



## COURSE DESCRIPTION

### 1. Program Information

1.1 University	“Alexandru Ioan Cuza” University, Iași
1.2 Faculty	Computer Science Department
1.3 Department	Computer Science
1.4 Study Domain	Computer Science
1.5 Study Cycle	Undergraduate
1.6 Study Program / Qualification	Computer Science

### 2. Course Information

2.1 Course Name	Probabilities and Statistics						
2.2 Course Teacher	Lect. Dr. Olariu Emanuel Florentin/Conf. Dr. Zălinescu Adrian						
2.3 Seminary Teacher	Lect. Dr. Olariu Emanuel Florentin/Conf. Dr. Zălinescu Adrian						
2.4 Study Year		2.5 Semester		2.6 Evaluation		2.7 Course Status*	OB

\* OB – Compulsory / OP – Optional

### 3. Total estimated hours (hours per semester and didactic activities)

3.1 Hours per week	4	in which: 3.2 course	2	3.3 seminary/laboratory	2
3.4 Hours in curriculum	56	in which: 3.5 course	28	3.6 seminary/laboratory	28
Time Distribution					hours
Manual study, Course support, Bibliography, and others					30
Supplementary Documentation in library, in electronic forums, and on the field					10
Seminaries/laboratories preparation, homeworks, reports, portfolios and essays					50
Tutoring					-
Evaluation					4
Other activities (consultations per student)					-
3.7 Total hours individual study					90
3.8 Total hours per semester					150
3.9 Credits					6

### 4. Preconditions (if necessary)

4.1 Of Curriculum	Mathematics
4.2 Of Skills	Manipulate abstract mathematical concepts

### 5. Conditions (if necessary)

5.1 For Course Operation	-
5.2 For Seminary/Laboratory Operation	Laboratories are mandatory.



## 6. Specific Skills Acquired

<b>Professional Skills</b>	<p><b>C1.</b> The understanding and the use of specific concepts related to discrete probability theory and inferential statistics.</p> <p><b>C2.</b> The correct interpretation of basic concepts like random experiment, random event, probability function, and random sample, sample mean, frequencies, histograms.</p> <p><b>C3.</b> The use of elementary notions for understanding the more complex concepts (random variable, joint repartition, stochastic processes, inequalities involving random variables, random algorithms, central limit theorem (CLT), law of large numbers (LLN), confidence interval, significance tests etc).</p> <p><b>C4.</b> The capacity of manipulating concepts from both, probability theory and applied statistics.</p> <p><b>C5.</b> The understanding of usual applications of probability and statistics.</p>
<b>Transversal Skills</b>	<p><b>CT1.</b> The development of efficient individual study skills and of personal responsibility towards the teaching institution (university).</p> <p><b>CT2.</b> The capacity of understanding the utility of the interdisciplinary connections.</p> <p><b>CT3.</b> The creative crossover between theory and practice.</p>

## 7. Course Objectives (from the grid of specific skills acquired)

<b>7.1 General Objectives</b>	<p>The taming of elementary and medium-advanced concepts from probability theory and descriptive/inferential statistics.</p>
<b>7.2 Specific Objectives</b>	<p>At the end of this course, the students will be able to:</p> <ul style="list-style-type: none"> <li>▪ Explain basic notions like: random event, probability function, random variable, random sample expectation, variance etc.</li> <li>▪ Describe more complex notions like: stochastic process, random algorithms, CLT, LLN, statistical inference etc.</li> <li>▪ Use and inter-connect the above concepts.</li> <li>▪ Analyze and discriminate between the different types of repartitions for significance tests.</li> <li>▪ Calculate (using probabilistic formulas/schemes) various probabilities and discrete random variable characteristics, and use R for various statistical inferences.</li> </ul>

## 8. General Description

<b>8.1</b>	<b>Lectures</b>	<b>Teaching Methods</b>	<b>Observations</b> (hours and bibliographic references)
1.	Random experiment, random event, probability function.	Exposition	2, [1], [4], [8]
2.	Conditional probability, independence. Probabilistic formulas.	Exposition	2, [1], [4], [8]
3.	Probabilistic schemas. Random variable.	Exposition	2, [1], [4], [8]
4.	Random variables characteristics. Noteworthy discrete repartitions. Joint discrete distributions.	Exposition	2, [1], [4], [8]
5.	Covariance, independent variables. Markov and Chebyshev inequalities.	Exposition	2, [1], [4], [8]



6.	Stochastic processes. Markov chains. Random walks	Exposition	2, [1]
7.	Random algorithms. Probabilistic method.	Exposition	2, [1], [3], [6], [10]
8.			
9.	Descriptive statistics. Central tendency, variability, histograms.	Exposition	2, [2], [6]
10.	Continuous random variables. The fundamental laws. Computer simulation.	Exposition	2, [1], [5]
11.	Computer simulation. Monte Carlo methods.	Exposition	2, [1], [5]
12.	Confidence intervals. Significance tests. Inference on proportions.	Exposition	2, [2], [9]
13.	Significance tests. Inference on one and two populations.	Exposition	2, [2], [9]
14.	Linear correlation and regression.	Exposition	2, [2], [9]

### Bibliography

#### Main references:

- [1] Bertsekas, D. P., J. N. Tsitsiklis, Introduction to Probability, Athena Scientific, 2002.  
 [2] Freedman D., Pisani R., Purves R., Statistics, W.W.Norton&Company, 4th edition, 2007.  
 [3] Motwani, R., P. Raghavan: Randomized Algorithms, Cambridge University Press, 2005.  
 [4] Ross, S. M., A First Course in Probability, Prentice Hall, 5th edition, 1998.  
 [5] Baron, M.: Probability and Statistics for Computer Science, Chapman&Hall/CRC Press, 2013.

#### Supplementary references:

- [6] Alon, N., J. H. Spencer, The probabilistic method, Wiley, 2008  
 [7] P. Dalgaard, Introductory Statistics with R, Springer Verlag, 2nd edition, 2008.  
 [8] Gordon, H., Discrete Probability, Springer Verlag, New York, 1997.  
 [9] Johnson, R.: Elementary Statistics, PWS Publishers - Duxbury Press, Boston, 1991  
 [10] Mitzenmacher, M., E. Upfal: Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University Press, 1995.

8.2	Seminary / Laboratory	Teaching methods	Observations (hours and bibliographic references)
1.	Random experiment, random events, probability function (axioms, properties).	Course memento, exercise examples and exercises solving.	2, [4], [8]
2.	Conditional probability. Independence. Probabilistic formulas.	idem	2, [4], [8]
3.	Probabilistic schemas (hypergeometric, binomial, geometric). Random variables.	idem	2, [4], [8]
4.	Random variables parameters (expectation, variance) Discrete repartitions (uniform, Bernoulli, binomial, geometric, Poisson).	idem	2, [1], [4], [8]
5.	Joint repartitions – covariance, correlation. Markov and Chebyshev inequalities.	idem	2, [1], [4], [8]



6.	Markov chains, Chapman-Kolmogorov equation, steady state theorem.	idem	2, [1]
7.	R introduction.	idem	2, [7]
8.			2
9.	Descriptive statistics	Course memento, laboratory woks examples and individual works.	2, [2], [7]
10.	Randomized algorithms.	idem	2, [3], [7]
11.	Computer simulation. Monte Carlo methods	idem	2, [5], [7]
12.	Inferential statistics. Confidence intervals. Proportion test.	idem	2, [2], [7]
13.	Inferential statistics. Z test, t test.	idem	2, [2], [7]
14.	Laboratory evaluation	idem	2

### 9. Course content synchronization with the expectations of the community representatives, professional associations and employers from the program domain

This course aims to accommodate the undergraduate students with the modern framework of discrete probability and applied statistics. The course acquisitions will be used throughout the undergraduate studies and beyond.

### 10. Evaluation

Activity Type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 The weight of each evaluation form (%)
10.4 Course			
10.5 Seminary/ Laboratory	The correct handling of notions and results from Probability Theory and Statistics. The capacity of modelling using the appropriate concepts.	Written tests from seminar and works from laboratory.	100.00%
10.6 Minimal performance standards: to understand and to use the abstrac concepts of Probabilities Theory and Inferential Statistics.			
Promotion starts from 5. There is no arrears and enhancements session.			

Date  
30.09.2023

Course Teacher  
Lect. Dr. Olariu Emanuel Florentin  
Conf. Dr. Zalinescu Adrian

Seminary/Laboratory Teacher  
Lect. Dr. Olariu Emanuel Florentin  
Conf. Dr. Zalinescu Adrian  
Asist. C. Dr. Curca Eduard  
Asist. C. Simionescu Cristian



Department Date of Approval

Director of the Department  
Prof. Dorel Lucanu, PhD