SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Master**
1.6 Study programme / Qualification	**Applied Computational Intelligence**

2. Information regarding the discipline

2.1 Name of the discipline	**Statistical Computational Methods**						
2.2 Course coordinator	**Assoc.Prof.PhD. Hannelore Lisei**						
2.3 Seminar coordinator	**Assoc.Prof.PhD. Hannelore Lisei**						
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar/laboratory	14

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	56
Additional documentation (in libraries, on electronic platforms, field documentation)	35
Preparation for seminars/labs, homework, papers, portfolios and essays	30
Tutorship	14
Evaluations	8
Other activities:	15

3.7 Total individual study hours	158
3.8 Total hours per semester	200
3.9 Number of ECTS credits	8

4. Prerequisites (if necessary)

4.1. curriculum	• Probability Theory, Statistics
4.2. competencies	• Average programming skills

5. Conditions (if necessary)

5.1. for the course	• Laptop, beamer
5.2. for the seminar /lab	• Laboratory with computers

activities	

6. Specific competencies acquired

Professional competencies	C 4.3 Identifying the models and adequate methods for solving real problems C 4.4 Using simulations for studying the elaborated models and evaluating their performance
Transversal competencies	CT1 CT3

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• To acquire basic knowledge of the applications of probability theory and mathematical statistics into computational intelligence • To be able to work with various probabilistic and statistical models in Matlab • To be able to perform statistical analysis of data
7.2 Specific objective of the discipline	• Application of Monte Carlo methods • Generation of random numbers • Simulation stochastic processes

8. Content

8.1 Course	Teaching methods	Remarks
1. Review of the basic notions of probability theory (random variables, mean variance, common distributions)	Lecture, description, explanation	
2. Review of the basic notions of statistics (sampling concepts, parameter estimation)	Lecture, description, explanation	
3. Generating random variables (general techniques)	Lecture, description, explanation, synthesis	
4. Generating discrete and continuous random variables	Lecture, description, explanation	
5. Exploratory data analysis	Lecture, description, explanation	
6. Classical inferential statistics (hypothesis testing, confidence intervals)	Lecture, description, explanation	
7. Monte Carlo methods for inferential statistics	Lecture, description, explanation	
8. Regression methods	Lecture, description, explanation	
9. Markov chains (1)	Lecture, description, explanation	
10. Markov chains (2)	Lecture, description, explanation	
11. Monte Carlo methods	Lecture, description,	

	explanation	
12. Simulation of stochastic processes	Lecture, description, explanation, modelling	
13. Random walks and Wiener processes	Lecture, description, explanation, modelling	
14. Poisson processes	Lecture, description, explanation, modelling	

Bibliography

- S. Asmussen, P.W. Glynn, Stochastic Simulation - Algorithms and Analysis, Springer Verlag, 2007
- J. Gentle, Random Number Generation and Monte Carlo Methods, Springer Verlag, 2003
- J.S. Liu, Monte Carlo Strategies in Scientific Computing, Springer, 2001
- B.V. Gnedenko, The theory of probability and the elements of statistics, AMS Chelsea Publishing, Providence, RI, 2005
- P.S. Mann, Introductory statistics, Hoboken, NJ: John Wiley & Sons, 2007
- W. L. Martinez, A. R. Martinez, Computational Statistics Handbook with MATLAB, Chapman Hall/CRC, 2007
- C. Robert, G. Casella, Monte Carlo Statistical Methods, Springer Verlag, 2004
- S.M. Ross, Simulation, Academic Press, 2002
- N.C. Roşca, Monte Carlo and Quasi-Monte Carlo methods with applications, Presa Univ. Clujeană, 2009

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Matlab Codes - applications to probability theory (Review)	Presentation, individual work	The seminar is structured as 2 hours classes every second week
2. Matlab Codes - applications to statistics	Presentation, individual work	
3. Generating random variables	Presentation, individual work,	
4. Markov chains - examples	Discussion, group-based work	
5. Monte Carlo methods	Discussion, group-based work, modelling	
6. Simulation of stochastic processes (modelling)	Presentation, individual work,	
7. Presentation of the individual projects	Presentation	

Bibliography

- P. Blaga, Statistică prin Matlab, Presa Univ. Clujeană, 2002
- G.H. Givens, J. A. Hoeting, Computational Statistics, Wiley Series in Probability and Statistics, 2005
- G.R. Grimmett G.R., D.R. Stirzaker, Probability and Random Processes, Oxford University Press, 2001
- W. L. Martinez, A. Martinez, J. Solka, Exploratory Data Analysis with MATLAB, Chapman & Hall/CRC, 2010

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course contains applications of probability theory and statistics into computational intelligence.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Knowledge of main concepts presented in the course	Written exam	70%
10.5 Seminar/lab activities	To be able to implement in Matlab course concepts and algorithms	-Practical examination -presentation -continuous observations	30%
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10) at both written exam and laboratory work. The student should be able to simulate random numbers/processes by using Matlab.			

Date	Signature of course coordinator	Signature of seminar coordinator
25.04.2014	Assoc.Prof.PhD. Hannelore Inge Lisei	Assoc.Prof.PhD Hannelore Inge Lisei

Date of approval ..... Signature of the head of department .....….....