

		The 4 th IPSA – HSE Summer School for Methods of Political & Social Research Course Syllabus
Course title:	Bayesian Statistics	
Instructor:	Boris Sokolov (Laboratory for Comparative Social Research, Higher School of Economics)	
ECTS / academic hours	2 ECTS / 76 academic hours: 38 contact hours, 38 self – study hours	
Brief course description (up to 100 words):	<p>Bayesian data analysis is a rapidly developing field of statistics, which has many useful applications in various areas of political science, sociology, and international relations. The goal of this course is to provide a brief and “mostly harmless” (that is, as informal as possible) introduction to the theory and application of Bayesian statistical methods. The course begins with the basic concepts of Bayesian statistics (e.g., conditional probability, Bayes’ theorem, prior and posterior distribution). Then we consider various approaches to the estimation and assessment of Bayesian models (with the focus on MCMC methods) in the context of generalized linear models. Next we learn about main Bayesian approaches to model selection, including Bayes factors, DIC, and cross-validation methods. We conclude by discussing Bayesian model averaging (BMA), a powerful Bayesian approach to reducing model specification uncertainty.</p> <p>Students are assumed to have basic knowledge of statistics and be familiar with several conventional statistical methods, most importantly regression analysis. Knowledge of advanced topics, such as multilevel regression analysis and maximum-likelihood estimation, is helpful, but not critical. In addition, for practical exercises we will use R programming environment, so another major prerequisite is basic knowledge of R.</p>	
Indicative concepts (up to 10):	Bayes’ theorem; priors; likelihood; posterior distribution; MCMC estimation; posterior predictive checks; Bayes factors; WAIC; LOOIC; Bayesian model averaging.	
Workshops overview:	Day 1	The fundamentals of Bayesian statistics. R packages for Bayesian modeling. Bayesian GLMs.
	Day 2	Bayesian model estimation. Markov chain Monte Carlo methods. Key convergence diagnostics.
	Day 3	Bayesian model evaluation. Posterior predictive checks.
	Day 4	Bayesian model comparison and model averaging
	Day 5	Preparation and presentation of research projects
Assessment techniques to receive graded certificate:	In order to receive ECTS points in this course, participants need to conduct a small study in which they apply Bayesian methods to a substantive problem of interest to them. The expected outcome is a PowerPoint/LaTeX presentation that describes in details the study’s theoretical background, the Bayesian statistical model and estimation and model assessment methods used, and the substantive interpretation of key results.	
Essential readings:	<ul style="list-style-type: none"> - Gelman, A., Carlin, J. B., Stern, H. S., Dunson, D. B., Vehtari, A., & Rubin, D. B. (2013). Bayesian Data Analysis. 3rd Edition. CRC Press. - John Kruschke (2015) Doing Bayesian Data Analysis, Second Edition. Academic Press / Elsevier. ISBN: 9780124058880 	
Contacts:	Boris Sokolov, bssokolov@gmail.com	