

AAE 635

# Applied Microeconomic Theory

Fall 2011

9/5/2011

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## **Today & next class**

- Syllabus
- Introduction (lecture note 1)
- Theory of the Firm (lecture note 1)
  - Profit maximization firms' problem

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# Syllabus

Class website: <http://www.aae.wisc.edu/aae635/main.asp>

- Study Materials:
  - Lecture notes and slides posted online
  - (Optional) Hal R. Varian, *Microeconomic Analysis*, Third Edition
  - (Optional) Eugene Silberberg and Wing Suen, *The Structure of Economics: A Mathematical Analysis*, Third Edition
- (Recommended) Sydsater, K., A. Strom and P. Berck, *Economists' Mathematical Manual*
- Grading:
  - Midterm 30%
  - Final 40%
  - Six Homeworks 30%
    - You can work in teams, but need to hand in your own work
- TAs: Lindsay Amiel, [lnamiel@wisc.edu](mailto:lnamiel@wisc.edu)  
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## 1.1 Introduction: What is Microeconomics?

- Allocate scarce resources to competing needs
- “Micro” level
  - Individuals (consumer, firm, ...)
  - Aggregate effects
- Questions
  - Economic decision rule
  - Economic rationality
  - Economic efficiency
- Positive studies vs. normative studies
  - A normative statement expresses a judgment about what ought to be, whether a situation is desirable or undesirable, → policy recommendations
  - A positive statement is a statement about what is and that contains no indication of approval or disapproval, → explanation and understanding

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## Topics to be covered in this class

- Firms' optimization problem
- Consumers' optimization problem
- Duality in analyzing economic behaviors
- Welfare consequences
- General equilibrium analyses

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## General framework under each topic

- (I) Set up the objective function
  - E.g. firms maximize the profit, consumers maximize utility
- (II) Solve for optimization solutions
  - E.g. find out the optimal output to produce or the optimal amount of goods to consume
- (III) Conduct comparative statics analysis
  - E.g. what is the impact of labor wage increase to the output decision?  
What is the impact of a gasoline tax on consumer's consumption behavior?
- (IV) Interpret the results
  - Making normative or positive statements...
- *Note the difference between mathematical context and economic context...*

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## A simple example: firms maximize profits

### *I: Set up the objective function*

- John uses  $x$  units of fresh orange to make  $y$  units of juice. What are his profit maximizing input and output given certain market conditions?

$$\underset{x,y}{\text{Max}} \quad \pi = p \cdot y - w \cdot x,$$

$$\text{s.t. } y = 50x - x^2, \text{ output price } p = 4, \text{ input price } w = 40.$$

Rewrite the objective function:

$$\underset{x}{\text{Max}} \quad \pi = 200x - 4x^2 - 40x = 160x - 4x^2,$$

Note that the choice variable now is  $x$  only...

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## A simple example: firms maximize profits

### *II. Solve for optimization solutions*

- Apply the first order condition:

$$\frac{\partial \pi}{\partial x} = 160 - 8x = 0, \Rightarrow x^* = 20;$$

- Check the second order condition:

$$\frac{\partial^2 \pi}{\partial x^2} = -8 < 0.$$

- Find the optimal output:  $y^* = 50x - x^2 = 50 \cdot 20 - 20^2 = 600$ .
- Find the maximum profits:  $\pi^* = 160 \cdot 20 - 4 \cdot 20^2 = 1600$ .

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## A simple example: firms maximize profits

### III. Conduct comparative statics

- How should John adjust his input and output if price of orange goes up?
  - You can try to plug in a real number and check the results, or more generally, we will keep “w” in the analysis and try to find a general fact...

$$\frac{\partial \pi}{\partial x} = 200 - 8x - w = 0, \Rightarrow x^* = 25 - \frac{w}{8}; \Rightarrow \frac{\partial x^*(w)}{\partial w} = -\frac{1}{8} < 0, \text{ and}$$

$$y^* = 50 \cdot \left(25 - \frac{w}{8}\right) - \left(25 - \frac{w}{8}\right)^2, \Rightarrow \frac{\partial y^*}{\partial w} = -\frac{w}{32} < 0.$$

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## A simple example: firms maximize profits

### IV. Interpret the results

- Given the market price for juice at \$4/unit and for orange at \$40/unit, John should use 20 units of orange to produce 600 units of juice, which will generate maximum profits at \$1600.
- If price of orange goes up, John should use less orange and produce less juice in order to maximize his profits.

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## Necessary conditions and sufficient conditions

- **A implies B;  $A \Rightarrow B$ ; if A then B**
  - **B** is necessary for **A**
  - **A** is sufficient for **B**
- FOC is necessary but not sufficient for profit maximization, given interior solutions. Why? See figure 1.2, and proof in lecture note
- Why “interior” solutions? Figure 1.4
  - Kuhn-Tucker conditions  $\rightarrow$  first order necessary conditions (FONC)
- The second order sufficient condition (SOSC) and SONC for a local maximum and a local minimum