

Probability and Statistics

Course Administrative Details

Course Title	Probability and Statistics		
Instructor(s)	Nikolay Shilov	Instructor's e-mail	n.shilov@innopolis.ru
Course #	BS-1, BS-2	Course Type	Elective
Faculty	Computer Science and Engineering	Major	Computer science
Academic year	2016-2017	Semester Offered	Spring
No. of Credits	6 ECTS	Total workload on average	6 hrs. per week inc. 2 hrs. of self-study
Lecture Hours	2 per week	Lab Hours	2 per week
Language	English	Frequency	Weekly
Target Audience	Bachelors	Anticipated Enrollment	30 students
Studying year	1(BS-1), 2(BS-2)		
Grading Mode	A, B, C, D	Keywords	Probability and sample (probability) spaces; discrete and continuous distribution; mean and variance; central limit theorem, law of large numbers; Markov processes and chains; linear regression and correlation; test statistics χ^2 and Student's test; information and entropy.

Course outline

The course is designed to provide Software Engineers and Computer Scientists by correct knowledge of basic (core) concepts, definitions, theoretical results and applied methods & techniques of Probability Theory and Mathematical Statistics. All definitions and theorem statements (that will be given in lectures and that are needed to explain the key-words listed above) will be formal, but just few of these theorems will be proved formally. Instead (in lab or problem-solving classes) we will try these definitions and theorems on work with routine exercises and fun problems. For this we will use a very popular textbook "Probability and Statistics for Engineers and Scientists" by Ronald E. Walpole et al. (790 pages!) altogether with popular science book like "The Drunkard's Walk: How Randomness Rules Our Lives" by Leonard Mlodinow (just 250 pages).

Course Delivery

The course will be given 1 lecture + 1 Lab per week from January to April 2016. Every lecture and lab will be 2-hours class. There will be couple (2-3) short tests (0.5 hour each in course hours), a mid-term exam (in course hours) and a final examination. All tests and examinations will be open-book.

Prerequisite courses

The course does not assume any prerequisites but pre-Calculus or Calculus-I will be an advantage.

Required background knowledge

Enrolled students should be able to implement elementary standard algebraic manipulations, series summation, find sequence and function limits, have very basic differentiation and integration skills.

Course structure

Week# / Date	Topic	Assignments
Week 1	Introduction to Statistics and Data Analysis	Exercises for chapter 1 from the textbook.
Week 2	Probability and probability spaces	Exercises for chapter 2 from the textbook.
Week 3	Discrete probabilityMade Easy	Exercises for chapter 3 from the textbook. In-class short test I.
Week 4	Random Variables and Probability Distributions	Exercises for chapter 3 from the textbook.
Week 5	Mathematical Expectation	Exercises for chapter 4 from the textbook.
Week 6	Selected Discrete Probability Distributions	Exercises for chapter 5 from the textbook.
Week 7	Selected Continous Probability Distributions	Exercises for chapter 6 from the textbook.
Week 8	Mid-term Examination	
Week 9	Law of Large Numbers and Central Limit Theorem	Exercises for chapter 8 from the textbook.
Week 10	Test Statistics-I	Exercises for chapter 10 from the textbook.
Week 11	Test Statistics-II	Exercises for chapter 10 from the textbook. In-class short test II.
Week 12	Linear Regression and Correlation-I	Exercises for chapter 11 from the textbook.
Week 13	Linear Regression and Correlation-I	Exercises for chapter 11 from the textbook.
Week 14	Elements of Markov Processes and Bayesian Statistics	Exercises for chapter 18 from the textbook.
Week 15	Elements of Information Theory	Exercises from Internet resources.
Week 16	Class Summary	In-class short test III (optional).

Textbook

Probability and Statistics for Engineers and Scientists (8th or 9th Edition) by Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying E. Ye. Prentice Hall, 2012 (8th edition).

Reference Materials

The Drunkard's Walk: How Randomness Rules Our Lives by Leonard Mlodinow. Toronto: Vintage Books, 2009.

Computer Resources

Any electronic spreadsheet (Excel for example) that provides data sorting and graph & chart drawing.

Laboratory Exercises

Lab classes will be exercises and problem-solving sessions with instructor introduction, guidance and assistance. They will follow lectures and address exercises and problems according the lecture topic at the same week.

Laboratory Resources

Any electronic spreadsheet (Excel for example) that provides data sorting and graph & chart drawing.

Grading criteria

- *In-class participation 1 point for each individual contribution in the lab class but not more than 10 points in total,*
- *in-class tests up to 15 points (for each test),*
- *mid-term exam up to 40 points,*
- *final examination up to 50 points.*

Final grade scale:

- *A: 100..130 points;*
- *B: 80..99 points;*
- *C: 65..79 points;*
- *D: less than 65 points.*

Late Submission Policy

There will be no assignments, but couple (2-3) in-class short tests (30 minutes each) and mid-term examination. Students who did not take a test or mid-term without legal excuse (e.g., documented medical) may try one (just one) test or exam not later than in one week with 30% deduction from the grade for this deliverable.

Cooperation Policy and Quotations

- *We encourage vigorous discussion and cooperation in this class. Especially we encourage in-class participation that may consists in detecting mistakes and errors in lectures, course materials, in individual contributions to exercise and problem solving by students. A contribution must be in public and may be awarded (also in public) by instructor by 1 point, but the total individual value should not exceed 10 points during the semester time.*
- *All tests and examinations will be open-book, i.e. it will be very legal to use any multimedia resource during run of a test or exam, but it should not disturb/involve other people. Cheating will be considered as a very bad practice and in case of a doubt all involved students should explain individually problematic solution of an exercise or a problem to th instructor.*
- *Any question related to course topics may be addressed to instructors in semester time during weekly office hours. The time of the office hours will be advertised and fixed during the first 2 weeks of the semester, but they should be at least 2 hours per week.*