

**COURSE: STATISTICS****Lecturer: Patrick Gaule****E-mail: patrickgaule@gmail.com****Office: 310****Phone: 224 005 191****Teaching assistants: Iryna Hramyak and Veronika Vrana****Office hours: Monday 3:00pm -4:30pm**

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**Course information**

*This course is the first course in the econometrics PhD sequence. The emphasis of this course is on the principles of probability theory and statistics inference with the goal of forming a solid background for econometrics analysis. No prior knowledge of probability or statistics is required. However, the course will proceed at a fast pace and students without strong prior training are advised to work very regularly to avoid falling back on the material.*

**Course outline**

- *Introduction to probability theory, set concepts and operations, probability set functions, counting rules, conditional probability and independence, Bayes' rule*
- *Random variables, cumulative density functions, probability density functions*
- *Expectations of random variables, moments and moment generating functions*
- *Uniform distribution, Binomial distribution, Poisson distribution, Normal distribution*
- *Systems of random variables, random vectors, joint cumulative density function, joint probability density functions, marginal probability density functions, expectations transformation of variables, conditional distributions, independence, covariance and correlation*
- *Introduction to asymptotic theory, convergence in probability and distribution, law of large numbers, central limit theorem*
- *Bivariate normal distribution, t distribution, chi-squared distribution, F distribution*
- *Introduction to inferential statistics, random sampling, unbiasedness and consistency, confidence intervals, mean square error*
- *Methods of moments*
- *Maximum likelihood estimation*
- *Maximum likelihood tests: likelihood ratio, Wald and Score tests*
- *Most powerful tests and the Neyman-Pearson lemma*
- *(time permitting) Ordinary Least Square estimation*

**Requirements and grading**

*Problem Sets and Written Assignments (10%), Midterm Exam (40%), Final Exam (50%).*

*The following grading scale will be used: 94% of points or more=A+, 88-94%=A, 83-88%=A-, 77-83% B+, 72-77%=B, 66-72%=B-, 61-66%= C+, 55-61%=C, 50-55% C-, less than 50%=F*

**Readings**

- Hogg, R.V., McKean J. and A. T. Craig (2012). *Introduction to Mathematical Statistics*, Prentice Hall, 7<sup>th</sup> edition.
- Casella, G., and R.L.Berger (2002). *Statistical Inference*, Duxbury Press, Belmont, CA, 2<sup>nd</sup> edition.