Syllabus

Department of Economics and Business
CENTRAL EUROPEAN UNIVERSITY

Course	**Pre-Session for Finance: Mathematics and Data**
Instructor	**Tibor Voros**
Email	vorost@ceu.edu
Office hours	by appointment
Credits	3 US credits (6 ECTS credits)
Module	Orientation / Pre-session
Term	Pre-session / FALL 2024-2025
Course level	Master's
Prerequisites	None
Course drop	No course drop, as described in the MS in Finance Regulations.

1. COURSE DESCRIPTION

This course provides an overview of basic and more advanced concepts in mathematics and Microsoft Excel. All the material provided by this course is required to complete subsequent courses.

2. LEARNING OUTCOMES

INTENDED LEARNING OUTCOMES	ASSESSMENT
Knowledge and Understanding Understand and use basic math, informatics and finance jargon.	Final exam
Intellectual Skills Ability to categorize different problems and have an idea how to approach to the solution.	Final exam
Practical Skills Using MS Excel and solving complex maths problems using MS Excel approaches.	Final exam
Transferable Skills Translate descriptions of business / financial situations into formal mathematical models, and investigate those models in an organized fashion	Final exam

3. READING LIST

- Knut Sydsaeter and Peter J. Hammond [SYD] - Mathematics for Economic Analysis (later editions of the book are available with a slightly different title: Essential Mathematics for Economic Analysis – all editions are good)
- Theresa Bradley and Paul Patton: Essential Mathematics for Economics and Business (2nd edition and later are preferred)
- Dirk P. Kroese [KROESE] - A Short Introduction to Probability (available here)
- John Walkenbach [WB] - Excel 2007 / 2010 etc Formulas (or any newer editions)

- MS Excel Basics Introductions (available here or here is another course)

4. TEACHING METHOD AND LEARNING ACTIVITIES

Lectures and seminar-type classes to present mathematical tools and concepts in Microsoft Excel, and to solve specific mathematical and Microsoft Excel problems together. The aim is to demonstrate the use of concepts. Most of the classes will employ MS Excel as a tool for calculations.

5. ASSESSMENT

Grading will be based on CEU's standard grading guidelines.

- **Assignment using Microsoft Excel**. 75% score must be achieved to pass.
- **Written exam.** Usually closed book exam, 75% score must be achieved to pass. One A4 page with any printed / written information and a scientific calculator may be used.
- **Class participation**. Participation in class is required (min. 75% of attendance), unless student passed the optional opt out exam before course starts.

Opt-out, The course may be 'opt-out' in case of a successful waiver examination. At end of August (notification will be sent) students will have the possibility to complete a two-section online exam. Participants will have at least one day to complete the online exam. The exam comprises of a maths section and a Microsoft Excel section. To fully opt-out of the classes, both sections have to be passed (min. 75% in each). If only one section is passed, the pre-session classes will have to be visited, but only the failed section would have to be re-written at the end of the pre-session classes. The opt-out exam content is based on the course content (see below).

6. TECHNICAL REQUIREMENTS

Please bring a notebook to the classes.

7. TOPIC OUTLINE AND SCHEDULE

Please see the CEU Department of Economics calendar for class timing. Further details and material will be available on Moodle. Please note that during the pre-session the sequence of the topics depends considerably on the participants' background knowledge and may change. Review the Moodle environment (updated daily) to see which topics would come up each day. If required, I will provide a more detailed schedule.

- **Elementary algebra** [SYD Appendix A]: Powers, square roots, rules of algebra (commutativity, distributivity, associativity), factors, fractions, simple equations, inequalities, quadratic equations, solving equations.
- **Functions of one variable** [SYD 2.2, 2.5, 3.1, 3.3, 3.4, 3.5, 3.6, 8.1, 8.2, 8.3]: Linear functions, quadratic functions, polynomials, power functions, exponential functions, logarithmic functions.
- **Calculus** [SYD 4.1, 4.2, 4.4, 4.5, 4.6, 4.7, 5.1, 5.2, 6.1, 6.2, 6.3, 6.4, 6.5, 10.1, 10.2, 10.3, 15.1, 15.3, 15.5, 17.1, 17.2, 17.3, 17.4, 17.5, 17.6, 17.7, 17.8, 17.9, 18.1, 18.2, 18.4, 18.5]: Limits,

continuity, differentiability, differentiation, minima and maxima, partial derivatives, single variable optimization, extreme points (max, min, inflection), integration, infinite sequences, series (extra: multivariate optimization, constrained optimization (lagrangian), chain rule, L'Hopital's rule).

- **Linear algebra** [SYD 12.1, 12.2, 12.3, 12.4, 12.6, 12.7, 12.8, 12.9, 13.1, 13.2, 13.3, 14.1, 14.2, 14.4]: Vectors, scalar product, systems of linear equations, matrices, matrix operations (multiplication, transpose), determinant, eigenvalues, eigenvectors, linear independence (extra: Gauss elimination, rank and the number of solutions).
- **Probability theory** [KROESE 1, 2, 3]: Sample space, events, probability, conditional probability, independence, Bayes' rule, law of total probability, random variables, probability distributions, expected value.
- **Microsoft Excel** [WB: 1, 2, 4, 5, 8, 18; EE: Introduction, Basics 1-5, Functions 1-6, 11, Data Analysis 1-5, 8, 9]: Workbook and worksheets, formatting, data management and visualization, formulas and functions (descriptive, logical, selection), pivot tables, optimization with solver, statistical tools with Analysis ToolPak (extra: automating with macros, recording only).

Initial timing plan for classes

	Activity
Session 1-3	**MS Excel basics + Elementary algebra**
Session 4-6	**MS Excel charting and formulae + Functions**
Session 7-9	**MS Excel pivot + Calculus**
Session 10-12	**MS Excel Data Analysis tools + Probability + Linear Algebra I**
Session 13-15	**MS Excel Solver + Linear Algebra II**
Session 16	**Overview, Practice Session**
Session 17-18	**Practice & Discussion** **Exam**

Sample maths exercises (this is just a sample to help prepare, more complex tasks may appear) – all these tasks are from the book SYD / KROESE.

Elementary algebra

- Simplify $\frac{x^{n+4}}{x^{n-2}}$
- Solve for x: $2x^{-1} = 8$
- Solve a quadratic equation, e.g. $x^2 + 8x - 9 = 0$

Functions of one variable

- Take the f(x)=3x + 4 function. What is the value for f(0)?

- What is compound interest and how do you calculate it?

Calculus

- Find the slope of the function f(x)=-4x+2.
- Complete an analysis of a quadratix f(x) function: find inflexion, min and max points, e.g. $f(x) = x^6 - 10x^4$
- Calculate $\int_0^5 (x + x^2)$.

Linear Algebra

Calculate the product of matrix A and B:

$$\begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & 5 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 2 & 5 \\ 6 & 2 \end{bmatrix}$$

Probability

What is a sample space of casting two dice consecutively?

8. SHORT BIO OF THE INSTRUCTOR

Tibor Voros has over 20 years experience in both academic and corporate environments. He is an enthusiastic and curious individual, who has explored areas ranging from medical approaches and robotics to corporate financial processes. Tibor's work is mostly related to information systems (e.g. rational decision making, business intelligence, business analytics) and quantitative areas. He also researched these topics and evaluated corresponding frameworks from the theoretical point of view. Tibor Vörös holds an MSc in Maths, Physics and Information Technology and he is a Harvard Executive Education graduate. He worked at the Central European University as a Senior Lecturer for several years. Tibor has spent considerable time on complex finance-driven business simulations and created unique storyboards to help participants experience real life problems in classroom situations. CEEMAN has selected Mr Vörös as the winner of the Innovation in Course Design category for the CEEMAN Champions' Award 2010. Current research work concentrates on the relationship of organizational culture and information technology. Tibor also took part in various industry campaigns, including the Microsoft Business Productivity Infrastructure Optimization campaign or the Cloud Business Transformation approach.