

**AED 503 Economic Analysis of Public Policy
Assignment 1, Fall 2009 - Answer Guide**

Answer all of the questions below. Your answers should be as complete as possible, using diagrams and written explanations where appropriate. In order to get partial credit, provide more than a one-or-two sentence answer. Each complete question is worth 20 points.

(1) In thinking about a consumer's preferences over bundles of goods, explain what is meant by *strict preference*, *indifference*, and *weak preference*. In your own words, explain what is meant by the axioms of *completeness*, *reflexivity* and *transitivity*. State and *explain* carefully the two key features of well-behaved consumer preferences. Illustrate in a diagram an indifference map for a consumer that has well-behaved preferences. (Remember to label the diagram). Also use an indifference map to explain why indifference curves for one consumer should not cross each other.

Key points I am looking for in a good answer:

Strict preference means that a consumer, when presented with two different bundles of goods, can say that they really prefer one bundle to the other.

Indifference means that a consumer, when presented with two different bundles of goods, can say that one bundle gives them the same utility as the other bundle, i.e., they are indifferent between them.

Weak preference means that a consumer, when presented with two different bundles of goods, can either say they are indifferent between them, or that they strictly prefer one to the other, i.e., if bundle two is weakly preferred to bundle one, then bundle two is at least as good as bundle one.

The axiom of *completeness* states given two bundles of goods, a consumer can state that either one is preferred to the other, or they are indifferent between them.

The axiom of *reflexivity*: any bundle of goods must be at least as good as itself, i.e., a bundle containing 3 beers and a pizza must be as good as another bundle containing 3 beers and a pizza.

The axiom of *transitivity*: if a consumer prefers bundle 1 to bundle 2, and bundle 2 to bundle 3, they must prefer bundle 1 to bundle 3.

Note: you will get penalized if you discuss single goods in relation to each other rather than bundles, in this context, these concepts refer to bundles or combinations of goods.

The two key features of well-behaved consumer preferences are that:

- both goods are 'goods', i.e., more of the goods is better and less is worse, which means

indifference curves slope downwards from upper left to bottom right

- indifference curves are convex to the origin, which is a function of the property of a diminishing marginal rate of substitution.

Note: it is important to make a connection between these features and the shape and slope of indifference curves

A diagram illustrating these features is also required to get full credit. Remember marks are lost if the diagram is wrong.

Finally, draw an indifference curve map where two indifference curves cross each other. Then pick two points on each indifference curve, e.g. points 1 and 4 on one curve and 2 and 3 on the other. Suppose point 1 is on a higher indifference curve than point 2, you should prefer point 1 over 2. Logically, you should also be indifferent between points 1 and 4 if they are on the same indifference curve, and you should also be indifferent between points 2 and 3 on the other indifference curve. Consequently by the axiom of transitivity, you should prefer point 4 over point 3. This is violated if the indifference curves cross whereby point 3 now appears to be preferred to point 4. In other words, by transitivity, indifference curves for one consumer should not cross each other.

(2) Using an Edgeworth Box diagram, illustrate the concept of a *Pareto improvement* in an exchange economy consisting of two consumers (with well-behaved preferences), two goods, and some initial endowment of the two goods. Label carefully all of the elements of the diagram. Define precisely the condition required for a Pareto improvement, and point out in the diagram where this condition is satisfied relative to the initial endowment point. Then, redistribute the initial endowment to another point in the Edgeworth Box and explain where the condition for a Pareto improvement is satisfied for the new endowment. Then allow for the initial endowment being on the *contract curve* of exchange. Is it possible for a Pareto improvement to be made from this point? If not, why not?

Key points I am looking for in a good answer:

- first you have to draw an Edgeworth Box of exchange, accounting for the two goods, the two sets of well-behaved consumer preferences (i.e., their indifference curves), and an initial endowment point

Remember if the diagram is wrong or mislabeled, marks are lost, e.g., upward-sloping indifference curves, indifference curves that cross etc.

- the condition for *Pareto improvement* is when the two goods can be traded in such a way that either both consumers are made better off or one is made better off and the other no worse off

- you can illustrate this condition relative to the endowment point by tracing out where the “core” is in the diagram, i.e., that area bounded by the indifference curves of the two consumers that pass through the initial endowment point. From this you can show how moving into the core from the endowment point will make either both consumers better off (they both move to higher indifference curves) or one is better off (they move to a higher indifference curve), and the other is no worse off (they remain on their initial indifference curve)

- you then have to illustrate another endowment point, trace out where the new “core” is, and then show that a Pareto improvement can only occur in this new “core”

- if the initial endowment point is on the contract curve of exchange, it is impossible to move from this position to make the one consumer better off without hurting the other consumer, i.e., any point on the contract curve is already Pareto efficient

(3) Using an Edgeworth Box diagram, with eggs on the vertical axis, and bacon on the horizontal axis, show how a set of prices can result in there being an excess supply of eggs and an excess demand for bacon, and explain why this is *not* a competitive equilibrium. Remember to label everything in the diagram. What will have to happen to egg and bacon prices for there to be a competitive equilibrium? Is a competitive equilibrium also Pareto efficient? How do you know?

Key points I am looking for in a good answer:

- first, draw an Edgeworth Box illustrating a situation where at a specific set of prices, eggs are in excess supply, and bacon is in excess demand – fully explain why this is the case, showing how at these prices, one consumer is willing to sell more eggs than the other is willing to purchase (excess supply), and how one consumer is willing to purchase more bacon than the other is willing to sell (excess demand)

- second, explain why this cannot be a competitive equilibrium, i.e., at these prices, each consumer tries to maximize their utility, (they go the highest indifference curve that is tangent to the budget line) but because their marginal rates of substitution are not simultaneously equal to relative prices (the slope of the budget line), then it cannot be a competitive equilibrium where markets clear

- the price of eggs will have to fall, and the price of bacon will have to rise, this will make the budget line steeper, leading to a competitive equilibrium inside the “core” where demand and supply is equal for each good

- a competitive equilibrium is Pareto efficient, because at that point you know that the two consumers’ marginal rates of substitution are equal (their indifference curves are tangent), and in a competitive equilibrium, these will also be equal to relative prices (the slope of the budget line), i.e., the willingness of the two consumers to trade one good for the other along a particular indifference curve is equal to the rate at which they can exchange them in the market

(4) In a Scottish village near Arbroath, the Laird Alex Ferguson runs a commercial fish farm consisting of 25,000 salmon, and also raises a few grouse on the side, totaling 1,500 birds. His nearest neighbor, Lady Annie Lennox raises 10,000 grouse for commercial hunting, and also raises 3,000 salmon. Both Laird Ferguson and Lady Lennox have well-behaved preferences. Given the *initial endowment*, at that point Laird Ferguson is willing to trade 800 salmon for 200 grouse, while Lady Lennox is willing to trade 400 grouse for 25 salmon.

Based on this information, answer the following:

(a) Using appropriate scaling, draw the Edgeworth Box based on the information given above. Then re-draw the Edgeworth Box to reflect Laird Ferguson losing 6,000 salmon to local poachers, and Lady Lennox's gamekeeper's skill at breeding grouse producing an additional 3,000 birds, Laird Ferguson's grouse remaining at 1,500 birds, and Lady Lennox's salmon remaining at 3,000 fish.

(b) At the *initial endowment* point, what are the *marginal rates of substitution* for Laird Ferguson and Lady Lennox? Given their marginal rates of substitution, is the initial endowment Pareto efficient? Why or why not? Could a Pareto improvement be made? Do you have enough information in the question to draw their indifference curves at the *initial endowment*? If not, what additional information would you need?

(c) Suppose an auctioneer sets the salmon price at \$300/fish, and the grouse price at \$150/bird. Given these prices, calculate the wealth of Laird Ferguson and Lady Lennox based on their *initial endowments*, and derive the value of the slope of their budget line(s). If these prices eventually result in there being a competitive equilibrium, does their wealth change compared to that at their initial endowment? With this information on prices, what will the marginal rates of substitution have to be for Laird Ferguson and Lady Lennox at the competitive equilibrium?

(d) If these prices *do not* result in competitive equilibrium, there being an excess supply of salmon and excess demand for grouse, what will have to happen to relative prices to bring about competitive equilibrium?

Key points I am looking for in a good answer:

(a) You would scale the box by putting salmon on say the vertical axis, and total salmon are 28,000, of which Ferguson has 25,000, and Lennox has 3,000. Then put grouse on the horizontal axis, where there are 11,500 grouse in total of which Ferguson has 1,500 and Lennox has 10,000 grouse. You then have to re-draw the Edgeworth Box to reflect the fact that its height is now 22,000 salmon, and the width is 14,500.

(b) At the initial endowment, Ferguson's marginal rate of substitution between salmon and grouse is $800/200$ (4) and Lennox's is $25/400$ (1/16). The initial endowment point is not Pareto efficient. This follows from the fact that for Pareto efficiency, Ferguson's and Lennox's marginal rates of substitution would have to be equal. Consequently, a Pareto improvement could be made from the initial endowment. You do not have enough

information to draw their indifference curves at the initial endowment, as you know only the slope (the marginal rate of substitution) at that point. To draw their indifference curves you would need the slope at every point.

(c) You know the initial endowments of each person, and you know prices, so you use the budget line equation to work out their wealth, Ferguson has $(25,000 \cdot \$300 + 1,500 \cdot \$150) = \$7,725,000$, and Lennox has $(3000 \cdot \$300 + 10,000 \cdot \$150) = \$2,400,000$. If these prices actually lead to competitive equilibrium, their wealth will be the same as at the endowment point, as they simply move along the budget line to a competitive equilibrium, trading the two goods with each other, i.e. their wealth does *not* change. Given you know that the prices of \$300 and \$150 will result in a competitive equilibrium, then you know that the ratio of these prices, $150/300$ ($1/2$), is the slope of the budget line, which means that for a competitive equilibrium, this would have to be the same as the equalized marginal rates of substitution for Ferguson and Lennox – i.e., $1/2$ for both of them.

(d) The price of salmon will have to fall, and the price of grouse rise, i.e., the slope of the budget line would get steeper.