Intermediate Micro

MIDTERM EXAM
March 2, 2004

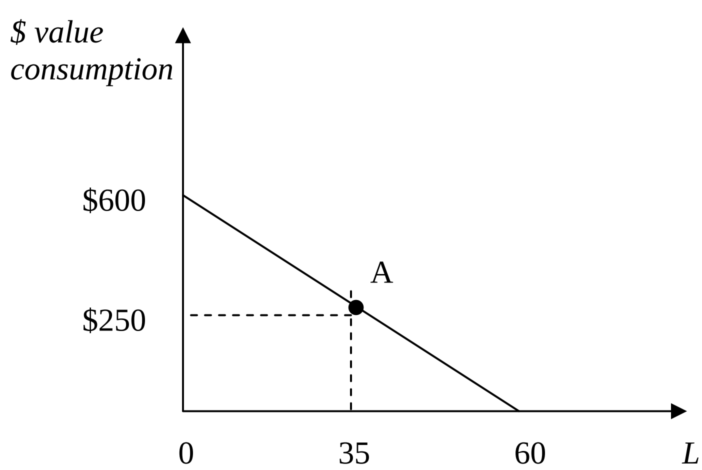
You have 75 minutes to answer the following questions. Each of the first five questions is worth 15 points. The five remaining questions are worth 5 points apiece. There is one bonus question at the end worth 10 points. The test is thus out of 100 with 10 possible bonus points. Allocate your time accordingly. <u>You must show your work!</u> Good luck!

<u>When you are done you must place this test paper in your exam booklet!</u>

<u>1. Income vs. Leisure (15 points)</u>

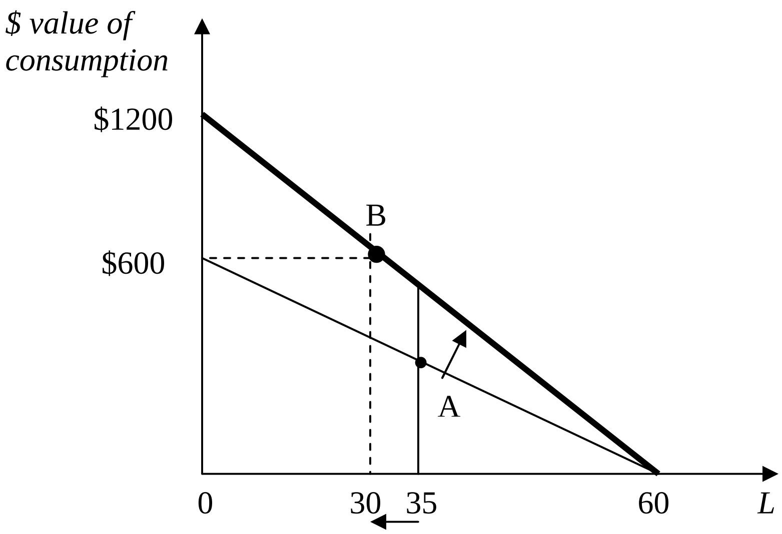
Yoko Kubota is the head ramen chef at Yokohama's most elite ramen restaurant ("Ii Ii Ramen"). Ms. Kubota has 60 hours of personal time that she can use to either work or pursue leisurely activities (singing in a karaoke bar). Currently she earns a wage of \$10/hour and works 25 hours per week. Assume that leisure is a normal good.

a. Sketch Yoko's budget line (BL), where we measure the number of hours spent crooning (singing) on the *x*-axis, and her money consumption of all other goods on the *y*-axis, and show her optimal bundle (label it "A") on the BL. Label your diagram explicitly.



Currently Yoko earns \$250 a week and spends 35 hours singing in karaoke bars.

b. Trying to keep Yoko from bolting to a rival restaurant ("Ramen Desu Gohan"), her boss doubles her wage. At this higher wage she works 30 hours (call the new optimum "B"). Sketch the new BL and clearly label the graph.



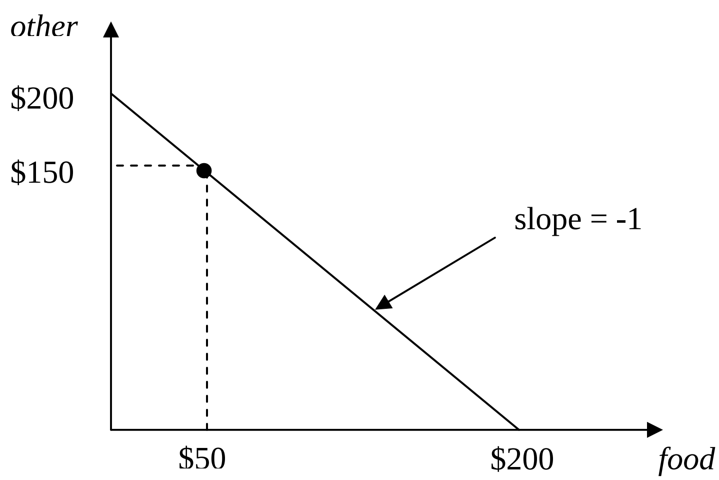
Yoko consumes less leisure at her higher wage.

c. What can you say about the sizes of the income and substitution effects of leisure for Yoko?

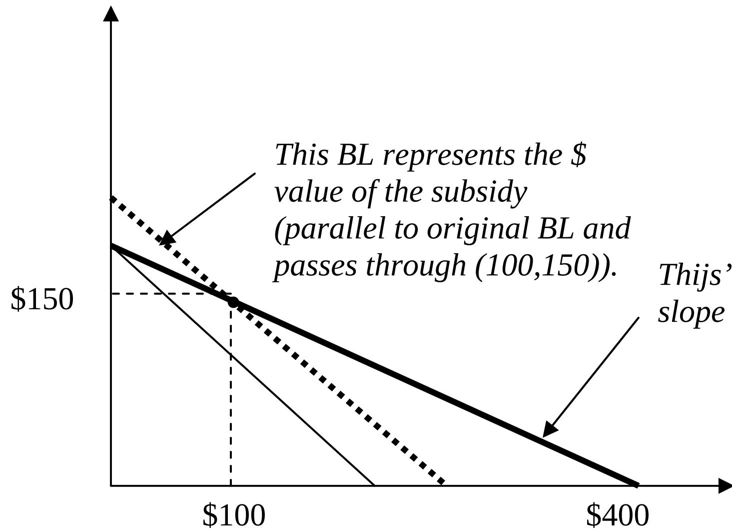
Since Yoko consumes less leisure we can conclude that for her, the wage increase engendered a substitution effect that was stronger than the income effect. (The tug-of-war happening is that her higher wage makes her richer and so she would like to consume more leisure, but her implicit price of leisure is her wage rate, and this has gone up.)

2. Price Subsidy vs. Cash (15 points)

(i) Draw and label the BL for a starving student (Thijs van Rens, a.k.a., "Blondie") who has a weekly income of $200 but spends only $50 on foodstuffs. (Label the *y*-axis as money spent on all other goods, and the *x*-axis as money spent on food.)



(ii) Consider a subsidy program undertaken by the government to help starving university students (and possibly newly appointed assistant professors). With valid identification, students can now buy food at half the store price. (Note that this differs from the example in your homework, which was an in-kind transfer. The subsidy is a change in price of food.) At the discounted prices he buys $100 worth of food (at a cost of $50). Draw and label Thijs' new BL, and include another BL that shows how much this program is worth to Thijs in dollar terms. (Hint: What point must this "dollar-value" BL pass through?)



(iii) Would giving Thijs the dollar amount you found above make him better off? Explain. (Assume that Blondie has smooth, convex preferences.)

With smooth convex IC, Blondie is necessarily better off according to standard economic theory (he can reach a higher IC with the dotted-lined BL). But as you should be well aware, there are times when a price subsidy is preferred to cash. Although cash offers a consumer more choices, there are times when choices lead to temptation in frivolous spending. This is the case when the consumer has problems with self-control in her spending.

<u>*3. Utility & Preferences (15 points)*</u>

Giorgio Primeceri loves spaghetti (good 1) and cannelloni (good 2). His utility function is $u(x_1,x_2) = x_1 + (3/2)x_2$.

a. Rank ($\succ$) the following bundles, (x_1,x_2), for Giorgio: $A = (6,6)$, $B = (12,1)$, $C = (3,7)$, $D = (1,9)$, $E = (4,5)$.

Just compute the utility values for each bundle: u(A) = 15; u(B) = 13.5; u(C) = 13.5; u(D) = 14.5; u(E) = 11.5. Thus $A \succ D \succ B \sim C \succ E$.

b. What is the ratio of marginal utilities (i.e., MU_1/MU_2)?

$MU_1 = 1$ and $MU_2 = 3/2$ (just take partial derivatives). So the ratio is 2/3.

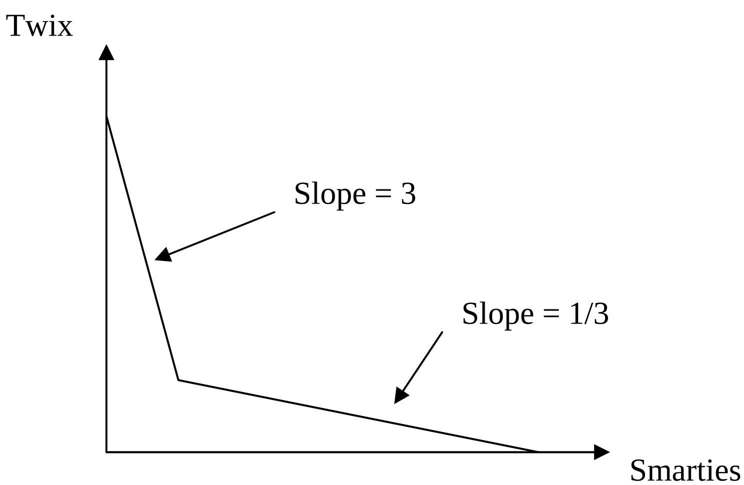
c. Now suppose that his utility function is $u(x_1, x_2) = \sqrt{x_1 + (3/2)x_2 + 100}$. Rank the bundles again with this utility function.

This utility is a positive monotonic transformation of the original utility, so the rankings remain the same as in (a).

4. MRS and the Shape of Indifference Curves (15 points)

Peter ("Professor") Bondarenko spends all his income on Smarties (good 1) and Twix (good 2). His MRS between Smarties and Twix is 3 when he has sufficiently many Twix, and his MRS between Smarties and Twix is 1/3 when he has sufficiently many Smarties.

a. Sketch a typical indifference curve of Professor Bondarenko



b. Under what conditions will he buy only Twix? That is, at what price for Twix (relative to Smarties) will he buy only Twix?

Professor buys Twix if the price ratio is three or higher. That is, if $p_1/p_2 \geq 3$, meaning that Twix is 1/3 or less the price of Smarties.

c. Under what conditions are we assured that he will buy positive quantities of both?

If the price ratio falls between 3 and 1/3, Professor will necessarily buy both in positive quantities. This means that $1/3 < p_1/p_2 < 3$; i.e., neither good is three times more expensive than the other. (Note that with equality we cannot be certain that strictly positive quantities will be bought.)

5. Decomposing Income and Substitution Effects (15 points)

Dave ("Toothpick") Biderman is trying to beef up ("Je veux être un gâteau à la viande!") with the help of Weight Gain 4000. His demand for WG4000 is given by $x_1 = 10 +$

$m/(10p_1)$. Originally his income is \$120 (per week) and the price of WG4000 is \$4 per serving.

a. How many servings of WG4000 does Dave buy in a week?

Just plug in price and income into the demand equation: $x_1 = 10 + 120/(10\times4) = 13$.

b. Find the change in demand if price falls to \$3

Plugging in a price of \$3, we get $x_1' = 10 + 120/(10\times3) = 14$.

c. How much does income have to change to keep Dave at his original consumption? (Hint: $\Delta m = x_1\Delta p_1$.)

Using the formula we get $\Delta m = x_1\Delta p_1 = 13(3\text{-}4) = -\$13$. *(Note that this is minus \$13. We need to take money away from Dave to compensate for the fact that WG4000 is now cheaper.) Thus, his compensated income (Slutsky) is 120-13 = \$107.*

d. Now use the fact that $m' = m + \Delta m$ to find the substitution effect of the price change. (Hint: Substitution effect is defined as $\Delta x_1^s = x_1(p_1', m') - x_1(p_1, m)$.)

With $m' = \$107$ *and* $p_1' = 3$ *we get* $x_1(p_1', m') = 10 + 107/(10\times3) = 13.57$. *From part (a) we know that* $x_1(p_1, m) = 13$. *Thus the substitution effect is 0.57.*

<u>*6. Nation of Second Guesses (5 points)*</u>

What is the principle thesis of the article “Nation of Second Guesses” (Barry Schwartz, NY Times, 2004)? Do you think his arguments are valid?

Mr. Schwartz’s thesis was that choice is not necessarily good. He said that this phenomenon was true after a certain bliss point in the amount of options that one has in life. He cited some interesting studies that showed that people with more choices were often more depressed, and that, for example, as the variety of jams offered in a supermarket increased, shoppers were more likely to have left without buying any.

His arguments are very relevant to economics, since it is taken as orthodoxy in standard economic theory that an expanded choice set always makes a consumer (weakly) better off. His work is thus supportive of the more recent trend in economics to appeal to psychology and non-conventional economics (e.g., “temptation and self-control” of Gul and Pesendorfer).

Shwartz’s arguments are very compelling. You can see even in your own life how sometimes expanded choices make your own life more miserable. Moreover, I am sure that all of us have some kind of vice in life that we wish we could handle with more control, and we furthermore know that we would be better off if we were not tempted with the vice from the onset.

7. Pareto Efficiency (5 points)

Define and state the significance of Pareto efficiency.

An allocation is Pareto efficient if there is no reallocation that exists that makes at least one person better off without making someone else worse off. This is a very important concept because it is a measure of "wastage" in an allocation. Moreover, economists often take this as a measure of the desirability of a policy option. However, one should note that efficiency need not be fair (and usually is not).

8. Inefficiency of Taxation? (5 points)

Evaluate the following statement:

> "Sales taxes always generate a deadweight loss (as long as we ignore the cases which are perfectly inelastic). Therefore it is a bad policy for governments to raise revenues through sales taxes. Instead, governments should look to other ways of raising revenues (such as selling lotteries, auctioning mining rights, creating for profit crown corporations, head taxes, etc.)."

The statement that sales taxes generate DWL is true. However, this is a very weak argument against a sales tax. For one, we often wish to tax a product if we think that the consumption is above the socially optimal level (e.g., a good whose production produces noxious fumes – a negative externality). Moreover, it may be good to tax a good to discourage its consumption per se (e.g., cigarettes). In any case, beyond the DWL we have to measure how the tax revenues are being spent. Taxation, in this sense, is just a reallocation of resources from one market – that which is being taxed – to another (where the tax revenues are diverted). If we believe that the social benefits of reallocating resources to the new market outweigh the DWL associated with the sales tax, the taxation is optimal. (Consider the case where we tax cigarettes and use these revenues to fund schools and hospitals. Although we certainly create a DWL in the cigarette market, most of us would agree that such a policy is beneficial to society as: (i) it discourages an unhealthy practice; (ii) since cigarettes present an externality – second-hand smoke, we know that too much is consumed relative to the social optimum; (iii) schools and hospitals are worthwhile targets to reallocate resources within.

9. Producer's Surplus (5 points)

Suppose a firm's supply curve is described by the function $p_S(y) = (1/10)y^2$. Find the change in producer's surplus when price changes from \$12.10 to \$14.40.

At a price of \$12.10 note that $y = 11$. At a price of \$14.40 note that $y = 12$. As the price change is positive we know that the change in surplus will be positive. We can thus estimate that the change will be about $\$(11.5\times 2.30) = \$26.45$ (using the rectangle and triangle approximation). In any case, just integrate this creature at the limits we found.

$$\int_0^{11}\left[12.10-0.1y^2\right]dy \ \ and \ \int_0^{12}\left[14.40-0.1y^2\right]dy$$

The first integral is 88.733, the second integral is 115.2. Thus the change is 26.467.

10. The Debate Surrounding Trade (5 points)

There is a great debate about the merits of trade and globalisation (c.f. the articles on trade posted on the course webpage). Why do economists generally support free trade? Why are some people opposed to trade liberalisation?

Economists harp about trade because it allows countries to realise "gains from trade." When the domestic economy faces a world price ratio, it can increase its wealth position by readjusting its production given the different prices. (Just as much as having a different price ratio makes a consumer better off – so long as the adjusted BL passes through the original point). In addition, we get gains from variety when we allow trade. Aside from the obvious point of increased variety, countries are made better off by allowing them to specialise in the goods for which they have a comparative advantage. Specialising also allows countries to reap the benefits of increasing returns in production.

Many are opposed to trade because it has redistributive effects. Some people are made better off; some are made worse off. It usually happens that the net effect is positive. That is, the overall gains outweigh the overall losses. Thus, there exists a set of transfers from winner to losers that would make everyone better off. Unfortunately, coordinating this transfer scheme is next to impossible. Moreover, as resources are reallocated in response to trade, people get caught in the middle, and in the real world one cannot seamlessly transfer laid-off workers into the industries that boom under trade.

In the end, trade policy is usually not a Pareto improving policy. Some people are made worse off by trade, even though economists will avow that trade produces a net gain in a country's wealth.

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Bonus. (10 points) Suppose you have the utility function that depends on two time periods:

$$U = u(C_1) + \beta u(C_2)$$

where C_i is consumption in time period i and $0 \le \beta \le 1$ is a personal discount factor. The consumer's budget constraint is that the present value of consumption cannot exceed the present value of income:

$$C_1 + C_2/(1+r) \le Y_1 + Y_2/(1+r)$$

where r is the interest rate and Y_i is period i income. Thus the consumer's problem is to choose consumption to maximise overall utility U. Find the condition that defines the consumer's optimal choice – this is known as the Euler equation for consumption. (Hint: You can assume that the budget constraint as binding.)

This requires much less work than you probably think. Just set up this maximisation problem replacing second period consumption with the equation

$$C_2 = (1 + r)(Y_1 - C_1) + Y_2$$

which we derived from the budget constraint (when the inequality is binding). That is, once we optimally choose first period consumption, the second period optimal level is chosen implicitly by our first period choice. From here we have a simple single-variable maximisation problem.

$$\max_{C_1} u(C_1) + \beta u\left[(1+r)(Y_1 - C_1) + Y_2\right]$$

The first order condition for this problem is

$$u'(C_1) = (1+r)\beta u'(C_2) \Leftrightarrow \frac{\beta u'(C_2)}{u'(C_1)} = \frac{1}{1+r}$$

It says that marginal utility today should be set equal to the value of marginal utility tomorrow, discounted by $(1 + r)\beta$. If $\beta = 1/(1 + r)$ then this boils down to setting MU equal in each period.

Super Bonus. (5 points) When Gilligan's Island first appeared critics didn't give the show much chance of lasting beyond the first season. Needless to say, the show with the seven castaways stole the hearts of North America. What was the name of Gilligan's favourite rock group? (And how in the world can one have such a string of bad luck every time they are about to be rescued from the island?!)

Gilligan's favourite rock band is "The Mosquitoes". As for their lack of luck in finding a way off the island, in the end, their bad luck was really good luck. As all who grew up watching the show know that in the very end they were returned to civilisation. Nevertheless, all had realised that their lives were better off on the island. And as luck would have it, they did shipwreck on that island again when they went on a nostalgic cruise after their return to the mainland.

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<u>1. Utility & Preferences (15 points)</u>

Giorgio Primeceri loves spaghetti (good 1) and cannelloni (good 2). His utility function is $u(x_1,x_2) = 3x_1 + 2x_2$.

d. Rank ($\succ$) the following bundles, (x_1,x_2), for Giorgio: $A = (7,6)$, $B = (10,1)$, $C = (3,9)$, $D = (9,2)$, $E = (5,5)$.

Calculate the utility of each bundle we get: u(A) = 33; u(B) = 32; u(C) = 27; u(D) = 31; u(E) = 25. Thus we get the ranking $A \succ B \succ D \succ C \succ E$.

e. What is the ratio of marginal utilities (i.e., MU_1/MU_2)?

Taking partial derivatives wrt the first and second arguments, we get $MU_1 = 3$ *and* $MU_2 = 2$. *Thus the ratio is 3/2.*

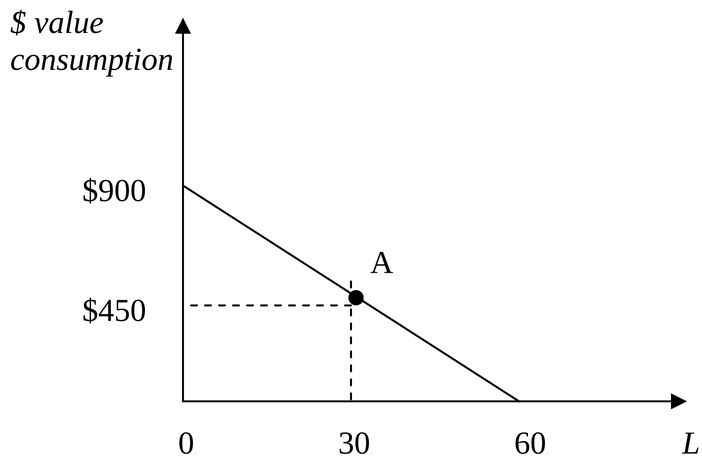
f. Now suppose that his utility function is $u(x_1,x_2) = \sqrt{3x_1 + 2x_2 + 100}$. Rank the bundles again with this utility function.

This utility is a positive monotonic transformation of the original utility, so the ranking found in (a) is preserved.

<u>2. Income vs. Leisure (15 points)</u>

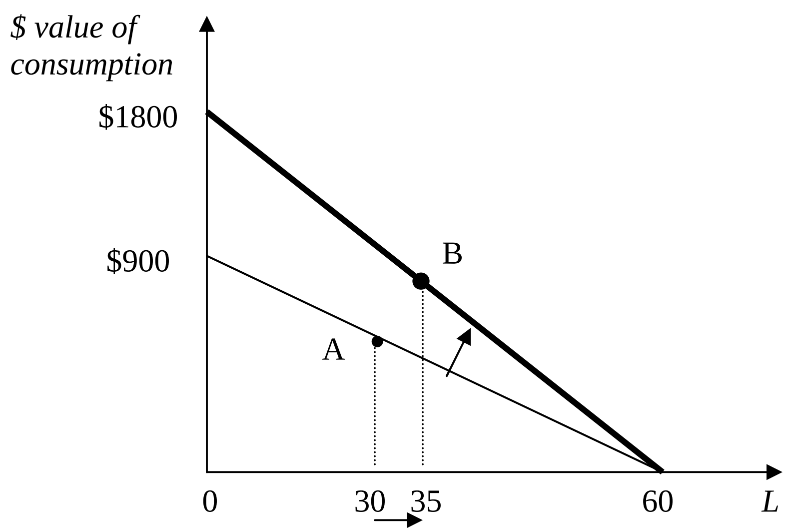
Yoko Kubota is the head ramen chef at Yokohama's most elite ramen restaurant ("Ii Ii Ramen"). Ms. Kubota has 60 hours of personal time that she can use to either work or pursue leisurely activities (singing in a karaoke bar). Currently she earns a wage of $15/hour and works 30 hours per week. Assume that leisure is a normal good.

d. Sketch Yoko's budget line (BL), where we measure the number of hours worked on the *x*-axis, and her money consumption of all other goods on the *y*-axis, and show her optimal bundle (label it "A") on the BL. Label your diagram explicitly.



Currently Yoko earns $450 a week and spends 30 hours singing in karaoke bars.

e. Trying to keep Yoko from bolting to a rival restaurant ("Ramen Desu Gohan"), her boss doubles her wage. At this higher wage she works 25 hours (call the new optimum "B"). Sketch the new BL and clearly label the graph.



f. What can you say about the sizes of the income and substitution effects of leisure for Yoko?

Since Yoko ends up working less we can conclude that for her the substitution effect is smaller than her income effect. (Since we assume that leisure is a normal good, we can say that she should consume more leisure as her wage – and thus her income – increases.)

<u>*3. Decomposing Income and Substitution Effects (15 points)*</u>

Dave ("Toothpick") Biderman is trying to beef up ("Je veux être un gâteau à la viande!") with the help of Weight Gain 4000. His demand for WG4000 is given by $x_1 = 15 + m/(10p_1)$. Originally his income is $120/week and the price of WG4000 is $4 per serving.

e. How many servings of WG4000 does Dave buy in a week?

Just plug in income as $120 and price as $4 to get $x_1 = 15 + 120/(10\times4) = 18$.

f. Find the change in demand if price falls to $3

When price is $3 we get $x_1 = 15 + 120/(10\times3) = 19$.

g. How much does income have to change to keep Dave at his original consumption? (Hint: $\Delta m = x_1\Delta p_1$.)

Plugging away with the formula we get $\Delta m = x_1\Delta p_1 = 18(3\text{-}4) = \text{-}\$18$. That is, we have to take away $18 from Dave to "compensate" him for the decreased price. (So his compensated income is $102.)

h. Now use the fact that $m' = m + \Delta m$ to find the substitution effect of the price change. (Hint: Substitution effect is defined as $\Delta x_1^s = x_1(p_1', m') - x_1(p_1, m)$.)

With compensated income we get a demand of $x_1(p_1', m') = 15 + 102/(10\times3) = 18.4$. We already know from part (a) the original demand is 18. Thus the size of the substitution effect is 0.4.

<u>*4. Cobb-Douglas Utility (15 points)*</u>

Kazushi Sakuraba's preferences over Asahi (x_1) and wasabe peas (x_2) are described by the utility $u(x_1, x_2) = x_1^{1/3}x_2^{2/3}$. Currently he consumes 10 beer and 40 bags of peas.

a. If Mr Sakuraba's income is $300 find the prices for Asahi beer and wasabe peas. (Hint: What kind of preferences does he have?)

With Cobb-Douglas preferences we know that he spends 1/3 of his income on Asahi beer and 2/3 on wasabe peas. Thus we have $10p_1 = \$100$ and so the price of good 1 is $10. For wasabe peas we have $40p_2 = 200$, and so we have $p_2 = \$5$, as well.

b. Given the prices you found above, what is Sakuraba's marginal rate of substitution between the goods at his optimum?

We know that at an optimum MRS is equal to the price ratio. This is just $p_1/p_2 = 2$.

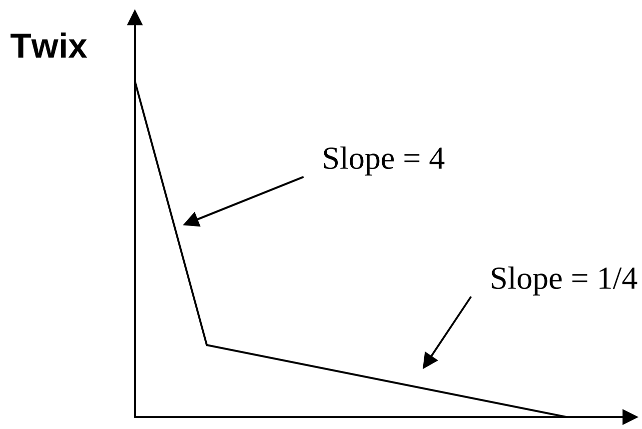
c. If Mr Sakuraba's income drops to \$150 what is his new optimal bundle?

Since his utility is homothetic, if income drops by half he reduces his consumption of both goods exactly by half. So his new bundle is 5 beer and 20 wasabe peas.

5. MRS and the Shape of Indifference Curves (15 points)

Peter ("Professor") Bondarenko spends all his income on Smarties (good 1) and Twix (good 2). His MRS between Smarties and Twix is 4 when he has sufficiently many Twix, and his MRS between Smarties and Twix is 1/4 when he has sufficiently many Smarties.

d. Sketch a typical indifference curve of Professor Bondarenko.



e. Under what conditions will he buy only Twix? That is, at what price for Twix (relative to Smarties) will he buy only Twix?

When the price ratio is greater than 4 Professor Bondarenko will buy only Twix. This is to say that $p_1/p_2 > 4$, so that Twix is 1/4 or less the price of Smarties.

f. Under what conditions are we assured that he will buy positive quantities of both?

He will buy positive quantities of both so long as the prices never diverge by more than four factors. That is so long as $1/4 < p_1/p_2 < 4$. (Note that with equality we cannot be certain that strictly positive quantities will be bought.)

6. Nation of Second Guesses (5 points)

What is the principle thesis of the article "Nation of Second Guesses" (Barry Schwartz, NY Times, 2004)? Do you think his arguments are valid?

Mr. Schwartz's thesis was that choice is not necessarily good. He said that this phenomenon was true after a certain bliss point in the amount of options that one has in *life. He cited some interesting studies that showed that people with more choices were often more depressed, and that, for example, as the variety of jams offered in a supermarket increased, shoppers were more likely to have left without buying any.*

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Shwartz's arguments are very compelling. You can see even in your own life how sometimes expanded choices make your own life more miserable. Moreover, I am sure that all of us have some kind of vice in life that we wish we could handle with more control, and we furthermore know that we would be better off if we were not tempted with the vice from the onset.

7. Pareto Efficiency (5 points)

Define Pareto efficiency. Are Pareto efficient allocations optimal? Explain.

An allocation is Pareto efficient if there is no reallocation that exists that makes at least one person better off without making someone else worse off. Such allocations are optimal in the sense that there is no wastage. But from a normative point of view we cannot say that it is optimal. For instance, one might, with their own value judgements, deem an allocation in which the king owns everything and the peasants nothing, an inequitable allocation (and thus not optimal). Such an allocation is efficient since the only way to make the peasants better off is to make the king worse off. Economists tend to overrate efficiency. It's a nice thing to have, but there should be many other factors that one takes into consideration when designing policy.

9. Consumer's Surplus (5 points)

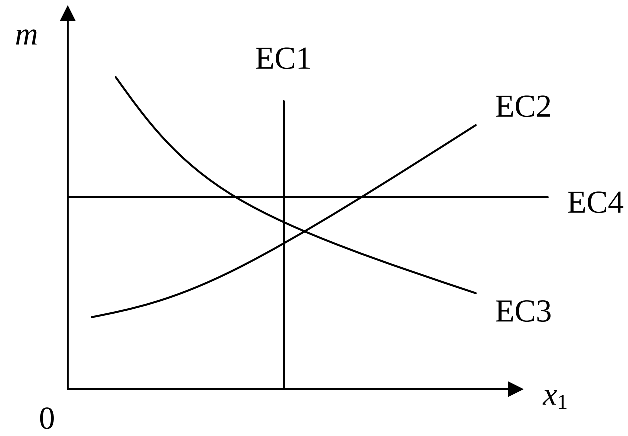
Suppose that (inverse) demand is described by the function $p_D(y) = 20 - (1/10)y^2$. Find the change in consumer's surplus when price changes from \$10 to \$7.90.

Even without any calculus we can guess the approximate size of the change in surplus. At a price of \$10 we see that y = 10. Likewise, at a price of \$7.90 we see that y =11. Thus an approximation of the change in surplus (it is positive since price has gone down for the consumer) is 10.5×\$2.10 = \$22.05. If one calculates the integrals we get

$$\int_0^{10}\left[(20-0.1y^2)-10\right]dy = 66.667 \text{ and } \int_0^{11}\left[(20-0.1y^2)-7.9\right]dy = 88.733$$

The exact change with the integrals is thus 88.733-66.667 = 22.066.

8. Inferior & Normal Goods (5 points)



Refer to the diagram above depicting four different Engel curves. Which Engel curve refers to a normal good? And which refers to an inferior good?

Since inferior goods are goods for which demand decreases as income increases we see that it must be EC3. As for normal goods, the demand for them increases with income, so it must be EC2.

10. The Debate Surrounding Trade (5 points)

There is a great debate about the merits of trade and globalisation (c.f. the articles on trade posted on the course webpage). Why do economists generally support free trade? Why are some people opposed to trade liberalisation?

Economists harp about trade because it allows countries to realise "gains from trade." When the domestic economy faces a world price ratio, it can increase its wealth position by readjusting its production given the different prices. (Just as much as having a different price ratio makes a consumer better off – so long as the adjusted BL passes through the original point). In addition, we get gains from variety when we allow trade. Aside from the obvious point of increased variety, countries are made better off by allowing them to specialise in the goods for which they have a comparative advantage. Specialising also allows countries to reap the benefits of increasing returns in production.

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In the end, trade policy is usually not a Pareto improving policy. Some people are made worse off by trade, even though economists will avow that trade produces a net gain in a country's wealth.

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Bonus. (10 points) Suppose you have the utility function that depends on two time periods:

$$U = u(C_1) + \beta u(C_2)$$

where C_i is consumption in time period i and $0 \leq \beta \leq 1$ is a personal discount factor. The consumer's budget constraint is that the present value of consumption cannot exceed the present value of income:

$$C_1 + C_2 /(1+r) \leq Y_1 + Y_2 /(1+r)$$

where r is the interest rate and Y_i is period i income. Thus the consumer's problem is to choose consumption to maximise overall utility U. Find the condition that defines the consumer's optimal choice – this is known as the Euler equation for consumption. (Hint: You may assume that the budget constraint is binding.)

This requires much less work than you probably think. Just set up this maximisation problem replacing second period consumption with the equation

$$C_2 = (1 + r)(Y_1 - C_1) + Y_2$$

which we derived from the budget constraint (when the inequality is binding). That is, once we optimally choose first period consumption, the second period optimal level is chosen implicitly by our first period choice. From here we have a simple single-variable maximisation problem.

$$\max_{C_1} u(C_1) + \beta u\left[(1+r)(Y_1 - C_1) + Y_2\right]$$

The first order condition for this problem is

$$u'(C_1) = (1+r)\beta u'(C_2) \Leftrightarrow \frac{\beta u'(C_2)}{u'(C_1)} = \frac{1}{1+r}$$

It says that marginal utility today should be set equal to the value of marginal utility tomorrow, discounted by $(1 + r)\beta$. If $\beta = 1/(1 + r)$ then this boils down to setting MU equal in each period.

<u>Super Bonus</u>. (5 points) "The Littlest Hobo" (Glen-Warren Productions, 1979-85) epitomised the vagabond lifestyle (and even inspired some to travel outside of their backyard). What was the name of the dog that played that ever-clever canine?

Besides having a really catchy theme song (maybe tomorrow I'll want to settle down…), "The Littlest Hobo" was remarkable in how that dog could always save the day. My mum always called him the "obedient dog" because, well, it seemed like if he understood humans. In any case, our little friend's name is "London".

<u>Please do not forget to place this test paper in your exam booklet.</u>