HOMEWORK 2 - SOLUTIONS

Intermediate Microeconomics EC 308-004
October 10, 2007 **Name:** by writing my name i swear by the honor code

Read all of the following information before starting the Assignment:

- You are allowed to work together on the homework. However, when it comes time for you to write up the solutions, you are required to do this on your own.
- Show all work, clearly and in order, if you want to get full credit. I reserve the right to take off points if I cannot see how you arrived at your answer (even if your final answer is correct).
- Justify your answers algebraically whenever possible to ensure full credit. When you do use your calculator, sketch all relevant graphs and explain all relevant mathematics.
- Circle or otherwise indicate your final answers.
- Please keep your written answers brief; be clear and to the point. I will take points off for rambling and for incorrect or irrelevant statements.
- This assignment has 5 problems and is worth 100 points. It is your responsibility to make sure that you have all of the answers!
- This assignment is due next Tuesday, October 9 in class.
- Good luck!

1. (*20 points*) PROBLEM 1: This question has 2 parts:

a. (*10 pts*) PART A: An individual sets aside a certain amount of his income per month to spend on his hobbies, collecting wine and collecting books. Given the information below, illustrate both the price-consumption curve associated with changes in price of wine and the demand curve for wine.

Price Wine	*Price Book*	*Quantity Wine*	*Quantity Book*	*Budget*
\$10	\$10	7	8	\$150
\$12	\$10	5	9	\$150
\$15	\$10	4	9	\$150
\$20	\$10	2	11	\$150

See Figure 4.1 on page 109 for details.

b. (*10 pts*) PART B: An individual consumes two goods, clothing and food. Given the information below, illustrate both the income-consumption curve and the Engel curve for clothing and food.

Price Clothing	*Price Food*	*Quantity Clothing*	*Quantity Food*	*Income Income*
\$10	\$2	6	20	\$100
\$10	\$2	8	35	\$150
\$10	\$2	11	45	\$200
\$10	\$2	15	50	\$250

See Figure 4.2 on page 111 for details.

2. (*20 points*) PROBLEM 2: This problem has two parts:

a. (*10 pts*) PART A: Using graphs, show and discuss the income and substitution effects for a normal good.

See Figure 4.6 on page 117 for details.

b. (*10 pts*) PART B: Using graphs, show and discuss the income and substitution effects for an inferior good. Without drawing, how are these effects different for a Giffen good?

See Figure 4.7 on page 118 for details.

3. (*20 points*) PROBLEM 3: Maurice has the following utility function:

$$U(X,Y) = 20X + 80Y - X^2 - 2Y^2 \tag{1}$$

where X is his consumption of CDs with a price of \$1 and Y is his consumption of movie videos, with a rental price of \$2. He plans to spend \$41 on both forms of entertainment.

a. (*10 pts*) PART A: Fine Maurice's marginal utility with respect to X and with respect to Y.

$$MU_X = \frac{\partial U(X,Y)}{\partial X} = 20 - 2X \tag{2}$$

$$MU_y = \frac{\partial U(X,Y)}{\partial Y} = 80 - 4Y \tag{3}$$

b. (*10 pts*) PART B: Determine the number of CDs and video rentals that will maximize Maurice's utility. What is his utility at these levels? (Hint: Use the Lagrangian method)

Step 1. Set up the Lagrangian:

$$Ł = 20X + 80Y - X^2 - 2Y^2 - \lambda(X + 2Y - 41) \tag{4}$$

Step 2. Take the first order conditions (FOC):

$$\frac{\partial Ł}{\partial X} = 20 - 2X - \lambda = 0 \tag{5}$$

$$\frac{\partial Ł}{\partial X} = 80 - 4Y - 2\lambda = 0 \tag{6}$$

$$\frac{\partial Ł}{\partial X} = X + 2Y - 41 = 0 \tag{7}$$

Combining the first 2 FOCs one gets that: $\lambda = 20 - 2X = 40 - 2Y$ so that $Y = 10 + X$ (Note: you could find X in terms of Y without affecting your final result).

Step 3. Plug the expression for X in the third FOC to find that:

$$X + 20 + 2X - 41 = 0 \Longrightarrow X = 7. \tag{8}$$

Next, get $Y = 17$. These represent the optimum levels of X and Y that maximize Maurice's utility which is:

$$U(7,17) = 20 \times 7 + 80 \times 17 - 7^2 - 2 \times 17^2 = 873. \tag{9}$$

4. (*20 points*) PROBLEM 4: Suppose two investments have the same three payoffs, but the probability associated with each payoff differs, as illustarted in the table below:

Payoff	Probability (Investment A)	Probability(Investment B)
\$300	0.10	0.30
\$250	0.80	0.40
\$200	0.10	0.30

a. (*5 pts*) PART A: Find the expected return and standard deviation of each investment.

$$E(r_A) = 0.10 \times 300 + 0.80 \times 250 + 0.10 \times 200 = \$250 \quad (10)$$

$$\sigma_A = \sqrt{0.10 \times (300 - 250)^2 + 0.80 \times (250 - 250)^2 + 0.10 \times (200 - 250)^2} = \$22.36 \quad (11)$$

$$E(r_B) = 0.30 \times 300 + 0.40 \times 250 + 0.30 \times 200 = \$250 \quad (12)$$

$$\sigma_B = \sqrt{0.30 \times (300 - 250)^2 + 0.40 \times (250 - 250)^2 + 0.30 \times (200 - 250)^2} = \$38.73 \quad (13)$$

b. (*5 pts*) PART B: Jill has the utility function $U = 5I$, where I denotes the payoff. Which investment will she choose?

Given Jill's linear utility function, she is risk neutral. Thus, she will choose either one of the two payoffs. This can also be seen numerically:

$$E(U(I_A)) = 0.1 \times (5 \times 300) + 0.8 \times (5 \times 250) + 0.1 \times (5 \times 200) = 1250 \quad (14)$$

$$E(U(I_A)) = 0.3 \times (5 \times 300) + 0.4 \times (5 \times 250) + 0.3 \times (5 \times 200) = 1250 \quad (15)$$

Note that the two investments give Jill the same utility level.

c. (*5 pts*) PART C: Ken has the utility function $U = \sqrt{5I}$, where I denotes the payoff. Which investment will he choose?

Given Ken's concave utility function, he is risk averse. Thus, he will choose the less risky investment (i.e., investment A). This can also be seen numerically:

$$E(U(I_A)) = 0.1 \times \sqrt{5 \times 300} + 0.8 \times \sqrt{5 \times 250} + 0.1 \times \sqrt{5 \times 200} = 35.32 \quad (16)$$

$$E(U(I_A)) = 0.3 \times \sqrt{5 \times 300} + 0.4 \times \sqrt{5 \times 250} + 0.3 \times \sqrt{5 \times 200} = 35.25 \quad (17)$$

Note that investment A gives Ken a higher utility level.

d. (*5 pts*) PART D: Laura has the utility function $U = 5I^2$, where I denotes the payoff. Which investment will she choose?

Given Laura's convex utility function, she is risk loving. Thus, she will choose the investment with a higher degree of variability (i.e. investment B). This can also be seen numerically:

$$E(U(I_A)) = 0.1 \times (5 \times 300^2) + 0.8 \times (5 \times 250^2) + 0.1 \times (5 \times 200^2) = 315,000 \quad (18)$$

$$E(U(I_A)) = 0.3 \times (5 \times 300^2) + 0.4 \times (5 \times 250^2) + 0.3 \times (5 \times 200^2) = 320,000 \quad (19)$$

Note that investment B gives Laura a higher utility level.

5. (*20 points*) PROBLEM 5: Consider the information in the table below, describing choices for a new doctor. The outcomes represent different macroeconomic environments, which the individual cannot predict:

Job Choice	Outcome 1 Prob.	Outcome 1 Income	Outcome 2 Prob	Outcome 2 Income
Work for HMO	0.95	\$100,000	0.05	\$60,000
Own practice	0.2	\$250,000	0.8	\$30,000
Research	0.1	\$500,000	0.9	\$50,000

a. (*15 pts*) PART A: Compute the expected income and standard deviation of income for each job choice.

$$E(I_{HMO}) = 0.95 \times 100,000 + 0.05 \times 60,000 = \$98,000 \quad (20)$$

$$\sigma_{HMO} = \sqrt{0.95 \times (100,000 - 98,000)^2 + 0.05 \times (60,000 - 98,000)^2} = \$8717.80 \quad (21)$$

$$E(I_{Practice}) = 0.2 \times 250,000 + 0.8 \times 30,000 = \$74,000 \quad (22)$$

$$\sigma_{Practice} = \sqrt{0.2 \times (250,000 - 74,000)^2 + 0.8 \times (60,000 - 74,000)^2} = \$88,000 \quad (23)$$

$$E(I_{Research}) = 0.1 \times 500,000 + 0.9 \times 50,000 = \$95,000 \quad (24)$$

$$\sigma_{Research} = \sqrt{0.1 \times (500,000 - 95,000)^2 + 0.9 \times (50,000 - 95,000)^2} = \$135,000 \quad (25)$$

b. (*5 pts*) PART B: If the doctor is risk-averse, which job should she accept? Explain.

The doctor should accept the HMO because it is the least risky (and also on average pays the most).

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