LECTURE NOTES ON MICROECONOMICS

ANALYZING MARKETS WITH BASIC CALCULUS

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Part 4: General equilibrium and market power

Chapter 13: General equilibrium

Problems

(13.1) [Efficiency versus fairness] Suppose four shoes—two left shoes and two right shoes—must be divided between two people: Adam and Becky.

a. Give an example of an allocation that is efficient (Pareto-optimal) but not fair.
b. Give an example of an allocation that is fair but not efficient.

(13.2) [Efficiency versus fairness] Amy and Brian both like all kinds of ice cream, but Amy likes chocolate more than vanilla, while Brian likes vanilla more than chocolate. Suppose four scoops of ice cream—two chocolate and two vanilla—must be divided between Amy and Bob.

a. Give an example of an allocation that is Pareto-efficient (or Pareto-optimal) but not fair.
b. Give an example of an allocation that is fair but not efficient.

(13.3) [Exchange efficiency] True or false? Explain your answer in detail.

a. "Exchange efficiency in an economy requires each consumer to have the same amount of income."
b. "In a competitive economy in general equilibrium, if Ann has twice as much income as Bob, Ann's marginal rate of substitution in consumption is twice as large as Bob's."

(13.4) [Technical efficiency] True or false? Explain your answer in detail.

a. "In a competitive economy in general equilibrium, all firms have the same marginal rate of substitution in production."
b. "If output is to be produced by two firms at the lowest possible total cost, then both firms should produce at their efficient scales—that is, at the lowest points of their average cost curves."

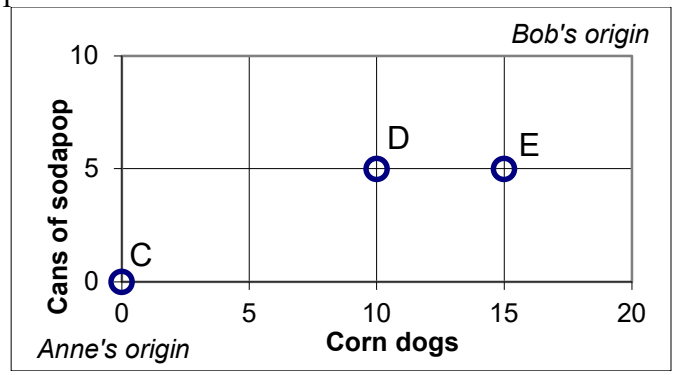
(13.5) [Efficiency of output mix] True or false? Explain your answer in detail.

a. "Suppose in a competitive economy in general equilibrium, the price of pencils is 10 cents and the price of pens is 50 cents. It follows that to produce one more pen (and keep output of all other goods at their current level) the economy must produce 5 fewer pencils."
b. "The efficient mix of outputs is the same regardless of how equally income is distributed."

(13.6) [Exchange efficiency] Anne and Bob both like corn dogs and sodapop. Let q_1 denote the number of cans of sodapop and q_2 denote the number of corn dogs. Anne's utility function is $U_A = q_1 q_2^3$ and Bob's utility function is $U_B = q_1 q_2$.

a. Find a formula for Anne's marginal rate of substitution in consumption of corn dogs for sodapop—that is, the slope of her indifference curves with corn dogs on the horizontal axis and sodapop on the vertical axis.
b. Find a formula for Bob's marginal rate of substitution in consumption of corn dogs for sodapop—that is, the slope of his indifference curves with corn dogs on the horizontal axis and sodapop on the vertical axis.

There are a total of 20 corn dogs and 10 cans of sodapop available to be allocated between these two people. Determine whether each of the three allocations plotted in the Edgeworth box diagram at right is efficient—that is, Pareto optimal. Justify your answers.

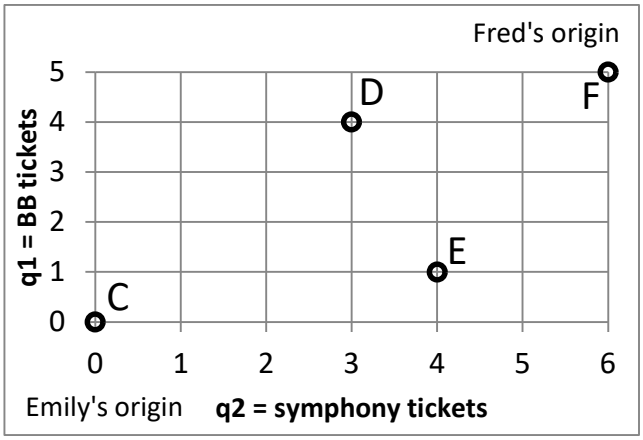


(13.7) [Exchange efficiency] Emily and Fred both like basketball and the symphony. Let q_1 denote the number of basketball tickets and q_2 denote the number of symphony tickets. Emily's utility function is $U_E = q_1^2 q_2$ and Fred's utility function is $U_F = q_1 q_2^2$.

a. Find a formula for Emily's MRSC of symphony tickets for basketball tickets—that is, the slope of her indifference curves with symphony tickets on the horizontal axis and basketball tickets on the vertical axis.
b. Find a formula for Fred's MRSC of symphony tickets for basketball tickets—that is, the slope of his indifference curves with symphony tickets on the horizontal axis and basketball tickets on the vertical axis.

Five basketball tickets and six symphony tickets can be allocated between these two people. Determine whether each of the allocations plotted in the Edgeworth box diagram at right is efficient—that is, Pareto optimal. Justify your answers.

g. Sketch the contract curve in this graph.



(13.8) [Exchange efficiency] Caleb and Debbie both like ice cream cones and tacos. Let q_1 denote the number of ice cream cones and q_2 denote the number of tacos. Subscript "C" flags Caleb's values and subscript "D" flags Debbie's. Caleb's utility function is $U_C = q_{C1}\, q_{C2}$ and Debbie's utility function is $U_D = q_{D1}^2\, q_{D2}$.

a. Find a formula for Caleb's marginal rate of substitution in consumption of tacos for ice cream cones—that is, the slope of his indifference curves with ice cream cones on the vertical axis and tacos on the horizontal axis.

b. Find a formula for Debbie's marginal rate of substitution in consumption of tacos for ice cream cones—that is, the slope of her indifference curves with ice cream cones on the vertical axis and tacos on the horizontal axis.

There are a total of 30 ice cream cones and 30 tacos available to be allocated between these two people. Determine whether each of the following allocations is efficient—that is, Pareto optimal. Justify your answer. [Hint: By definition, a Pareto-optimal allocation is one from which it is not possible to make one person better off without making someone else worse off.]

	Caleb		Debbie	
Allocation	Ice cream cones (q_{C1})	Tacos (q_{C2})	Ice cream cones (q_{D1})	Tacos (q_{D2})
C	30	30	0	0
D	15	15	15	15
E	10	15	20	15
F	5	15	10	15

g. Find one more feasible allocation, not listed above, that is efficient. Indicate how many ice cream cones and how many tacos would be given to each person. Explain why this allocation is efficient.

The next two problems refer to the following information. Suppose there are just two sectors, manufacturing and agriculture, which both use machines (x_1) and workers (x_2). Subscript "M" flags the manufacturing sector's values and subscript "A" flags the agricultural sector's. The production function for manufacturing is $Q_M = x_{M1}^{1/3} x_{M2}^{2/3}$. The production function for agriculture is $Q_A = x_{A1}^{2/3} x_{A2}^{1/3}$. There are a total of 60 machines and 60 workers available in the economy. Seven examples of feasible allocations of those inputs are given in the following table.

	Manufacturing		Agriculture	
Allocation	Machines (x_{M1})	Workers (x_{M2})	Machines (x_{A1})	Workers (x_{A2})
A	60	60	0	0
B	0	0	60	60
C	20	40	40	20
D	12	30	48	30
E	44	55	16	5
F	30	30	30	30
G	15	30	30	15

(13.9) [Technical efficiency] See the information given above.

a. Are allocations A and B technically efficient? Why or why not? [Hint: By definition, a technically efficient allocation is one from which it is not possible to produce more of any good without producing less of some other good.]
b. For each sector, find formulas for the marginal product of machines and the marginal product of workers.
c. For each sector, find a formula for the marginal rate of substitution in production (also called the "marginal rate of technical substitution") of workers for machines, that is, the |slope| of an isoquant when machines are on the vertical axis. [Hint: They are different for the two sectors.]
d. Are allocations C through G technically efficient? Why or why not? [Hint: Technically efficient allocations use all available inputs and assign them so that MRSPs are identical for all sectors.]

(13.10) [Efficiency of output mix] See the information given above. Suppose the economy is in general competitive equilibrium at allocation D.

a. For each sector, find a formula for the marginal product of workers.
b. If one worker is transferred from agriculture to manufacturing, would output in agriculture rise or fall? By about how much?
c. If one worker is transferred from agriculture to manufacturing, would output in manufacturing rise or fall? By about how much?
d. Use your results from parts (b) and (c) to calculate the marginal rate of product transformation of manufacturing for agriculture—that is, the slope of the production-possibility curve with agriculture on the vertical axis and manufacturing on the horizontal axis—at allocation D.
e. What must be the slope of every consumer's budget constraint (with manufactured goods on the horizontal axis and agricultural goods on the vertical axis)?
f. If the price of agricultural goods is \$1, what must be the price of manufactured goods?

[end of problem set]