Syllabus

Mathematics and Informatics Pre-session for Business Analytics

- **Instructor:** Olivér Kiss (kiss_oliver@phd.ceu.edu, Office hours: before each class between 2pm and 3pm at N13 519)

- **Credits:** 0 (0 ECTS)

- **Term:** Fall 2017-2018

- **Course level:** MA/MSc

- **Prerequisites:** None

- **Course drop:** Course can be dropped free of charge 24 hours after the first session. After this date drop is possible until the course is halfway over (late drop fee applies). No changes are allowed past that date.

Course description

This course provides an overview of basic concepts of mathematics and informatics required to complete subsequent courses.

Learning outcomes

Upon the completion of the course students will be familiar with the basics of linear algebra, calculus and probability theory. They will also accumulate knowledge on general concepts of informatics, on collaboration tools and version control, on programming languages and on data structures and storing data.

Reading list

- Knut Sydsaeter and Peter J. Hammond **[SYD]** - Mathematics for Economic Analysis
- Dirk P. Kroese **[KROESE]** - A Short Introduction to Probability (available here)
- Michael Freeman and Joel Ross **[FR]** - Technical Foundations of Informatics (available here)
- Scott Chacon and Ben Straub **[CH]** - Pro Git (available here)
- W3C on encoding **[W3C]** (available here)
- GitHub Learning Path **[GITHUB]** (available here)

Assessment (including minimum pass requirement)

- One informatics assignment (must be completed perfectly to pass)
- One mathematics problem set (must complete 20 out of 30 problems correctly to pass)

Technical/laptop requirement

Having laptops on the informatics sessions is highly advised.

Course schedule and materials for each session

1. Elementary algebra **[SYD Appendix A]**: Powers, square roots, rules of algebra (commutativity, distributivity, associativity), factors, fractions, simple equations, inequalities, quadratic equations.
2. 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.
3. 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, 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, multivariate optimization, constrained optimization (lagrangian), infinite sequences, series. (Also good to know: chain rule, L'Hopital's rule)
4. 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. (Also good to know: Gauss elimination, rank and the number of solutions)
5. Probability theory **[KROESE 1, 2, 3]**: Sample space, events, probability, conditional probability, independence, Bayes' rule, law of total probability, random variables, probability distributions (Bernoulli, binomial, uniform, normal, lognormal, power-law, exponential), expected value.
6. Informatics. Operating systems, file systems, relative and absolute paths, basic command line operations, managing data, CEU VPN network, encryption **[FR 1, 2, 3]**
7. Informatics. Collaboration tools and version control (Git, Github, Slack), introduction to programming (types of languages, advantages, limitations) **[FR 4, 14, 15, CH 1, 2, GITHUB]**
8. Informatics. Working with data: Types of data, storing data, text encoding **[W3C]**

Short bio of the instructor (1 para)

I've been a research assistant at CEU MicroData for 3 years now. I mostly work on data engineering projects that aim to design and deliver reliable pipelines for large-scale datasets. I am also a third-year Economics PhD student at the Department of Economics and Business.