Homework 1

due Wednesday, September 14 by 9am

Instructions: Complete all 6 problems. Answers may be handwritten or typed. Students may work together, but must independently formulate their own answers. Failure to do so will result in a grade of zero.

Problem 1 Antonio buys five new college textbooks during his first year at school at a cost of \$80 each. Used books cost only \$50 each. When the bookstore announces there will be a 10% increase in the price of new books, and a 5% increase in the price of used books, Antonio's father offers him \$40 extra.

a. What happens to Antonio's budget line? Illustrate the change with new books on the vertical axis, and used books on the horizontal axis.

Antonio was spending \$400 on books before the changes in prices and before the extra money from his father. The intercepts of his budget line were at 5 new books, and 8 used books. After the prices change and he gets an additional \$40, his budget line has intercepts at $\frac{\$440}{\$88} = 5$ new books and $\frac{\$440}{\$55} = 5$ used books. In other words, the extra \$40 he gets from his father is exactly enough to offset the bookstore's price increases.

b. Is Antonio worse or better off after the price change? Explain.

Since Antonio's preferred bundle prior to the price and income changes (5 new books, 0 used books) is still affordable, he must be at least as well off as before. Since there are no additional bundles that are affordable after the price and income changes that were not affordable before (the budget line is exactly the same), there is no reason he would be strictly better off after the changes.

Problem 2 Pauly allocates \$100 per week to two goods: hair gel (H), and fake tan spray (F). One unit of hair gel costs \$5, while one unit of fake tan spray costs \$10. Pauly's preferences over these two goods are given by the utility function $u(H, F) = 5 * H * F$.

a. On a graph with H on the y-axis and F on the x-axis, sketch the indifference curve that gives Pauly utility of 100. Label at least 3 distinct points. Then, do the same for a utility of 500.

You may do this by plotting out a few points, each of which give Pauly 100 utility, or by plotting the mathematical equation $5HF = 100$. For the former method, note that $(HF, H) = (20, 1), (10, 2), (5, 4), (4, 5), (2, 10), (1, 20)$ all give utility of 100. Connecting the dots will reveal the shape of his indifference curve. For the latter method, note that we can rewrite the equation as $H = \frac{100}{F}$, which, when graphed describes Pauly's indifference curve for utility = 100. For utility of 500, the equation would be $H = \frac{500}{F}$.

b. On a similar graph, plot Pauly's budget line. Based on your graph, when Pauly maximizes his utility, will he get more or less utility than 100? Than 500?

See picture. Based only on trying to draw reasonably to-scale pictures, we see that Pauly's budget line crosses his 100 utility indiference curve, but never touches his 500 utility indifference curve. We can conclude from this that his preferred bundle will give him more than 100 utility but less than 500 utility.

c. Pick at least three points on Pauly's budget line, and calculate Pauly's marginal utility of fake tan spray and hair gel at each of those points. For each point, state whether or not Pauly is maximizing his utility at that point, and, if not, whether he should buy more hair gel and less fake tan spray, or vice-versa.

Pauly maximizes his utility by consuming 10 hair gel units and 5 fake tan units. For any guess that has more hair gel than 10, you should have said that Pauly consumers fewer hair gel units. Similarly, for any

guess that Pauly consumes fewer than 10 hair gels, you should have concluded that his marginal utility per dollar was higher for fake tans.

Problem 3 Arthur spends his income on bread and chocolate. He likes chocolate, but is neutral towards bread, in that he doesn't care if he consumes it or not. Sketch Arthur's indifference curve map over bread and chocolate

see pictures.

Problem 4 Suppose that Boston consumers pay twice as much for avocados as for tangerines, whereas San Diego consumers pay half as much for avocados as for tangerines. Assuming that consumers maximize their utility, which city's consumers have a higher marginal rate of substitution of avocados for tangerines? Explain your answer.

While we don't know anything about the preferences or incomes of people in Boston or San Diego, we do know that every Bostonian's budget line has slope -2 (if avocados are on the x-axis), while every San Diegan's budget line has slop $-\frac{1}{2}$. Assuming each Bostonian and each San Diegan is maximizing her utility, regardless of what her budget is, she will consume a bundle whose indifference curve is tangent (has same slope) to her budget line, meaning the MRS of tangerines for avocados is 2 for Bostonians and $\frac{1}{2}$ for San Diegans. This means a Bostonian would be willing to trade 2 tangerines to get one avocado, while a San Diegan would be willing to trade 2 avocados to get one additional tangerine.

Problem 5 One can of Coke is a perfect substitute for one can of Pepsi for Islay.

a. Which of the following utility functions best represents her preferences? Support your answer (possibly by plotting out indifference curves for each of the three options).

1. $u(P, C) = 3PC$

2. $u(P, C) = P + C$

3. $u(P, C) = \sqrt{P} + \sqrt{C}$

Goods that are perfect substitutes have indifference curves that are straight lines. Of the 3 choices above, only 2 yields straight line indifference curves. Therefore, $u = P + C$ is the appropriate utility function to represent preferences over two goods that are perfect substitutes.

b. Suppose that a can of Coke costs \$.75, while a can of Pepsi costs \$.80 at Islay's preferred vending machine. Obviously, she will purchase only Cokes. Draw a picture of the corresponding indifference curve/budget line graph, and indicate Islay's utility-maximizing bundle on your graph.

See pictures.

Problem 6 For Broderick, beer and pizza are perfect complements: he never drinks a beer without a slice of pizza, and vice-versa.

a. Try to write down a utility function representing Broderick's preferences. For example, assign him a utility of 10 if he has 10 slices of pizza and 10 beers. Note that he would also have utility of 10 if he had 10 slices and 15 beers, since he would just throw the excess beer away. (hint: the easiest way to write down a utility function for Broderick is to use the min function).

Since all Broderick cares about is the number of beer-pizza pairs he has, if he has X slices and Y beers, his utility is the *smaller* of X and Y. Mathematically, his utility function is $U(B, P) = \min\{B, P\}$. A verbal description of how to construct his utility function is a sufficient answer for this question.

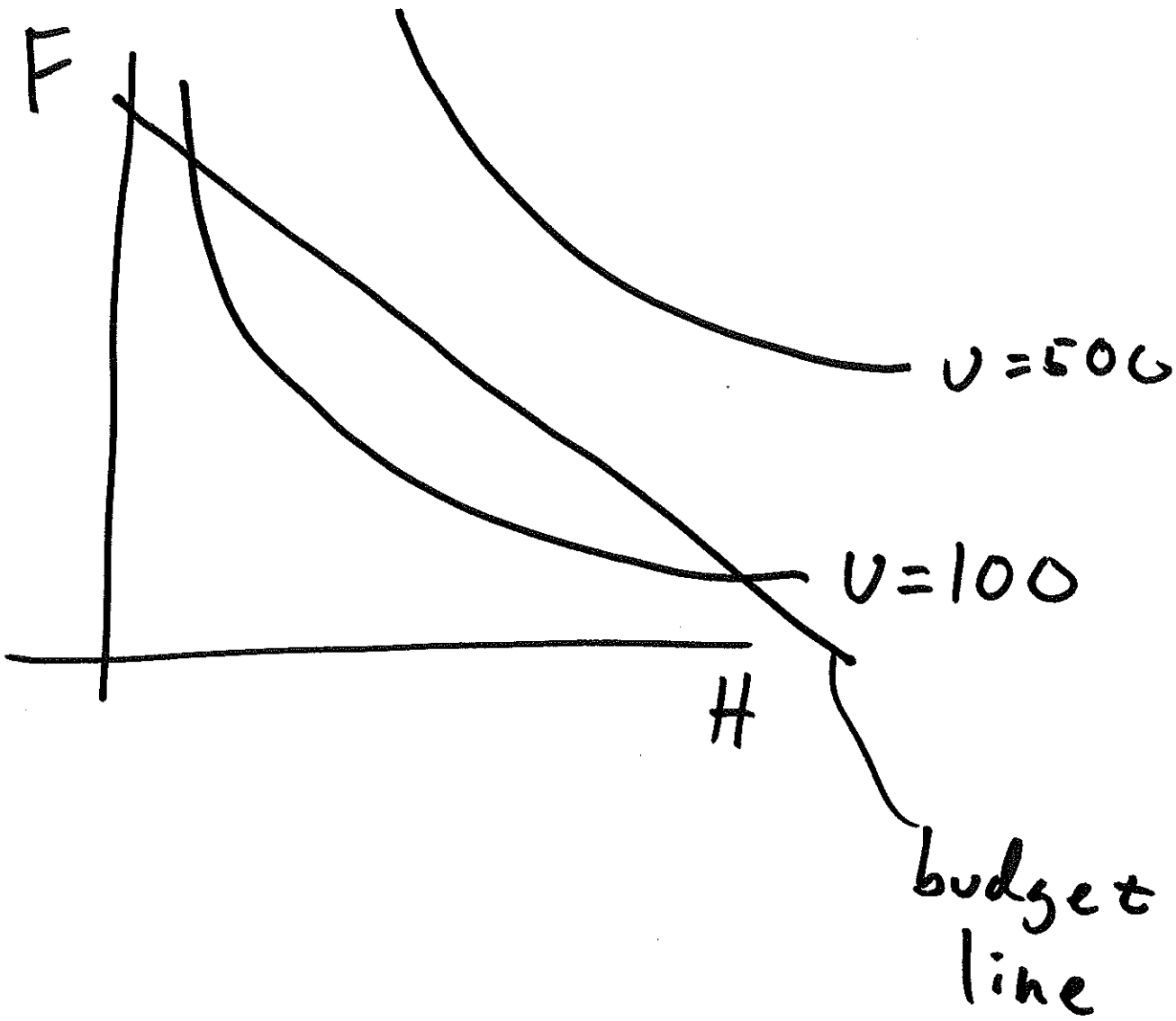
b. Suppose the price of a slice of pizza is \$2, and the price of a beer is \$3. Broderick has \$30 to spend. What is his utility-maximizing bundle?

He's only interested in buying as many beer-pizza pairs as possible. Each such pair costs \$5, so with \$30 to spend, he'll buy 6 of each good.

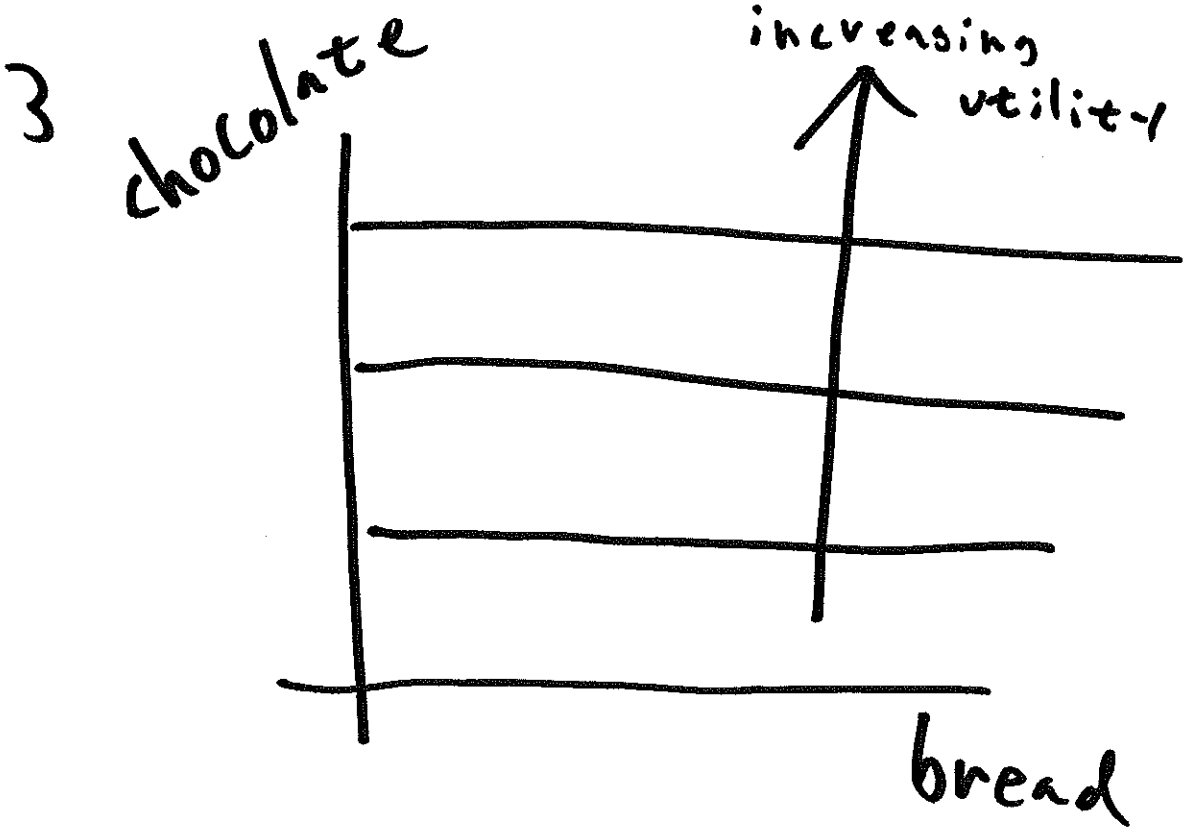
c. Now suppose the price of a slice of pizza changes, to p. Can you write down Broderick's demand function for pizza, as a function of p?

Now, each beer-pizza pair costs $\$3 + p$, and so with \$30 to spend, he'll purchase $\frac{30}{3+p}$ slices of pizza.

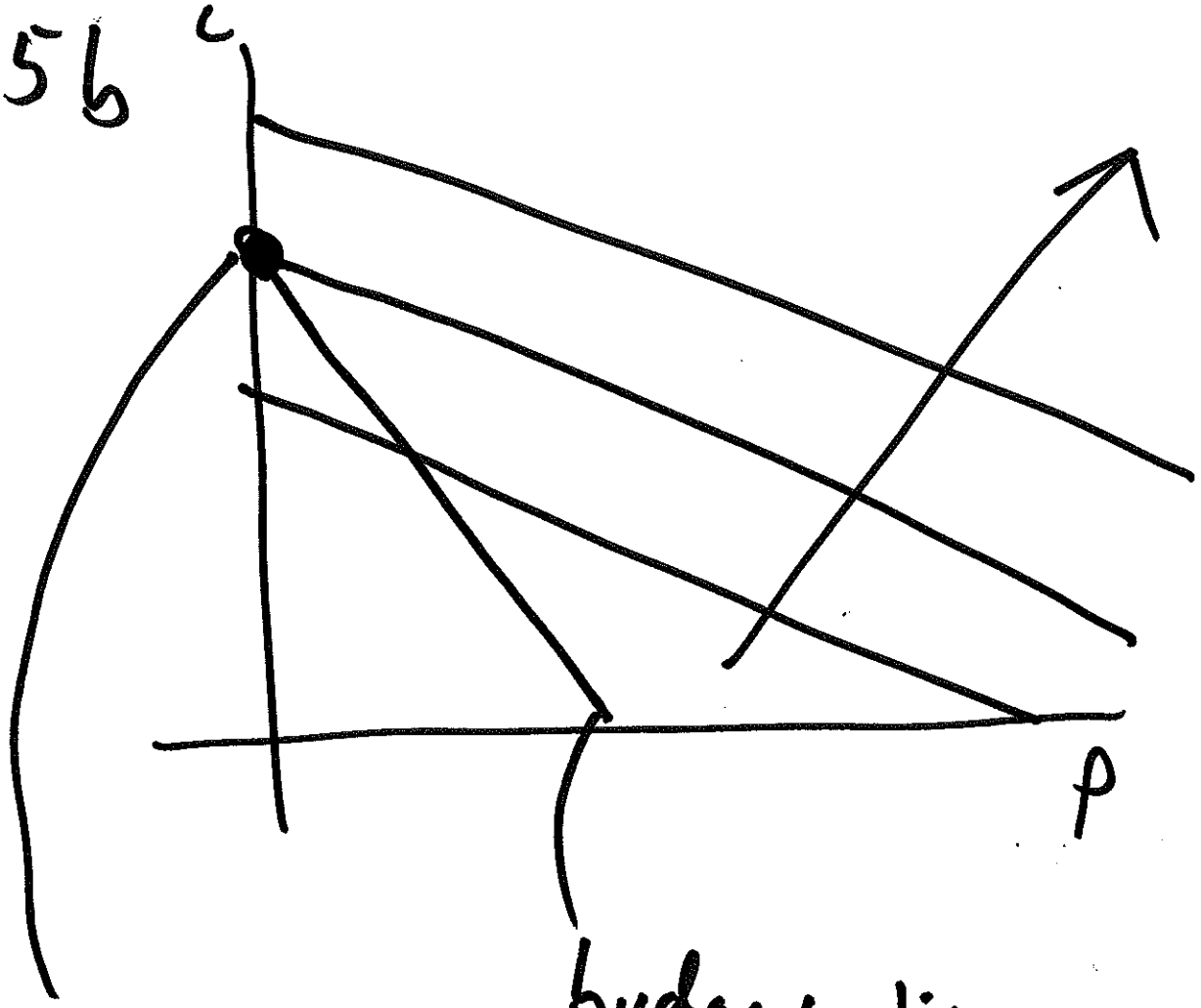
26


F
U=500
U=100
H
budget line

3


chocolate
increasing utility
bread

5b



budget line

U-max bundle