 1896 “cross of gold” speech, in which he argued against the gold standard.]

5a) [3 pts] $C = C_d + IM$
 $= a + (MPC - MPI)(1 - \tau)Y + (MPI)(1 - \tau)Y$
 $= a + MPC(1 - \tau)Y = 10 + .72Y$

b) [6 pts] $Y = C + I + G + EX - IM$ (or, equivalently, $Y = C_d + I + G + EX$)
Substituting, we obtain $Y = a + (MPC - MPI)(1 - \tau)Y + I + G + EX$

Thus, $Y = (1/[1 - (MPC - MPI)(1 - \tau)])(a + I + G + X)$
 $= (1/[1 - (.9 - .3)(1 - .2)])(10 + 40 + 50 + 15) = (1/.52)(115) = 221.15$

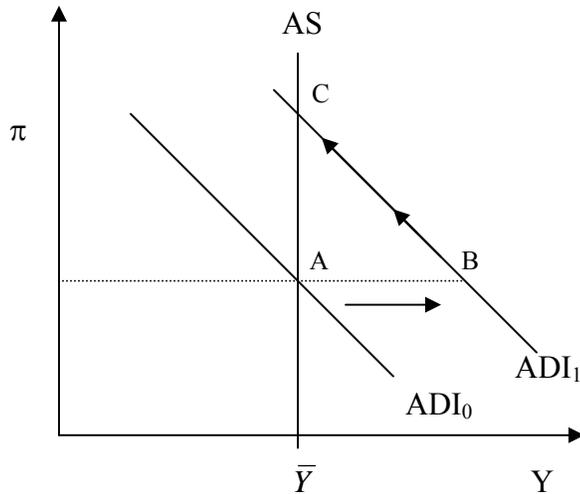
c) [6 pts] $Y = (1/[1 - (.9 - .2)(1 - .2)])(10 + 40 + 50 + 15) = (1/.44)(115) = 261.36$

d) [12 pts] Given $MPI = .3$,
 $G = 50$ and $T = \tau Y = 44.23 \rightarrow$ budget *deficit* $G - T = 5.77$
 $EX = 15$ and $IM = (MPI)(1 - \tau)Y = 53.076 \rightarrow$ trade *deficit* $IM - EX = 38.08$

Given $MPI = .2$,
 $G = 50$ and $T = \tau Y = 52.27 \rightarrow$ budget *surplus* $T - G = 2.27$
 $EX = 15$ and $IM = (MPI)(1 - \tau)Y = 41.82 \rightarrow$ trade *deficit* $IM - EX = 26.82$

e) [3 pts] Given the fall in MPI, government fiscal policy is more effective because the multiplier $(1/[1 - (MPC - MPI)(1 - \tau)])$ has risen.

6) [12 pts] As shown in question (5), a decrease in the MPI causes equilibrium Y to rise. In terms of the ADI-AS analysis, this implies that the ADI curve shifts rightwards.



Given a rightward shift from ADI_0 to ADI_1 , the economy initially moves from point A to point B so that there is an increase in the output level while inflation remains constant. But given that Y is above the full employment level, there will be upward pressure on the inflation rate. Over time, the economy will move along the ADI_1 from point B to point C. In the long run (at point C), the economy returns to the full employment level of output, but there is now a higher inflation rate.

The preceding scenario assumed that the Fed did not change its policy rule. But if the Fed immediately tightened monetary policy (so that the Fed would set a higher interest rate at every possible inflation rate), the ADI curve would have immediately shifted back to the left, returning the economy immediately to point A.