QUANTITATIVE METHODS

Department of Economics, National Chi Nan University
Syllabus (Fall 2020)

Instructor: Yo-Long Lin
Contact: yolong@ncnu.edu.tw
Time and Location: Tuesday 2:10-5pm in College of Management Building 329R
Office Hours: Tuesdays 12-2pm or by appointment
Credits: 3.0
Class code: 110170

Course Objective: The course is designed for undergrade students entering the master program in economics. I will introduce elementary mathematics necessary to complete graduate–level courses in macroeconomics. This course can be particularly useful and inspiring students in dynamic macroeconomics, growth theories, business cycle theories, international finance theories, and monetary economics.

Prerequisite: Calculus.

Primary Reference:

- Simon, C. and L. Blume, 1994, *Mathematics for Economists*, Norton.
- Strang, G., 2006, *Linear Algebra and Its Applications*, Brooks Cole.

Secondary References:

- Sundaram, R., 1996, *A First Course in Optimization Theory*, Cambridge University Press.
- Kamien, M.I. and N.L. Schwartz, 1981, *Dynamic Optimization: The Calculus of Variations and Optimal Control in Economics and Management*, North-Holland.

Grading: There will be several problem sets (90%). Attendance (10%).

Course Outlines:

0. Review Section
   (a) Concavity and Convexity
      i. Concave Function
      ii. Quasi-concavity and Strict Quasi-concavity
      iii. Convex and Linear Function
   (b) Nonlinear Programming Problem (Optional)
      i. Extreme Value Theorem
      ii. Uniqueness Theorem
      iii. Unconstrained Optimization
      iv. Optimization with Inequality Constraints

1. Linear Algebra
    (a) Matrix Algebra
    (b) Transition Matrix
    (c) Linear Independence
    (d) Eigen Analysis
    (e) Stability
    (f) Definiteness
    (g) Application: Linear Rational-expectations Models
2. Linear Differential Equation
    (a) First-order Linear Differential Equation
    (b) Higher-order Linear Differential Equation
    (c) Stability
    (d) Application: Walrasian and Marshallian Adjustment Model
    (e) Linear Differential System
    (f) Application: Business Cycle Models
    (g) Optimal Control Theory: The Maximum Principle