Problem set 3

answers

Problem 1 Suppose that good A is an inferior good and good B is a normal good, and that the consumer spends all of his money on these two goods.

a. If the price of good A rises, what will happen to the consumer's demand for Good A? Explain briefly in terms of income and substitution effects. If the price of A rises, the substitution effect causes the consumer to buy less of A, while the income effect causes the consumer to buy more of A. The total effect of the price change on demand for A is then ambiguous, though it is likely the income effect is smaller than the substitution effect and so quantity demanded of A decreases.

b. If the price of good B rises, what will happen to the consumer's demand for good A? Explain briefly in terms of income and substitution effects.If B becomes more expensive, the substitution effect leads to less B and more A, while the income effect leads to less B and more A. Thus the quantity of A clearly increases.

c. Are these goods complements of substitutes? Explain. Since the quantity of A increases given a price increase in B, A and B are substitutes.

Problem 2 Derive and plot Olivia's demand curve for pie if she eats pie only a la mode and does not eat either pie or ice cream alone (so that pie and ice cream are perfect complements).Olivia's utility function is then $u(P, I) = \min\{PI, IC\}$, which is maximized only if $PI = IC$. Her budget constraint is $p_{PI}PI + p_{IC}IC = Income$. Substituting the former into the latter yields $PI = \frac{Income}{p_{PI}+p_{IC}}$.

Problem 3 Caliban allocates \$240 to clothes (C) and food (F). He has utility function $u(C, F) = CF^3$ (so that $MU_C = F^3$ and $MU_F = 3CF^2$). The price of clothing is p_C, while the price of food is p_F.

a. Derive Caliban's demand function for food. Caliban's utility is maximized only if $\frac{MU_C}{MU_F} = \frac{p_C}{p_F}$, which is equivalent to $\frac{F}{3C} = \frac{p_C}{p_F}$. His budget constraint is $p_cC + p_F F = 240$. Substituting the former condition into the latter and solving yields $F = \frac{180}{p_F}$.

b. How much food does Caliban consume if $p_F = \$6$ and $p_C = \$15$? What if $p_F = \$12$ and $p_C = \$22$?If $p_F = \$6$ and $p_C = \$15$, Caliban consumes 30 food. In the latter case he consumes 15 food.

Problem 4 Each week, Bill and Jane select the quantity of two goods, A and B, that they will consume in order to maximize their respective utilities. They each spend their entire weekly income on these two goods.

a. Suppose you are given the following information about the choices that Bill makes over a three-week period:

	A	B	p_A	p_B	Income
Week 1	10	20	2	1	40
Week 2	7	19	3	1	40
Week 3	8	31	3	1	55

Did Bill's utility increase or decrease between week 1 and week 2? Between week 1 and week 3? Explain using a graph to support your answer.Between week 1 and week 2, Bill's income remained constant while the price of one of the goods increased. Therefore, his preferred bundle in week 1 is no longer affordable, and so he must switch to a different bundle, which necessarily makes him worse off. Between weeks 1 and 3,

p_A increases, but his income also increases. However, note that his preferred bundle in week 1 **is** affordable in week 3, with \$5 to spare. Therefore, he is better off in week 3 than in week 1.

b. Now suppose you are given the following information about Jane's choices:

	A	B	p_A	p_B	Income
Week 1	12	24	2	1	48
Week 2	16	32	1	1	48
Week 3	12	24	1	1	36

Draw a budget line-indifference curve graph that illustrates Jane's three chosen bundles. Are these goods complements or substitutes for Jane? Identify the income and substitution effects that result from a change in the price of good A.From week 1 to week 2, p_A decreases and income remains constant, yet consumption of good B increases. Therefore, goods A and B are complements. To disentangle income and substitution effects of the price change between weeks 1 and 2, note that in week 3, Jane is as well off as in week 1 (she consumes exactly the same bundle, so she must be as well off). The shift from week 1 to week 3 is the substitution effect, while the shift from week 3 to week 2 is the income effect. We can see, for example, that both goods are normal, as the income effect causes consumption of both goods to increase.

Problem 5 Suppose the market for lawn gnomes is described by demand curve $q_g^d = 440 - 10p$ and supply curve $q_g^s = p$. Suppose also that the market for cigarettes is described by demand $q_c^d = 44 - \frac{1}{10}p$ and supply $q_c^s = p$.

a. Show that both markets have equilibrium quantity $q^* = 40$ and $p^* = 40$.This is trivial.

b. Evaluate the effect of a tax of \$10 on consumers in each market. Calculate consumers' surplus, producers' surplus, and government revenue before and after in each.Before the tax, the lawn gone market has a CS of 80 and a PS of 800. After the tax on lawn gnomes, the new quantity will be 30.91, while the price will be \$30.91 without the tax and \$40.91 including the tax. CS is now 47.76, PS is now 444.71, government revenue is \$309.10, and so deadweight loss is 45.43, or 5.16% of the original total surplus.

In the market for cigarettes, before the tax CS is 8,000, while PS is 800. After the tax, quantity is reduced to 39.09, while the price without the tax is \$39.09 and the price including the tax is \$49.09. After the tax, CS is 7640.36 while PS is 764.01. The deadweight loss is therefore 4.75, or .054% of the original total surplus.

c. Which market has the higher deadweight loss of the tax? Explain why this is so, intuitively.The cigarette market has a much lower deadweight loss of a \$10 tax. This is because while supply has the same elasticity in both markets ($\eta = 1$), demand for cigarettes is very inelastic ($\epsilon = -\frac{1}{10}$ in equilibrium), while demand for lawn gnomes is very elastic ($\epsilon = -10$ in equilibrium). Taxes distort markets by lowering the quantity traded, and do so more profoundly the more elastic a market is.

Problem 6 Suppose that the supply for corn is given by $q = 2p$ while the supply is given by $q = 210 - p$. Suppose that the government institutes a price floor of \$100 in this market, and supports it by purchasing the excess of supply over demand at that price. Suppose that the government is able to sell this excess corn in the third world for \$20/unit. Calculate the deadweight loss of this price floor, making sure to take into account the cost to the government.Before the price floor, CS is 9,800 and PS is 4,900. After the price floor, CS decreases to 6,050, PS increases to 10,000, but the cost of the program to the government is

$(\$100 - \$20) * 90 = \$7,200$, as the government must buy up 90 units and sell them at a loss of \$80 each. The deadweight loss of the program is thus 5850.