EE320 Introductory Mathematical Economics (Section 046401) semester 2/2016 moodle enrolment key 5115

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Room 7

Course Description:

- Applying mathematical concepts and tools such as functions, equations, matrices, univariate and multivariate differential calculus, constrained and unconstrained optimization and integral …
- to explain concepts of microeconomic theory and macroeconomic theory to understand the relationship between different economic variables.
- An emphasis will be placed on relationships between total, average, and marginal functions, the analyses of elasticity, market equilibrium, impacts of taxation, and the basic input-output model.

Course objectives:

- To equip students with essential mathematical concepts and tools in studying economics.
- To expose students to the application of mathematical concepts in analyzing economic problems.

Readings

- **Textbooks**
- Baldani, J., James Bradfield, and Robert Turner. *Mathematical Economics. Second Edition,* Ft. Worth: Dryden Press, 1996. (HB 135 B285)
- **Supplementary Texts**
- Sydsaeter, Knut and Hammond, Peter J. *Essential Mathematics for Economic Analysis.* Englewood Cliffs, NJ: Prentice-Hall, 2008. (HB135 .S895 2008).
- Chiang, A. and Wainwright, K. (2005). *Fundamental Methods of Mathematical Economics*, 4th international edition, McGraw-Hill.
- Dixit, A.K. (1990). *Optimization in Economic Theory*, Oxford University Press. 2nd ed.

Course Evaluation

• Homework	20%
• Mid-term exam	40%
• Final exam	40%

Lecture 1 Introduction to Mathematical Economics

Read chapter 1

topics

- Concept of a mathematical model (model, example of simple and solvable model, about functional form)
- Optimization (calculus with one variable, example of economic optimization)
- Value functions and the Envelope theorem (about endogenous variables, example of a simple value function, and the envelope theorem)

Economic Models:

- **An economic model is an abstraction from reality, emphasizing key features of an economic problem, thereby in the form that easily tractable.**

Economic Models: 5 elements

- **Economic agents**: consumers, workers, firms, governments. They make decisions to achieve their goals.
- **Economic environment**: factors that agent cannot control. For example, prices are given. We present environment as parameters or exogenous variables (not solved in the model).
- **Choices**: made rationally
- **Equilibrium solution**: no tendency to change unless parameters change. This shows agent's optimal decision under environment. The equilibrium values of economic variables are endogenous.
- **Analysis of how changes in the environment affect equilibrium** : economic model is to predict changes in economic behavior. How are your choices changed if parameters change.

Practical issues

- Economic models are incomplete and, often, unrealistic.
- An ideal model is simple enough to be solvable and good enough to capture important features, to make predictions (verified or refuted by evidence or data)
- To simplify reality, we make mathematical assumptions, such as demand is linear. Or we can limit choice sets, such as quality of product is fixed. Or we can steps up from simple to complex.

1.A Solvable example: Linear demand and supply

- Agents are :………………., ……………………
- Environments:
- Choices:
- Parameters:
- Solutions : numerical values (numbers) or in forms of parameters
- How changes in environment affect equilibrium :
- firms' environments :
- consumers' environments:
- Unrealistic characters:
- Practical assumptions:
- Given demand: $P = a – b\ Q$ and Supply : $P = c + dQ$

A Solvable example: Linear demand and supply

- Given demand: $P = a - b\,Q$ and Supply : $P = c + dQ$
- We can solve $P^* = (ad+bc) / (b+d)$; And $Q^* = (a - c) / (b+d)$
- Draw diagrams

A Solvable example: Linear demand and supply

- Noting that we require a, b, c, d > 0 and a > c.
- Once we solve for endogenous variables P*, Q*, we can predict how changes in a, b, c, d affect equilibrium P and Q. We call this Comparative static analysis. That is, comparing old and new; statics means we ignore how it moves from old to new.
- Comparative statics = take derivatives of our solution functions wrt parameters = How the endogenous variable changes when a single exogenous variable changes.
- For example, $\frac{\partial Q*}{\partial a} = \frac{1}{b+d} > 0 \ \ and \frac{\partial P*}{\partial a} = \frac{d}{b+d} > 0.$
- Also, you can try $\frac{\partial Q*}{\partial d} = \frac{-(a-c)}{(b+d)^2} < 0 \ \ and \frac{\partial P*}{\partial d} = \frac{b(a-c)}{(b+d)^2} > 0.$
- We sign them using values of those parameters.

Class exercise

- Suppose the government imposes a per-unit tax t Baht / unit.
- Suppose firms pay for this tax = shift up Marginal cost by tax amount.
- The new supple curve is P = (c+t) + dQ
- Find new Q* and P*
- And $\frac{\partial Q*}{\partial t} = \frac{-1}{b+d} < 0 \;\; and \, \frac{\partial P*}{\partial t} = \frac{d}{b+d} > 0.$
- Trick: think c’ = c + t, we can pluck this into the previous solution

2.A general functional form example

- Now no specific functional forms: $\pi = TR - TC$
- Consider firms want to maximize profits by choosing output level q
- Assume: single good, price takers in competitive market P, cost-min uses of inputs, C(q), C'>0.
- $\pi = TR - TC$= Pq – C(q)
- What is endogenous and exogenous variables?
- What is the solution or equilibrium?
- **The solution is not a single level of output, but a function showing q* = f(p)**
- **Solution shows how endo = f(exo); how choices depends on environment or parameters.**
- This is supply function and the comparative static result is how output responses to price changes, dq*/dp = f'

3.Optimization: calculus with one variable

- Consider $y = f(x)$
- $f'(x)$ depend on value of x that is evaluated.
- For local **maximum**, we require two conditions
- FONC for local extreme point: $f'(x^*) = 0$
- But this is not sufficient to tell us whether at x^*, we get max or min or not both
- SOSC for max : $f'' < 0$ (= f is locally strictly concave)

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Ex. A function with multiple extremes

Examples of functions

- A constant function
- Linear function
- Quadratic function
- Polynomial function
- Exponential function
- Logarithmic function

reviews

- Derivative of function at point (xo,yo) is
- The rate of change
- Slope of the tangent line
- To find derivatives of functions, review differential rules (product of two functions, quotient of two functions and chain rule)
- Apply them to all functional forms
- See 1.A.2.3 for your review