ECON 200A MICROECONOMICS: DECISIONS

Fall 2015 **Tuesday, Thursday 9:30am-11:20pm** **Economics Bldg 200**

Prof. Mark Machina **Office: ECON 217** **Office Hours: Tues,Thu 12-2pm**

TA: Paul Feldman **ECON 119** **Wed 9:00-11:00**

The topics of this course are the economic theories of consumer and producer behavior.

The texts for the 200A/B/C sequence are:

Kreps, D., *A Course in Microeconomic Theory.* Princeton: Princeton Univ. Press, 1990.

Mas-Colell, A., M. Whinston and J. Green ("MWG"), *Microeconomic Theory,* Oxford: Oxford Univ. Press, 1995.

Varian, H., *Microeconomic Analysis, 3rd ed.* New York: W.W. Norton & Co., 1992.

There is also a Mathematical Handout for this course, and additional in-class handouts.

An extremely useful book of problems, designed to hone your analytical ability is:

Dixon, P., S. Bowles and D. Kendrick, *Notes and Problems in Microeconomic Theory*, 1985, (Amsterdam: North-Holland)

Other useful readings include the relevant chapters of:

Debreu, G., *Theory of Value*, 1959 (New York: Wiley).

Henderson, J. and R. Quandt, *Microeconomic Theory: A Mathematical Approach,* 3rd ed., 1980 (New York: McGraw-Hill)

Malinvaud, E., *Lectures on Microeconomic Theory*, 1972 (Amsterdam: North-Holland)

Russell, R. and M. Wilkinson, *Microeconomics: A Synthesis of Modern and Neoclassical Theory*, 1979 (New York: Wiley)

EXAMS: The midterm exam will be on Tuesday, October 27, and the final will be on Thursday, December 10, 8:00am – 11:00am.

PRACTICE QUESTIONS: For those who would like prior practice working with the material at a more basic level, or whose microeconomics background is not strong, there is a package of approximately ∞ practice questions available

http://www.econ.ucsd.edu/~mmachina/courses/ECON_200A/ECON_200A.html

ECONOMICS 200A COURSE OUTLINE

Fall 2015 **Mark Machina**

I. INTRODUCTION AND BASIC MATHEMATICAL IDEAS

a. Some Introductory Ideas

Domain of Microeconomic Analysis
Role of Models in Economics
The Circular Flow Diagram
Stocks versus Flows and the Dimensions of Economic Variables

b. Elasticity

c. Level Curves of Functions

Formula for the Slope of a Level Curve
Gradient Vectors and their Relation to Level Curves

d. Possible Properties of Functions

Cardinal vs. Ordinal Properties of Functions
Scale Invariance and Constant Returns to Scale
Homogeneity and Euler's Theorem
Homotheticity
Concavity and Convexity
Quasiconcavity and Quasiconvexity
Additive and Multiplicative Separability

e. Systems of Linear Equations and Cramer's Rule

II. MATHEMATICS OF OPTIMIZATION

a. The General Structure of Optimization Problems

Objective Functions, Control Variables, Parameters, Constraints
Solution Functions and Optimal Value Functions

b. Unconstrained Optimization

First Order Conditions
Second Order Conditions

c. Constrained Optimization

First Order Conditions
- Lagrangians
- Corner Solutions
- Shadow Prices of Constraints

Second Order Conditions

d. Comparative Statics of Solution Functions – Implicit Differentiation

Differentiating the First Order Conditions
A Related Application: Comparative Statics of Equilibria

e. Comparative Statics of Optimal Value Functions – The Envelope Theorem

Unconstrained Case: Differentiating the Objective Function
Constrained Case: Differentiating the Lagrangian

III. CONSUMER PREFERENCES AND THE UTILITY FUNCTION

a. The Choice Space

- The Objects of Choice
- The Relevant Time Period
- The Issue of Divisibility

b. Preference Relations

- Weak Preference, Strict Preference and Indifference
- General Properties of the Preference Ranking:
  - Completeness, Reflexivity and Transitivity
  - Continuity
    - Alternative Definitions of Continuity
    - Example of Non-Continuous Preferences: Lexicographic Preferences
- Possible Additional Properties of Preference Relations
  - Weak Monotonicity / Strong Monotonicity / Local Nonsatiation
  - Weak Convexity / Convexity / Strong Convexity
- The Theory of Revealed Preference
  - Rationalization of a Choice Function by a Preference Relation
  - Revealed Preference over Budget Sets
- Equivalent Variation versus Compensation Variation

c. Indifference Curves and the Marginal Rate of Substitution

- Better-Than Sets, Worse-Than Sets and Indifference Sets
- Typical Properties of Indifference Curves
  - One Through Each Point
  - Downward Sloping and "Thin"
  - Can't Cross
- Marginal Rate of Substitution (MRS)
  - Definition of MRS
  - Graphical Interpretation: Slope of the Indifference Curve
  - Convexity of Preferences and the Hypothesis of Diminishing MRS

d. Utility Functions

- Representation of a Preference Ranking by a Utility Function
- Monotonic Invariance of Utility Functions
- Possible Properties of a Utility Function:
  - Weak/Strong Monotonicity
  - Weak/Strong Quasiconcavity
  - Homotheticity
  - Additive/Multiplicative Separability
- Expressing the MRS in Terms of Marginal Utilities
- Monotonic Invariance of the MRS
- Hypothesis of Diminishing MRS
  - Algebraic Condition for Hypothesis of Diminishing MRS
- Important Examples of Utility Functions
  - Linear
  - Cobb-Douglas
  - Leontief
  - Constant Elasticity of Substitution (CES)
  - Quasilinear

IV. UTILITY MAXIMIZATION AND DEMAND FUNCTIONS

a. Utility Maximization Subject to a Budget Constraint

- Graphical Illustration
- First Order Conditions for Utility Maximization
  - Two Interpretations of the First Order Conditions
  - Monotonic Invariance of the First Order Conditions
  - Corner Solutions
- Economic Interpretation of the Lagrangian Multiplier
- Second Order Conditions (Hypothesis of Diminishing MRS)
- Algebraic Examples: Cobb-Douglas, Leontief, Linear, Quasilinear

b. Regular ("Marshallian") Demand Functions

- Definition of Regular Demand Functions
  - Examples: Cobb-Douglas, Leontief, Linear, Quasilinear
- General Properties of Demand Functions:
  - Walras' Law
  - Scale Invariant in Prices and Income
  - Relationship between Price Elasticities & Income Elasticity for a Good
- Market Demand Functions

c. The Indirect Utility Function

- Properties:
  - Increasing in Income, Nonincreasing in Prices
  - Scale Invariant in Prices and Income
  - Quasiconvex in Prices and Income
- Roy's Identity
- Price Indifference Curves
- Effect of Monotonic Transformation of Utility
- Examples: Cobb-Douglas, Leontief, Linear, Quasilinear
- Justification of the Two-Good Approach: The Composite Commodity Theorem

d. Compensated ("Hicksian") Demand Functions and the Expenditure Function

- The Expenditure Minimization Problem
  - First Order Conditions for Expenditure Minimization
- Compensated Demand Functions
  - Properties:
    - Scale Invariant in Prices
    - Nonincreasing in "Own Price"
  - Identities Linking the Marshallian and Hicksian Demand Functions
  - Examples: Cobb-Douglas, Leontief, Linear, Quasilinear
- The Expenditure Function
  - Properties:
    - Increasing in Utility, Nondecreasing in Prices
    - Homogeneous of Degree One in Prices
    - Concave in Prices
    - Relationship Between the Expenditure and Compensated Demand Functions
  - Identities Linking the Expenditure and Indirect Utility Functions
- Consumer Surplus

V. COMPARATIVE STATICS OF DEMAND

a. Changes in Income

- Income-Consumption Loci
- Engel Curves: Definition and Graphical Derivation
- Income Elasticity
  - Superior, Normal and Inferior Goods
  - Income Elasticity and Budget Shares
  - Relationship Between Income Elasticities of All Goods
- Algebraic Derivation of the Effect of an Income Change

b. Changes in Prices

- Price-Consumption Loci
- Graphical Derivation of Marshallian Demand Curves
- Own Price Elasticity
  - Price Elasticity and Budget Shares
- Cross Price Elasticity
  - Gross Substitutes and Gross Complements
- Algebraic Derivation of the Effect of a Price Change
- Relationship Between All Price and Income Elasticities for a Good

c. Compensated Price Changes

- Graphical Illustration of a Compensated Price Change
- Algebraic Derivation of the Effect of a Compensated Price Change
- Nonpositivity of Own Compensated Price Effect
- Compensated Cross Price Elasticity
  - Net Substitutes and Net Complements

d. The Slutsky Equation

- Graphical Illustration and Interpretation of the Slutsky Decomposition
- Algebraic Statement and Proofs
- Giffen Goods
- Cross-Price Slutsky Equations

VI. SUPPLY OF FACTORS OF PRODUCTION

a. Supply of Labor: The Labor-Leisure Decision

- Income-Leisure Space and the Labor-Leisure Decision
- First Order Conditions for Optimal Supply of Labor
- Comparative Statics: Income and Substitution Effects
- Backward Bending Supply of Labor Curves
- Kinked Budget Lines and the Overtime Decision

b. Supply of Capital: The Consumption-Savings Decision

- Intertemporal Income and Consumption Streams
- Interest Rates and the Discounted Present Value of a Stream
- Relationship between the Rental Rate and the Price of Capital
- Intertemporal Utility Maximization
  - First Order Conditions and Interpretation
- Comparative Statics: Income and Substitution Effects

c. Intertemporal Production: The Demand for Capital

Two-Period Illustration
Finite-Period Production and Investment
Continuous Time Production: When to Cut a Tree

d. Relationship between Rental Market and Sales Market for Capital

VII. CHOICE UNDER UNCERTAINTY

a. Objective Uncertainty

Objects of Choice and Preference Functions
Structure of Expected Utility Preferences
    Axiomatic Characterization of Expected Utility
Arrow-Pratt Characterization of Comparative Risk Aversion
    Risk Aversion and Wealth
Rothschild-Stiglitz Characterization of Comparative Risk
Demand for Insurance

b. Subjective Uncertainty

States, Events, Outcomes and Acts
Probabilistic Sophistication
Expected Utility Preferences over Subjective Acts
    State-Dependent Utility

c. Evidence and Alternative Models

Evidence on the Independence Axiom
Non-Expected Utility Preference Functionals
    Generalized Expected Utility Analysis
Evidence on Probabilistic Sophistication and the Stability of Preferences

VIII. PRODUCTION, COST AND DUALITY

a. Factors of Production

The Stock-Flow Distinction
Types of Factors and Their Income

b. Production Functions and Production Sets

Definition and Important Examples of Production Functions
Marginal Products and the Law of Diminishing Marginal Returns
Average Products and the Average-Marginal Relationship
Returns to Scale
Technical Progress
    Three Implications of Technical Progress
    Hicks-Neutral, Harrod-Neutral and Solow-Neutral Technical Progress
    Continuous Technical Progress
Production Sets and Input Requirement Sets

c. Isoquants and the Marginal Rate of Technical Substitution (MRTS)

Definition and General Properties of Isoquants
Definition of MRTS
Expressing MRTS in Terms of Marginal Products
Hypothesis of Diminishing MRTS
Elasticity of Substitution

d. The Nature of Cost

- Definition of Cost
- Accounting Cost vs. Opportunity Cost of Owned Factors
- Cost of Entrepreneurial Ability and Definition of "Normal Profits"
- Short Run versus Long Run Planning Horizons

e. Long Run Minimization and Long Run Cost Functions

- Isocost Lines
- Long Run Cost Minimization
  - First Order Conditions and Output-Constrained Factor Demands
    - Two Interpretations of the First Order Conditions
  - Second Order Conditions and the Hypothesis of Diminishing MRTS
  - Equivalence to Constrained Output Maximization
- The Long Run Expansion Path
- Long Run Total Cost Function (LTC)
  - Properties of LTC:
    - Increasing in Output, Nondecreasing in Factor Prices
    - Homogeneous of Degree One in Factor Prices
    - Concave in Factor Prices
  - Deriving Output-Constrained Factor Demands from LTC
- Long Run Marginal Cost Function (LMC)
  - Relation of LMC to Marginal Products and Factor Prices
- Long Run Average Cost Function (LAC)
  - Returns to Scale and Long Run Average Cost
  - Average-Marginal Relationship
- Relation Between Long Run and Short Run Total, Average and Marginal Cost Curves

f. Short Run Cost Functions

- Expansion Path in the Short Run
- Graphical Derivation of the Short Run Total Cost Curve
- Algebraic Derivation of Short Run Total Cost Function (STC)
  - Examples: Linear, Leontief, Cobb-Douglas
- Short Run Variable Cost Function (SVC)
- Short Run Fixed Cost Function (SFC)
- Short Run Marginal Cost Function (SMC)
  - Relation of SMC to Marginal Product of Labor and Wage Rate
- Short Run Average Total Cost Function (SATC)
- Short Run Average Variable Cost Function (SAVC)
- Short Run Average Fixed Cost Function (SAFC)
    - Average-Marginal Relationships
    - Effects and Interpretation of "Changes in Fixed Capital $\bar{K}$"

g. Duality Between Production and Cost

- Equivalence of Cost Minimization and Constrained Output Maximization
- Convexification of Input Requirement Sets and Competitive Production
- Recovery of Production Function and Cost Functions from Each Other
- Characterization of Cost Functions:
  - Positive
  - Nondecreasing in Output and Factor Prices
  - Homogeneous Degree One in Factor Prices
  - Concave in Factor Prices

IX. PROFIT MAXIMIZATION AND SUPPLY

a. Long Run Profit Maximization and Supply

- Long Run Profit Maximization (Graphical Illustration and Algebraic Formulation)
  - First Order Conditions and Interpretation
  - Second Order Condition (Increasing Marginal Cost)
- The Long Run Supply Function of the Firm
  - Properties:
    - Increasing in Price, Nonincreasing in Factor Prices
    - Scale Invariant in Output and Factor Prices
    - Long Run Elasticity of Supply
  - Cobb-Douglas Example
- The Long Run Profit Function
  - Properties:
    - Increasing in Price, Nonincreasing in Factor Prices
    - Homogeneous of Degree One in All (Output and Factor) Prices
    - Convex in Output and Factor Prices
  - Cobb-Douglas Example
- Identity Linking the Long Run Profit and Supply Functions

b. Short Run Profit Maximization and Supply

- The Three Relevant Regions and the Shut Down Decision
  - Illustration in Terms of STC and SVC Curves
  - Illustration in Terms of SATC and SAVC Curves
  - The Short Run Supply Curve of the Firm
- The Short Run Supply Function of the Firm
  - Properties:
    - Increasing in p, Nonincreasing in (w,r)
    - Scale Invariant in (p,w)
    - Effects of Changes in $\bar{K}$
  - Short Run Elasticity of Supply
  - Cobb-Douglas Example
- The Short Run Profit Function
  - Properties
    - Increasing in p, Nonincreasing in (w,r)
    - Homogeneous Degree One in (p,w,r)
    - Convex in (p,w,r)
  - Effects of Changes in $\bar{K}$
  - Cobb-Douglas Example
- Identity Linking the Short Run Profit and Supply Functions
- Comparison of Short Run and Long Run Profit Functions
- Comparison of Short Run and Long Run Supply Elasticities

c. Factor Demand Functions

Maximizing Profits by Choosing Optimal Input Levels
Marginal Value Product of a Factor of Production
Short Run Factor Demand
First Order Condition for Short Run Profit Maximization
Short Run Factor Demand Functions
Nonincreasing in Own Factor Price
Scale Invariant in Output Price and Prices of Variable Factors
Relation to Short Run Supply Function
Long Run Factor Demand
First Order Conditions for Long Run Profit Maximization
Long Run Factor Demand Functions
Nonincreasing in Own Factor Price
Scale Invariant in Output Price and Factor Prices
Relation to Long Run Supply Function
Relation to the Profit Function
Properties:
Nonincreasing in Own Price
Scale Invariant in (p,w,r)
Symmetric Cross Factor Price Effects

X. SPECIFICATION AND ESTIMATION OF DEMAND, COST AND SUPPLY

a. Parametric Estimation of Demand Systems

b. Parametric Estimation of Production and Cost Systems

c. Nonparametric Testing of the Maximization Hypothesis

ECONOMICS 200A: READINGS BY TOPIC

Fall 2015 Mark Machina

I. Introduction and Basic Mathematical Ideas
Required: Math Handout, Sections A through F; Kreps Ch.1
Also suggested: MWG App.A-E; Varian Ch.26

II. Mathematics of Optimization
Required: Mathematical Handout, Sections G through I
Also suggested: Kreps App.1; MWG App. J-L; Varian Ch.27

III. Consumer Preferences and the Utility Function
Required: Kreps Sect.2.1; MWG Ch.1, Sects.2A -2C,3A - 3C; Varian Sect. 7.1
Also suggested: Suggested readings will be provided in an in-class handout

IV. Utility Maximization and Demand Functions
Required: Kreps Ch.2; MWG Sects.2D,3D; Varian Sects.7.2-7.5
Also suggested: Henderson & Quandt, Sects.2.1-2.3

V. Comparative Statics of Demand
Required: MWG Sects.2E-2F, 3E-3J; Varian Chs. 8, 9

VI. Supply of Factors of Production
Required: MWG Sects.20A-20D; Varian Ch.19
Also suggested: Kreps Ch.4, Sect.6.5; MWG Sects.19A-19B
Also suggested: MWG Ch.4; Varian Ch.10, Henderson & Quandt, Sects.2.5-2.7

VII. Choice Under Uncertainty
Required: Kreps Ch.3; MWG Ch.6; Varian Ch.11;
Required: Pratt J. (1964). "Risk Aversion in the Small and in the Large," *Econometrica* 32, 122-136.
Also suggested: Rothschild, M. & J. Stiglitz (1970). "Increasing Risk: I. A Definition," *Journal of Economic Theory* 2, 225-243;
Machina, M. (1987). "Choice Under Uncertainty: Problems Solved and Unsolved," *Journal of Economic Perspectives,* Summer 1987.

VIII. Production, Cost and Duality
Required: Kreps Sect. 7.1 ; MWG Ch.5; Varian Chs.1,4,5,6
Also suggested: Henderson & Quandt, Chs.4,5

XI. Profit Maximization and Supply
Required: Kreps Ch.7; MWG Ch.5; Varian Chs.2,3
Required: Viner, J. (1931). "Cost Curves and Supply Curves," *Zeitschrift für Nationalökonomie* III. 23-46.
Also suggested: Kreps Chs.19,20

X. Specification and Estimation of Demand, Cost and Supply
Required: Varian Ch.12
Required: Ch. 3 of Deaton & Muellbauer (1980), *Economics and Consumer Behavior*.

ECON 200A: FAMOUS OPTIMIZATION PROBLEMS

Optimization Problem	Objective Function	Constraint	Control Variables	Parameters	Solution Functions	Optimal Value Function
Consumer's Problem	$U(x_1,...,x_n)$ utility function	$p_1 \cdot x_1 + ... + p_n \cdot x_n = I$ budget constraint	$x_1,...,x_n$ commodity levels	$p_1,...,p_n, I$ prices and income	$x_i(p_1,...,p_n,I)$ regular demand functions	$V(p_1,...,p_n,I)$ indirect utility function
Expenditure Minimization Problem	$p_1 \cdot x_1 + ... + p_n \cdot x_n$ expenditure level	$U(x_1,...,x_n) = u$ desired utility level	$x_1,...,x_n$ commodity levels	$p_1,...,p_n, u$ prices and utility level	$h_i(p_1,...,p_n, u)$ compensated demand functions	$e(p_1,...,p_n, u)$ expenditure function
Labor/Leisure Decision	$U(H,I)$ utility function	$I = I_0 + w \cdot (168 - H)$ budget constraint	H, I leisure time, disposable inc.	w, I_0 wage rate and nonwage income	$L(w,I_0) \equiv 168 - H(w,I_0)$ labor supply function	$V(w,I_0)$ indirect utility function
Intertemporal Optimization	$U(c_1,...,c_n)$ utility function	$\sum_{t=1}^{n} (1+i)^t \cdot (I_t - c_t) = 0$ budget constraint	$c_1,...,c_n$ consumption levels	$I_1,...,I_n, i$ income stream and interest rate	$c_i(I_1,...,I_n, i)$ consumption functions	$V(I_1,...,I_n, i)$ indirect utility function
Long Run Cost Minimization	$w \cdot L + r \cdot K$ total cost	$F(L,K) = Q$ desired output	L, K factor levels	Q, w, r desired output and factor prices	$L(Q,w,r), K(Q,w,r)$ output-constrained factor demands	$LTC(Q,w,r)$ long run total cost function
Long Run Profit Maximization (in terms of Q)	$P \cdot Q - LTC(Q,w,r)$ total profit	none	Q output level	P, w, r output price and factor prices	$Q(P,w,r)$ long run supply function	$\pi(P,w,r)$ long run profit function
Long Run Profit Maximization (in terms of L, K)	$P \cdot F(L,K) - w \cdot L - r \cdot K$ total profit	none	L, K factor levels	P, w, r output price and factor prices	$L(P,w,r), K(P,w,r)$ factor demand functions	$\pi(P,w,r)$ long run profit function
Long Run Profit Maximization (in terms of Q, L, K)	$P \cdot Q - w \cdot L - r \cdot K$ total profit	$F(L,K) = Q$ production function	Q, L, K output and factor levels	P, w, r output price and factor prices	$Q(P,w,r), L(P,w,r), K(P,w,r)$ output supply & factor demand functions	$\pi(P,w,r)$ long run profit function