14.03 Exam 2 Fall 2004

Please do not open this exam until directed

November 10, 2004

- There are 80 points on this exam and you have 80 minutes to complete it.
- Answer all 5 problems.
- Associated points for each question are listed below.
- Answers without explanation will *not* receive credit.
- **No calculators or other reference materials are permitted (or needed)**

1 Causal inference [15 points]

1. Hal's high school career counsellor (Christine) tells him that people who get a college degree earn \$25,000 more per year than people who don't. Hal is a pretty typical person, and he infers that if he goes to college his salary will probably be about \$25,000 higher. Explain to Hal how his reasoning could be flawed.

2. In search of more convincing evidence, Christine finds out that (on average) people who live in a town with a major college earn \$2,500 more than people who don't. She also finds out that 30% of people in college towns have a college degree, while only 20% of people in non-college towns have a degree. How could Christine use this new information to estimate Hal's benefit from college?

3. What assumptions do you need for your estimator in part b to be valid? [Please explain your assumptions rigorously.] Do you think these assumptions are plausible?

4. Suppose that college graduates in college towns earn \$5,000 more than college graduates in non-college towns and that high school graduates (without a college degree) earn \$3,000 more in college towns than high school graduates in non-college towns. Qualitatively, would you be inclined to adjust your estimate in part b upward, downward, or not at all? Explain

2 Trade and redistribution [20 points]

Paula and Robert live on an island and are not able to exchange goods with other people. They look all day for bananas (B) and coconut (C). At the end of the day they always end up with the following quantities of the two goods: Paula gathers $E_P^B = 2$ bananas and $E_P^C = 1$ coconut; Robert gathers $E_R^B = 1$ banana and $E_R^C = 2$ coconuts. They have the same utility function over these two goods: $U = BC$. Every day they agree to exchange banana and coconuts as follows: Paula gives Robert half a banana and Robert gives Paula half a coconut. [HINT: remember that the utility function $U = BC$ gives rise to the following uncompensated demand functions: $B = \frac{1}{2}\frac{I}{p_B}$ and $C = \frac{1}{2}\frac{I}{p_C}$ where I is income, p_B is the price of bananas and p_C is the price of cononuts]

1. Show in the Edgeworth box for this economy how the exchange described above is an equilibrium: carefully indicate the agents indifference curves, the initial endowment and the final consumption point.

2. What is the equilibrium price of p_B? [To speed calculation, normalize p_C to 1 so that $p_B = p_B/p_C$.] What is the income of Paula and Robert as a result of this equilibrium price?

Now imagine that at the end of the day a boat comes to the island and offers to exchange two coconuts for one banana.

3. What is Robert's income? What is Paula's income at this new relative price?

4. At this new price level what are Paula and Robert's consumption of bananas and coconut?
5. Is Robert worse off as a result of this exchange opportunity? Why? Illustrate your answer using the indifference curves and the new consumption points in the Edgeworth box.
6. Show in the graph how a redistribution of endowment between Paula and Robert would allow both agents to be better off under this exchange opportunity.
7. Now imagine that initial endowments were $E_P^B = E_P^C = E_R^B = E_R^C = 1.5$. Would there still be a need for redistribution to make both parties better off after the boat arrives at the island?

3 Insurance and social welfare [15 points]

Consider a "nation" of two risk averse expected utility maximizers with identical utility functions $U(\cdot)$. Each person has $\$10,000$. One person is perfectly healthy. The other person will contract a disease (with certainty) and must pay $\$10,000$ for a cure (there are no other psychic or monetary costs). Neither knows in advance who will stay healthy and who will get the disease. There is no insurance.

1. Someone proposes a voluntary national health fund. Before finding out who gets sick, each person can choose to pay $\$5,000$ into the fund. Afterwards, the person who gets sick receives the money from the health fund, provided he paid into the fund beforehand. What is a person's expected utility if he does not pay into the fund? What is a person's expected utility if he does pay into the fund, assuming the other person pays in as well?
2. Will people join the national health fund? What is the impact of the health fund on social welfare, i.e., the sum of individual utilities? What insurance principle is at work?
3. A new genetic test is invented. At birth, each person finds out for free whether or not he will get sick. How will the genetic test impact the insurance fund from part (1)? What is the impact of the genetic test on social welfare? Explain.
4. Someone proposes that the government mandate that every citizen must pay $\$5,000$ into the fund, regardless of his or her genetic test. What is the impact of the mandate on social welfare relative to part (3)? What insurance principle is at work? Is this a Pareto improvement relative to the situation in part (3)? Explain.

4 The demand for actuarially unfair insurance [20 points]

A risk averse agent with a Von Neumman Morgenstern Expected Utility function has wealth w and faces probability p of experiencing a monetary loss, L. [Risk aversion implies that $u(\cdot)' > 0, .u''(\cdot) < 0$.] The agent is offered an *actuarially unfair* insurance policy. This policy sells for $p \cdot 2A$ where p is the probability of loss and A is the amount the policy pays in the event of a loss. Hence, if p were equal to 0.5 and the agent spent \$200 on this policy, the policy would pay \$200 in the event of a loss. [Note: an actuarially *fair* policy would pay \$400 in the event of a loss.]

1. Draw a state preference diagram that shows the agent's endowment, indifference curves, the fair odds line (that is, the price ratio offered by actuarially fair insurance). Now draw the actuarially *unfair* odds line offered by the policy above.

2. Write down the agent's expected utility function and find the first order condition for his optimal insurance choice (A_F^*) for an *actuarially fair* policy.

3. Write down the agent's expected utility function and find the first order condition for his optimal insurance choice (A_U^*) for the *actuarially unfair* policy.

4. Define $\gamma = w_n/w_l$ as the agent's relative wealth in the Loss versus Non-Loss states. Let γ_F and γ_U equal this ratio when the agent is buying the Fair or Unfair policies respectively. Is γ_U larger, smaller, or equal to γ_F, or is this indeterminate? Explain why or why not. [You may find it helpful to use your state preference diagram to check your intuition.]

5. Assume that the agent has the option to buy the actuarially unfair policy for *negative* amounts: $A_U < 0$. Here, the policy would cost $p2A < 0$ (the agent is **paid** to receive it) and would charge the agent an **additional amount,** $-A > 0$, if a loss occurred. Would the risk averse agent above ever purchase an actuarially unfair policy with $A_U^* < 0$? Explain why or why not. [Again, your diagram may aid intuition.]

5 Fun with WARP [10 points]

Every weekend, Neli goes to an amusement park (FunLand) and spends her entire budget of \$40. There are only two things she spends her money on there: roller coster rides and ice cream cones. In Week 1, when the roller coaster costs \$3/ride and ice cream costs \$2/cone, Neli buys 8 rides and 8 cones.

1. In Week 2, the FunLand changes its prices to \$2/ride and \$3/cone. Assuming only the Weak Axiom of Revealed Preference (WARP), is it possible for Neli to be strictly better off? Could she be strictly worse off? Could she be exactly as well off as before (indifferent)? Explain.

In Week 3, FunLand changes its prices back to \$3/ride and \$2/cone (the same as in Week 1). But a new amusement park, Bob's World of Wonders, opens. At Bob's World of Wonders, roller coaster rides and ice cream cones both cost \$2. If Neli went there, she would buy 15 rides and 5 cones. To compete, FunLand offers the following promotion: any customer who spends at least \$40 will get \$15 worth of free coupons to spend on either roller coaster rides or ice cream cones.

2 Would Neli rather go to FunLand or to Bob's World of Wonders? Explain.