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Stern School of Business

New York University

### Problem Set 2

1. Assume that a consumer has an income of \$30,000 that he spends on air travel,  $Y$ , and all other goods  $X$ . Assume  $P_x = 1$ . Suppose that the price for each mile of the first 10,000 miles of air travel is \$2 per mile. A frequent traveler program gives a 50% discount to travelers for every mile above 10,000 miles.

(a) Draw the budget constraint and find the equations that define each part of it. (Hint: start from the point where the consumer does not travel at all. Find how much money he will have left after completing 10,000 miles. Find on the diagram the point corresponding to the purchase of 10,000. Now start from that point and consider a purchase of more air miles.)

(b) Suppose that the consumer's utility function is  $U = xy$ . The marginal utility of  $X$  is  $MU_x = y$ , and the marginal utility of  $Y$  is  $MU_y = x$ . Calculate and show on the diagram the optimal choice of the consumer.

(c) Show how it is possible that a consumer with different (from the ones in part (b)) but still convex indifferent curves could be indifferent between two different optimal choices.

2. While you were at college, your parents gave you \$300 per month. You spent the entire amount on video games and sci-fi books ( $V$  and  $B$ , respectively). Your utility function was  $U = B^2V$ . This implies that the marginal utility of video games was  $MU_v = B^2$  and the marginal utility of sci-fi books was  $MU_B = 2BV$ . Video games used to cost \$2 per unit and books used to cost \$10 per unit.

(a) Derive your marginal rate of substitution.

(b) Find the optimal consumption bundle.

(c) Explain why you would not settle for a solution where

$MRS > P_v/P_b$  or  $MRS < P_v/P_b$ .

3. The utility that Jane receives by consuming food F and clothing C is given by  $u(F,C) = FC$ .

a. Draw the indifference curve associated with a utility level of 12 and the indifference curve associated with the utility level with of 24. Are the indifference curves convex?

b. Suppose that food costs \$1 per unit and clothing \$3 per unit. Jane has \$12 to spend on food and clothing. Graph the budget line that she faces.

c. What is the utility-maximizing choice of food and clothing (solve the problem both mathematically and graphically).

d. What is the marginal rate of substitution of food for clothing when utility is maximized?

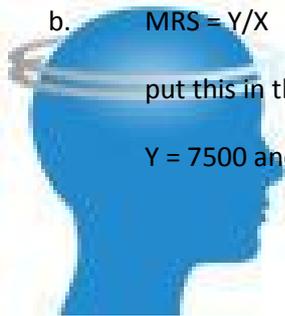
e. Suppose Jane buys 3 units of food and 3 units of clothing with her \$12 budget. Would her marginal rate of substitution of food for clothing be greater than or less than 1/3. Explain.

Question 1.

b.  $MRS = Y/X$  price ratio is  $\frac{1}{2}$  so that  $X = 2Y$

put this in the budget line to get  $2Y + 2Y = 30000$

$Y = 7500$  and  $X = 15000$  in optimal situation.



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c. for a consumer to be indifferent between two baskets these baskets must be on the same indifference curve. In equilibrium slope of IC equals slope of BL. If prices change, this slope of BL changes. Then it is possible to be on two different points on one IC and be in equilibrium under different prices.

**Question 2 :**

- a. MRS is given by the ration of the marginal utilities

$$MU_x/MU_y = MRS = MUB/MUV = 2V/B$$

- b. Equate MRS with the price ratio to get  $2V/B = 2/10 = 1/5$        $B = 10V$

The budget line is  $P_b B + P_v V = M$

$$2B + 10V = 300$$

$$2(10V) + 10v = 300$$

$V = 300/12 = 10$     $B = 100$ —these are the optimal bundles.

- c. The inequality between MRS and price ratio cant be an equilibrium . the MRS shows the amount of V a consumer gives up to get 1 more unit of B. The price ratio shows the money to be given up to get 1 more of B. If there is a mismatch between what the consumer is willing to pay and what the market wants it cant be equilibrium.



**Q3.**

- a. And b are in excel attachment

- b. .

- c. In equilibrium  $MRS = P_c/P_F$

$$MRS = F/C = 3/1 = 3 \quad \text{so that } F = 3C$$

Put this in the budget line  $P_c C + P_f F = 12$

$$3C + F = 12 \quad 3C + 3C = 12 \quad \text{so } C = 12/6 = 2 \text{ and } F = 6$$

- d. MRS at equilibrium is  $F/C = 6/2 = 3$

- e. If 3F and 3C are bought then  $MRS = 3/3 = 1 <$ price ratio of 3

This means that we are buying more of C –we must consume according to the relation  $F = 3C$

(THE ABOVE ASSUMES THAT C IS ON XAXISA AND F IS ON YAXIS. )

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