COURSE PROGRAMME

1. Information about the programme

1.1 University	**University "Alexandru Ioan Cuza" of Iasi**
1.2 Faculty	**Faculty of Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Domain	**Computer Science**
1.5 Cycle	**Licence**
1.6 Programme / Qualification	**Computer Science (in English)**

2. Information about the course

2.1 Course Name	Probabilities and Statistics
2.2 Course taught by	Lecturer PhD. EMANUEL FLORENTIN OLARIU
2.3 Seminary / laboratory taught by	Assoc. Prof. PhD. ADRIAN ZALINESCU/ Lecturer PhD. EMANUEL FLORENTIN OLARIU

2.4 Year I **2.5** Semester II **2.6** Type of evaluation* V **2.7** Course type** Ob

E – Exam / C – Colloquium / V – Verification

***OB – Obligatory / OP – Optionally / F – Facultative*

3. Total hours (estimated per semester and activities)

3.1 Number of hours per week	4	**3.2** course	2	**3.3** seminary/laboratory	2
3.4 Total number of hours	56	**3.5** course	28	**3.6** seminary/laboratory	28

Distribution	hours
Individual study using textbooks, course notes, bibliography items, etc.	35
Supplimentary study (library, on-line platforms, etc.)	10
Individual study for seminary/laboratory, homeworks, projects, etc.	20
Tutoring	0
Examination	4
Other activities	0

3.7 Total hours of individual activity*	69
3.8 Total hours per semester	125
3.9 Credit points	5

4. Pre-requisites - Curriculum (if necessary)

Mathematical analysis.

5. Conditions (if necessary)

5.1 Course

5.2 Seminary / Laboratory

6. Objectives

Taming of elementary and medium-advanced concepts from probability theory and descriptive/inferential statistics.

7. Specific competencies/Learning outcomes

- Studentul/absolventul alege, explică şi specifică fundamentele matematice aplicate în informatică, inclusiv logica formală, algebra, probabilităţile şi statisticile.
- Studentul/absolventul aplică, evaluează, propune metodele matematice pentru modelarea, simularea şi rezolvarea problemelor informatice.
- Studentul/absolventul dezvoltă soluţii interdisciplinare prin integrarea matematicii cu domenii conexe şi colaborarea eficientă cu echipe de specialitate.

8. Contents

8.1 Course	**Teaching methods**	**Remarks** (number oh hours, references)
Random experiment, random event, probability function.	Exposition.	2, [1], [4], [8]
Conditional probability, independence. Probabilistic formulas.	Exposition.	2, [1], [4], [8]
Probabilistic formulas. Probabilistic schemes.	Exposition.	2, [1], [4], [8]
Random variable. Characteristics. Remarkable discrete distributions.	Exposition.	2, [1], [4], [8]
Other discrete distributions. Joint discrete distributions. Independet random variables.	Exposition.	2, [1], [4], [8]
Random variables inequalities. Continuous random variables. Fundamental laws.	Exposition.	2, [1], [4], [8]
Fundamental laws. Computer simulation, Applications.	Exposition.	2, [4], [5], [9]
Computer simulation. Monte Carlo methods.	Exposition.	2, [1], [5]
Random algorithms. Probabilistic method.	Exposition.	2, [1], [3], [6], [10]
Descriptive statistics. Central tendency, variability, histograms.	Exposition.	2, [2],[9]
Inferential statistics. Confidence intervals. Significance tests. Inference on proportions.	Exposition.	2, [2],[9]
Inferential statistics. Z, T, Chi-square, and F tests.	Exposition.	2, [2],[9]
Inferential statistics. Corelation and regression. Randomness tests.	Exposition.	2, [2],[9]

Bibliography

[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.

[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**	**Remarks** (number oh hours, references)
Random experiment, random events, probability function: axioms and properties.	Course memento, exercice examples and exercices solving.	2, [4], [8]
Computing conditional probability. Independent events. Total probability formula. Bayes formula.	Course memento, exercice examples and exercices solving.	2, [4], [8]
Total probability formula - conditional variant. Multiplication formula. Probabilistic schemes (hypergeometric, binomial, geometric).	Course memento, exercice examples and exercices solving.	2, [4], [8]
Random variables (distribution, expectation, variance) Remarkable discrete distributions (uniform, Bernoulli, binomial, geometric, Poisson).	Course memento, exercice examples and exercices solving.	2, [1], [4], [8]
Other remarkable discrete distributions (negative binomial, hypergeometric, Zipf). Joint distributions. Covariance. Random variables independence.	Course memento, exercice examples and exercices solving.	2, [1], [4], [8]
Markov, Chebyshev, and Chernoff inequalities. Continuous random variables. Distribution and density functions.	Course memento, exercice examples and exercices solving.	2, [1], [4]
Computer simulation. Applications to the Central Limit Theorem and the Law of Large Numbers.	Course memento, exercice examples and exercices solving.	2, [5], [7]
Monte Carlo methods: expectation estimation, length, area, and volume estimation, MC integration, and probability estimation.	Course memento, exercice examples and exercices solving.	2, [5], [7]
Las Vegas and Monte Carlo algorithms.	Course memento, exercice examples and exercices solving.	2, [3], [7], [10]
Descriptive statistics: graphical representations, central tendency measures, variability and outliers.	Course memento, exercice examples and exercices solving.	2, [2], [7]
Inferential statistics. Confidence intervals. Proportion test.	Course memento, exercice examples and exercices solving.	2, [2], [7]
Inferential statistics: Z, T, Chi-square, and F tests.	Course memento, exercice examples and exercices solving.	2, [2], [7]
Laboratory evaluation.	Evaluation.	

Bibliography

[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.
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[10] Mitzenmacher, M., E. Upfal: Probability and Computing: Randomized Algorithms and Probabilistic Analysis, Cambridge University Press, 1995.

9. Coordination of the contents with the expectations of the community representatives, professional associations and relevant employers in the corresponding 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. Assessment and examination

10.1 Continuous assessment — Percentage (min. 30%): 100

Course	Assessment type			
	Percentage			0
	Failure to pass the continuous assessment results in failure to pass the final assessment			
	Assessment methods			
	Details	Percentage	with reexamination	
Seminary / Laboratory	Assessment type			Mixed assessment
	Percentage			100
	Failure to pass the continuous assessment results in failure to pass the final assessment			Yes
	Assessment methods			
	Details	Percentage	with reexamination	
	Theoretical Test	50	No	
	Lab assignment	17	No	
	Test	17	No	
	Continuous practical assessment	16	No	

10.2 Special notes (special situations is assessment)

10.3 Minimum performance standard

Correctly manipulate Probability Theory and Statistics related concepts and results. The ability to model problems using corresponding specific concepts.

Date, Course coordinator, Lecturer PhD. EMANUEL

Seminary coordinator, Assoc. Prof. PhD. ADRIAN ZALINESCU/ Lecturer PhD.

FLORENTIN OLARIU EMANUEL FLORENTIN OLARIU

Aproval date in the department, Head of the departament,
Assoc. Prof. PhD. ANDREI ARUSOAIE