ΕΘΝΙΚΟ ΚΑΠΟΔΙΣΤΡΙΑΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ ΣΧΟΛΗ ΟΙΚΟΝΟΜΙΚΩΝ και ΠΟΛΙΤΙΚΩΝ ΕΠΙΣΤΗΜΩΝ ΤΜΗΜΑ ΟΙΚΟΝΟΜΙΚΩΝ ΕΠΙΣΤΗΜΩΝ

# ΜΕΤΑΠΤΥΧΙΑΚΟ ΠΡΟΓΡΑΜΜΑ ΣΤΗΝ ΟΙΚΟΝΟΜΙΚΗ ΕΠΙΣΤΗΜΗ

## **TOPICS IN COMPUTATIONAL MATHEMATICS**

### **INSTRUCTORS**

Stelios Kotsios, Ilias Kostarakos

### **COURSE DESCRIPTION**

The aim of this course is to introduce the students to the basic notions of computational mathematics and the use of Mathematica for analyzing systems that arise in economics. Mathematica is a powerful software product that is capable of doing symbolic and numerical computations, and possesses remarkable facilities to produce graphics that are essential to investigating mathematical problems. The course is a good occasion for revisiting multivariable calculus, matrix algebra, systems of linear equations, eigensystems, quadratic forms, Taylor series, concave and quasiconcave functions, optimization, linear and nonlinear programming, difference equations, ordinary differential equations and statistics, which are ALL faced by means of the Mathematica software. By the end of the course the students will be able to handle this powerful package and to use it into their daily mathematical activities

#### **BIBLIOGRAPHY**

- Schaum's Outline of Mathematica. Eugene Don, 2000, Schaum's Outline.
- Applied Mathematical Economics with Mathematica Author: Alan G. Isaac Institution: American University Copyright (c) 2015 by Alan G. Isaac
- Mathematics and Mathematica for Economists. Cliff J. Huang, Philip S. Crooke, Blackwell.

#### GRADING

The course will meet for 3 hours lecture sessions per week. All students must have their laptops with them. All students will be called to write programs in MATHEMATICA for solving certain mathematical problems with economical application. The difficulty of these programs will increase gradually, from basic to more complex. No other requirements are needed.

#### **SYLLABUS**

- 1. A first description of the computational methods.
- 2. Introduction to Symbolic Programming
- 3. Introduction to the Mathematica Software.
- 4. Basic Mathematica Functions
- 5. Basic Mathematics with Mathematica
- 6. Solving equations with Mathematica.
- 7. Linear Algebra with Mathematica.
- 8. 2D and 3D Graphics with Mathematica.
- 9. Differentiation with Mathematica.
- 10. Optimization with Mathematica. (Constrained and unconstrained)
- 11. Solving Differential Equations with Mathematica.
- 12. Applications in Statistics
- 13. Application to Economics and Finance.
- 14. Programming with Mathematica.