MIDTERM EXAM

ECON 210
PROFESSOR GUSE

Instructions. You have 2 hours to complete the exam. There are a total of 75 points available. It is designed to take about 1 minute per point. You are allowed to reference a single page of notes, 2-sided. You may *not* use any other notes, books or aids of any kind, be they human, electronic or mechanical. Calculations may be left in expression form for full credit. There is space provided for each question. If you need additional space, you may write on the back of the pages or use additional sheets and staple them to your exam when you turn it in. Please show all of your work. (Or at least enough so that the grader can figure out how you arrived at your answers.) Please write your name on the exam itself and record the time you started and time you finished. Finally please turn in your cheat sheet with your exam.

Name:

Date and Time Started:

Date and Time Finished:

Pledge:

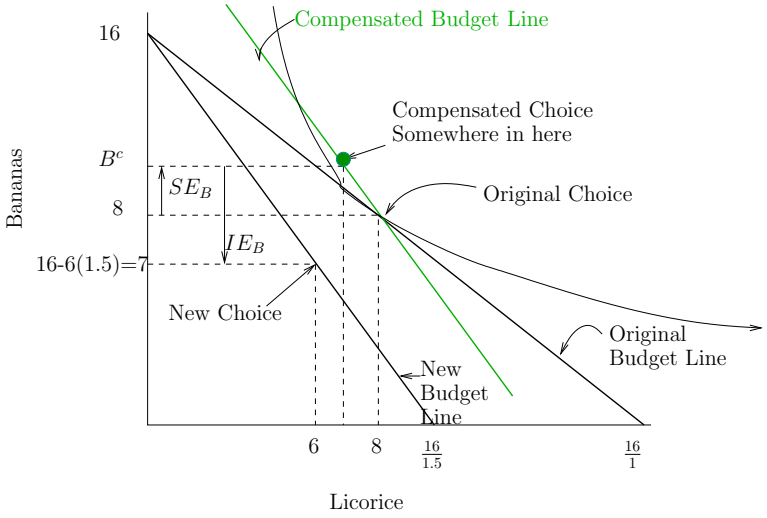
Date: Tuesday February 9, 2006.

(1) (10 points) Frederica gets a weekly allowance of m and cares only about her current weekly consumption of bananas and licorice. The price of bananas is \$1 each. Last week, the price of licorice was \$1 per ounce and Frederica consumed 8 bananas and 8 ounces of licorice.

(a) What is m equal to?
ANSWER:

$$\begin{aligned} m &= p_B B + p_L L \\ &= 8 + 8 \end{aligned}$$

(b) This week the price of licorice increased to \$1.50 per ounce and Frederica's consumption of licorice decreased to 6 ounces. Are bananas a normal or inferior good? Explain using a diagram.



Note that due to the increase in the price of licorice the *compensated* demand for bananas, B^c, *must* increase ($SE_B > 0$) by the law of compensated demand. However the fact that the new demand for bananas was *less* than 8, means that the total effect on bananas amounted to a *decrease*, which in turn means that the income effect must have been negative. A negative income effect for a an effective decrease in wealth (a price increase) means that bananas are unambiguously *normal*.

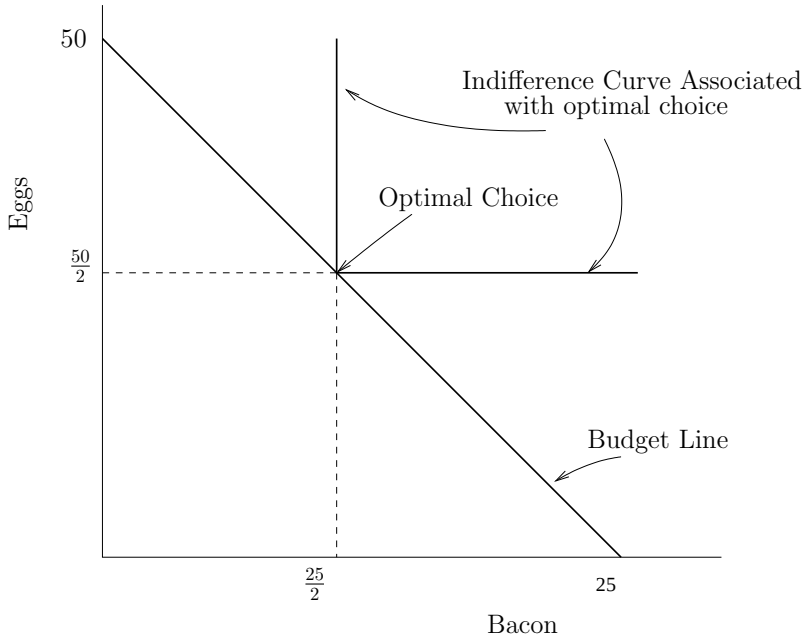
(2) (20 points) Sven consumes only bacon and eggs. Furthermore, he eats exactly 2 eggs for every strip of bacon and will not eat them in any other ratio.

(a) (5 pts) write down a utility function which represents Sven's preferences over bundles of strips of bacon (B) and eggs (G).
ANSWER:

$$u(B, G) = \min\{2B, G\}$$

Any monotonic transformation of this function is an acceptable answer.

(b) (5 pts) Draw a picture of Sven's optimal choice if his income is \$25, the price of bacon is \$1 per strip and eggs are \$0.50 each.



Sven has perfect complements preference for bacon and eggs, giving us the right-angled indifference curves.

(c) (5 pts) What is Sven's demand for eggs as a function of income and prices?
ANSWER:

$$B(p_B, p_G, m) = \frac{m}{p_B + 2p_G}$$
$$G(p_B, p_G, m) = \frac{2m}{p_B + 2p_G}$$

where p_B is the price of bacon and p_G is the price of eggs.

(d) (5 pts) Ole also likes eggs and bacon in the exact same strict ratio as Sven. However, Ole also likes orange juice (J) and always spends exactly 20% of his income on orange juice and 80% on bacon and eggs. Write down a utility function to represent Ole's preferences over B, G and J. [Hint. It may be easier to start by writing down demand functions for the three goods.]
ANSWER: if you recognized that such *constant* incomes shares in the demands is an indication of Cobb-Douglas preferences, this become relatively straightforward. Over what does Sven have CD preferences? Orange Juice and *plates* of bacon and eggs.

$$u(B,G,J) = (\min\{2B,G\})^{0.8} J^{0.2}$$

Here the number of plates of bacon and eggs is given by the result of the min function, which is used to count the plates since Sven still thinks of bacon and eggs as perfect complements. Note, I gave partial credit for following the hint and writing down the demand functions...

$$B(p_B,p_G,p_J,m) = \frac{(0.8)m}{p_B+2p_G}$$
$$G(p_B,p_G,p_J,m) = \frac{2(0.8)m}{p_B+2p_G}$$
$$J(p_B,p_G,p_J,m) = \frac{(0.2)m}{p_J}$$

(3) (25 points) Maurice has nice rational preferences for slices of pizza (x_z) and pints of beer (x_b) represented by a utility function, $u(x_z, x_b)$. His utility function exhibits the following properties

$$\frac{\partial u(x_z, x_b)/\partial x_b}{\partial u(x_z, x_b)/\partial x_z} = \frac{1}{3} \text{ whenever } x_z = 0 \text{ and } x_b > 0$$
$$\frac{\partial u(x_z, x_b)/\partial x_b}{\partial u(x_z, x_b)/\partial x_z} = 2 \text{ whenever } x_b = 0 \text{ and } x_z > 0$$

(a) (5 points) In 25 words or less, explain in plain English how Maurice feels about beer when he hasn't got any beer.
ANSWER: When he has no beer, Maurice is willing to give up pizza for beer at a rate of 2 slices per pint.

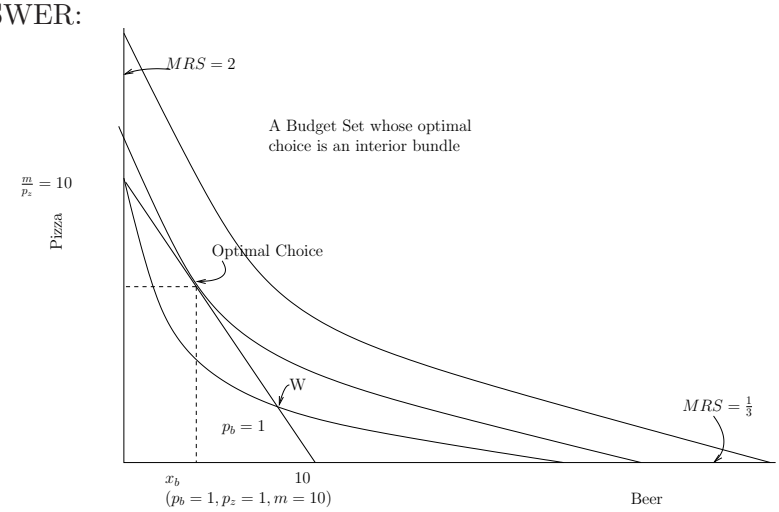
(b) (10 points) Suppose that income, m is greater than zero and that the price of pizza, p_z, is \$1 per slice.

(i) Give an example of an income level and a price of beer that would lead Maurice to optimally choose an *interior* bundle - one with strictly positive amounts of beer and pizza.
ANSWER: Note that given what know about preferences from the MRS along each axis, if the price of beer is $\frac{1}{3}$ or less, then a corner solution involving all beer and no pizza is optimal. Also, if the price of beer is 2 or more, then a corner solution involving all pizza and no beer is optimal. Therefore in order to be an interior solution, you must given an answer which has the price of beer greater than $\frac{1}{3}$ and less than 2. Any $m > 0$ will do. For example an acceptable answer is $m = 10$ and $p_b = 1$.

(ii) In a diagram, show Maurice's budget line for the parameters you chose.

(iii) Show the optimal choice and sketch the indifference curve going through it.

(iv) Pick another point on the budget line you drew and explain why it is or is not an optimal choice for Maurice.
ANSWER:



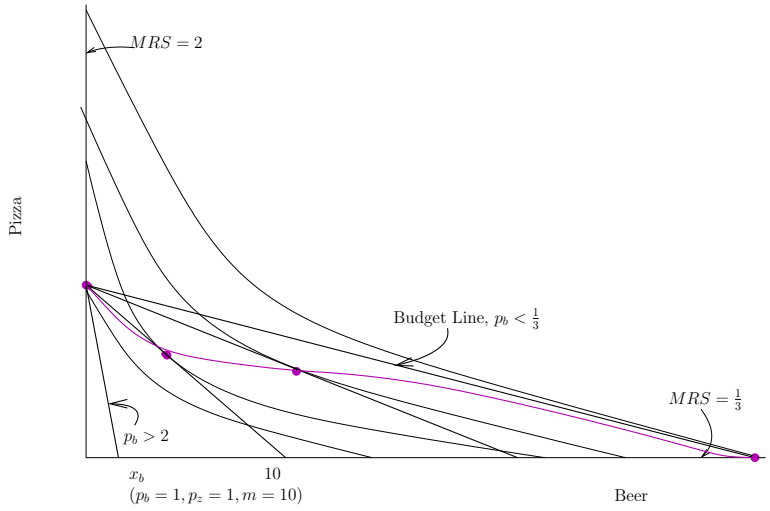
Notice that at the point labeled 'W', Maurice would be willing to give up more beer for pizza than he has to ($\frac{1}{MRS} > \frac{1}{MRT}$), therefore it cannot be optimal and the optimal choice will typical lie in the direction of more pizza and less beer. To accurately reflect the information given in the problem the indifference curves in your figure should have a slope of 2 and $\frac{1}{3}$ when they meet the pizza and beer axes respectivley.

(c) (10 points) Keep the assumptions that $p_z = 1$ and $m > 0$.

(i) What is the lowest price of beer which leads Maurice to optimally choose an interior bundle?
ANSWER:As discussed above $\frac{1}{3}$.

(ii) What is the highest price of beer which leads Maurice to optimally choose an interior bundle?
ANSWER: 2

(iii) Draw a picture showing the beer-price expansion path.
ANSWER:



The expansion path for the price of beer is shown in magenta. For budget line with slopes less than $\frac{1}{3}$ Maurice will not buy any pizza. For budgets whose lines have slopes more than 2, the solutions are all exactly the same: $(b, z) = (0, \frac{m}{p_z})$.

(4) (20 points) Household A has nice rational preferences for rice, x_r, and fish, x_f. The households weekly demand for rice and fish are given by the functions $x_r(p_r, p_f, m)$ and $x_f(p_r, p_f, m)$ repsectively, where p_r is the price of rice, p_f is the price of fish and m stands for the A's weekly income.

(a) (10 points) Suppose that the price of fish is fixed at $\bar{p_f}$ and A's income is $\bar{m}$. When the price of rice decreases from p_r^H to p_r^L, the demand for rice falls from $x_r(p_r^H, \bar{p_f}, \bar{m})$ to $x_r(p_r^L, \bar{p_f}, \bar{m})$. In other words assume that $p_r^L < p_r^H$ and $x_r(p_r^L, \bar{p_f}, \bar{m}) < x_r(p_r^H, \bar{p_f}, \bar{m})$. Consider what happened to A's demand for *fish* when the price of rice decreases from p_r^H to p_r^L as just described. Which of the following is true.

- $x_f(p_r^L, \bar{p_f}, \bar{m}) < x_f(p_r^H, \bar{p_f}, \bar{m})$
- $x_f(p_r^L, \bar{p_f}, \bar{m}) > x_f(p_r^H, \bar{p_f}, \bar{m})$
- $x_f(p_r^L, \bar{p_f}, \bar{m}) = x_f(p_r^H, \bar{p_f}, \bar{m})$

Explain your answer using a diagram if necessary. What can you say about the income and substitution effects on the demand for fish?
ANSWER: $x_f(p_r^L, \bar{p_f}, \bar{m}) > x_f(p_r^H, \bar{p_f}, \bar{m})$. By the observation given in the problem, rice is a Giffen good. The demand *decreased* when its price decreased. However a price decrease results in a expansion of the budget set. This means that whatever bundle the household was choosing when the price of rice was high, they can *still* afford. The monotonicity assumption tells us that they definitely will not choose a bundle involving less of both good. Since they are choosing one with less rice, it means the new choice *must* have a greater quantity of fish. Moreover, by the law of compensated demand, the substitution effect on fish for price decrease in rice, must be negative. Since we just established that the total effect must be positive, it means that the income effect on fish must be positive and its magnitude must be greater than the SE.

(b) (10 points) Suppose that in addition to the decrease in the price of rice, income changed to m' defined as follows.

$$m' = p_r^L x_r(p_r^H, \bar{p_f}, \bar{m}) + \bar{p_f} x_f(p_r^H, \bar{p_f}, \bar{m})$$

Does A prefer the budget with paramters $(p_r, p_f, m) = (p_r^H, \bar{p_f}, \bar{m})$, or would they rather face the budget given by parameters $(p_r, p_f, m) = (p_r^L, \bar{p_f}, m')$. Explain your answer using a diagram, if need be.
ANSWER: A weakly prefers $(p_r^L, \bar{p_f}, m')$ and probably strongly prefers it...m' is exactly the amount income needed to buy the original choice at the new prices (the set of prices with a low price of rice, p^L). In other words, $(p_r^L, \bar{p_f}, m')$ is our familiar "compensated budget", while $(p_r^H, \bar{p_f}, \bar{m})$ is just our original budget. By design the Slutsky-compensated budget cannot make the household worse off, and probably would make them strictly better off.