Problem Set #1

I. Budget Constraints

Ming has a budget of $60/month to spend on high-tech at-home entertainment. There are only two goods that he considers: CD's and video rentals. For each of the situations described below, draw Ming's budget constraint. Denote the axes as "CD's per month" and "video rentals per month." Label the x and y intercepts of the budget constraints, the slopes, and any kink points (that is, give the quantities associated with the intercepts, slopes, and kinks.)

1) CD's cost $12 each and video rentals are $4 each. (This is a standard budget constraint.)

2) Video-rentals cost $4 each. CD's cost $12 each for the first three; however, if more than three CD's are purchased, the price for additional CD's (that is, for the fourth, fifth, etc. CD) drops to $8. [Therefore: if three CD's are purchased, the cost is 12*3 = 36; if four are purchased, the cost is (12*3) + (8*1) = $44.]

3) Video rentals cost $4 each. The price of CD's is $12 for up to three CD's but drops to $10 if more than three are purchased. (That is, if three CD's are purchased, the cost is 12*3 = $36; if four are purchased, the cost is 10*4 = $40.)

4) Video rentals cost $4 each. CD's can be bought for $12 each or in groups of three for $30 for the three. (Hence: four CD's cost 30 + 12 = $42 and six CD's cost 30 + 30 = $60.)

5) CD's cost $12 each and video rentals are $4 each. However, for $24 Ming can purchase a video card that allows him to rent 10 videos in a month; for more than 10 videos, the cost returns to $4 each. He is allowed to purchase only one of these cards per month.

6) As in part "5," but now Ming is allowed to purchase as many of these cards as he would like each month (but he must use the cards entirely on each month.)

II. Indifference Curves

Let's drop the assumption of non-satiation. This allows us to represent a wider variety of preferences.

Consider our two goods: movies and concerts. Draw indifference curves that represent the preferences of each of the following people. Define the axes as "concerts per month" and "movies per month." For each graph, label the direction of preference with an arrow.

> *Example:* *YoYo Ma likes concerts but doesn't care whether or not he goes to movies. His indifference curves look like:*
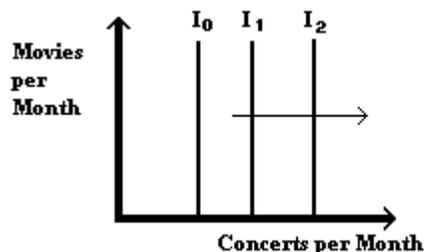
1)   Ruth like movies but dislikes concerts.

2)   Carlos dislikes both movies and concerts (he likes reading instead). He dislikes each movie more the more movies he goes to. He dislikes each concert the same, no matter how many he goes to.

3)   Sanjay also dislikes both movies and concerts and dislikes each concert the same no matter how many concerts he goes to. But, unlike Carlos, he dislikes each movie less the more movies he goes to.

4)   Marie likes concerts up until she goes to three per month and then starts to dislike extra ones. However, she likes movies no matter how many she sees.

5)   Andrea likes it best when she goes to three movies and two concerts each month. If she deviates from these most-preferred amounts, by either going to more movies/concerts or to fewer, then she is less happy. The amount by which she is dissatisfied increases by the amount by which she deviates, either more or less, from her most-preferred quantities.

III.   **Consumer Choice**

1)   Jake wears Levi's and T-shirts with surfer logos. He has lots of these, even some that he hasn't worn and can take back to the store for a refund if he wants. His marginal rate of substitution (MRS) of Levi's for T-shirts is 3, meaning that if given the opportunity he would be willing to trade 3 T-shirts for 1 pair of Levi's, or vice versa. The price of Levi's is $20 and the price of T-shirts is $10. Suggest a way that Jake can make himself even happier than he is now.

2)   Suppose the lobby for the salmon fishing industry gains enough political influence to convince the government to reduce fishing restrictions and to stimulate public demand for salmon. The government is considering three policies:

a)   the government could intervene to the extent of reducing the market price for salmon to $3/lb.

b)   the government could give each consumer a cash grant of $40.

c)   the government could issue $40 "salmon vouchers" to each consumer.
(These vouchers are only good for salmon purchases and cannot be resold.)

Assume:
One)   there are only 2 goods in the consumer's consumption bundle: S = salmon; C = chicken.
Two)   the price of salmon is $4/lb. and the price of chicken is $2/lb.
Three)   the consumer's food budget is $200.

(i)   Draw the budget constraint and a maximizing indifference curve <u>before</u> the government takes action. What is the marginal rate of substitution (MRS) at the maximizing point?

(ii)   If both salmon and chicken are normal goods, graphically show the effect of policies "a"- "c" on the consumer's food bundle choice

(iii)   Suppose that the consumer chooses to consume little or no salmon even under policy "a." Show that policy "c" <u>will</u> increase his consumption of salmon.

3)   Valerie wants to exercise and has a choice of going to an aerobics class, which costs $3 each time, or to the gym where she can work out with weights; the gym costs $2 per visit. She likes to do some of each type of exercise; that is, the more aerobics she does, the more she enjoys weightlifting, and vice versa. However,

she enjoys aerobics, even if she never lifts weights, while weightlifting is fun for her only if she also does some aerobics. The following utility function reflects Valerie's preferences:

$u = xy + 4x$ where   x is the number of aerobics classes per semester
                              y is the number of visits to the gym for weightlifting per semester

(Think about how this utility function represents Valerie's preferences as they have been described.)

Valerie's budget for exercising is $100 per semester. We want to determine the number of aerobics classes and visits to the gym that she will choose. Or, stated another way, we want to determine the number of aerobics classes and visits to the gym that will make her most happy given her budget of $100.

We will go through this exercise step-by-step:

a)   Give the formula for Valerie's budget constraint.
        (Express the constraint as y equaling some formula involving x.)

b)   Give the formula for Valerie's MRS of x for y. This is done in three steps:
                (i)   Give the formula for her MU_x.
                         (Hint: calculate the increase in U due to increasing x by 1 unit:
                         $[(x+1)y + 4(x+1)] - [xy + 4x]$)
                (ii)   Give the formula for her MU_y.
                (iii)   Using (i) and (ii), give the formula for her MRS.
                (iv)   Now: state in words what this MRS means, using "gym visits" and "aerobics
                         classes" instead of x and y.

c)   Note that Valerie's MRS changes as the number of aerobics classes and gym visits changes. To
        verify this, calculate her MRS when she:
                (i)   takes 12 aerobics classes and visits the gym 20 times.
                (ii)   takes 20 aerobics classes and visits the gym 16 times.

                In each case, state in words what the value of the MRS means.

d)   At any number of aerobics classes and gym visits, Valerie has a particular MRS (that is, a ratio at
        which she is willing to trade aerobics classes and gym visits.) If this MRS does not equal the ratio
        of prices, she can make herself happier by adjusting the number of aerobics classes and gym visits.
        (If this isn't clear, prove it to yourself.) When she makes these adjustments her MRS changes (think
        about why). She can continue making herself happier by adjusting the number of aerobics classes
        and gym visits until her MRS <u>does</u> equal the ratio of prices. That is, at the quantities that make her
        happiest, $MRS = P_x/P_y$.

        Substitute the formula for MRS from part b(iii) into the left hand side of this equation. Put the
        actual values of P_x and P_y into the right hand side. Now, solve for y in terms of x. (That is,
        rearrange the equation until it is in the form: y equals some formula involving x.)

e)   Valerie spends her entire budget on exercise. the budget constraint from part "a" is in the form: y
        equals a formula involving x. The result in part "d" is also of the form: y equals a (different)
        formula involving x. We know that both of these equations must be true for Valerie to be as happy
        as possible given her budget. Therefore, we have two equations and two unknowns (x and y). Let's
        first solve for x. Set the two formulas involving x equal to each other (since they both equal y).
        Solve for x. This is Valerie's chosen quantity of aerobics classes (or, stated differently, the quantity
        of aerobics classes that makes her happiest given her budget).

f)   Now, let's find y. Take the value of x obtained in part "e," substitute it into the budget constraint
        from part "a," and calculate y. This is Valerie's chosen number of gym visits (that is, then number
        of visits that makes her the most happy given her budget).

Congratulations!
Now do the next question on your own.

4)   Marco's utility for aerobics classes and gym visits is:

       $u = 2xy + 5x + 4y$

(Think about how Marco's preferences, as reflected in this utility function, differ from Valerie's.)

He lives in Beverly Hills where things are expensive: aerobics classes cost $10 each and a visit to the gym costs $8. However, his is also richer than Valerie and has a larger exercise budget: $400.

What number of aerobics classes and gym visits does Marco choose? (Or, stated alternatively, what number of aerobic classes and gym visits would make him happiest given his budget?)

5)   A local telephone company offers three pricing options:

I.   A monthly fee of $20 plus 5 cents per call
II.   No monthly fee, but 10 cents per call.
III.   No monthly fee, and 20 cents per call for up to 100 calls, and 5 cents per call for any calls beyond the first 100.

Note that the person can avoid the $20 monthly fee in option I by deciding to make no calls and discontinuing phone service. Hence, the first call under option I costs $20.05 ($20 for service plus 5 cents for the call).

Assume two goods: telephone calls and "All Other Goods," with All Other Goods measured in monetary units at $1 per unit. Income is $100.

a)   Show graphically that a person might choose more calls under option II than option I, even though the per-call charge is higher in option II.

b)   Show graphically that a person might spend less money on phone service and make more phone calls under option II than option I.

c)   Show graphically that a person might choose not to have any phone service under option I while choosing service under option II.

d)   Show graphically that under option III it is possible for a person to have more than one bundle that maximizes utility subject to the budget constraint.

IV.   **Income and Substitution Effects**

1)   Evans Hall society is composed of a large poor class and a minority wealthy class. Each consumer in this society buys only two goods: new economic books and used economics books (plus coffee to keep awake while trying to read them, but we'll ignore that). For each poorer consumer, the income effect of a change in the price of used books reinforces the substitution effect. For each wealthy consumer, the income effect opposes and outweighs the substitution effects.

    a)   For which class are used books a Giffen good? a normal good? an inferior good?

    b)   Illustrate graphically the effect of a decrease in the price of used books on an individual's consumption in each class. Label the substitution and income effects for used books.

    c)   Think about what could cause the income effects of the two classes to be different.

2)   Consider a government subsidy program that lowers the price of food to poor consumers from $3 per unit to $2. Assume:

        1)   diminishing MRS between food and all other goods (AOG)
        2)   price of AOG is $1
        3)   good and AOG are normal goods

    a)   Graphically show the change in food consumption that results from the program.

    b)   Graphically show the change in consumption attributable to the income and substitution effects.

    c)   Show graphically how much the program costs the government.

    d)   An economist claims that she can make these poor consumers better off without costing the government any more money. How is this possible? (This can be shown graphically).