

PROBABILITY and STATISTICS, MTH 2401, Aug 19, 2019 to Dec 11, Fall of **2019**

Instructor: *Eugene* (aka *Jewgeni*) *Dshalalow*, Dr. rer. nat., Professor of Mathematical Sciences

Meets MWF from 4:00 to 4:50 pm at Skurla 110

Observed days: (1) Mon, Oct 14 (*Columbus Day*), (2) Mon-Tu, Oct 14-15 (*Fall Break*), (3) Mon, Nov 11 (*Veterans Day*), (4) Wed, Nov 27 to Fri, Nov 29 (*Thanksgiving*).

Main academic events: (1) Wed noon, Aug 28, last day to drop a class with the full tuition refund and without receiving a grade of W; (2) Fri, Oct 25, last day to withdraw from a class with a final grade of W; (3) Fri, Dec 6, last day of classes; (4) Final Exam, Wed, Dec 11, from 8:00 to 10:00 am

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<https://www.fit.edu/faculty-profiles/3/jewgeni-dshalalow/>

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PRIMARY TEXT: **LECTURE NOTES** (provided free in the PDF format), by *Eugene Dshalalow*

OTHER SUGGESTED BOOKS:

R For Statistics, by P-A. Cornillon et al., CRC Press 2012

Essentials of MATHEMATICAL STATISTICS, by B. Albright, Jones & Bartlett Learning, 2014

<http://www.coursesmart.com/9781284031775>

Introduction to Scientific Programming & Simulation Using R, by O. Jones et al., CRC Press, 2014

R for Everyone, by J. Lander, Addison Wesley/Pearson, 2014.

Course Information. This course presents an introduction to probability theory, statistics and reliability theory. The course is based on instructor's lecture notes that are self-contained and complete. However, some students may choose to consult any of the above books to complement and support the lecture notes. Please note that we will use R in the context of statistical computing which is integrated in the course material. The program is available for a free download from the site <http://cran.at.r-project.org/> where you can also get any extra support and additional packages.

TOPICS

FOUNDATIONS OF PROBABILISTIC MODELING: 1. The Probability Space, 2. Combinatorial Probability, 3. Conditional Probability and Bayes Formula, 4. Independent Events.

DISCRETE RANDOM VARIABLES. 1. Moments. 2. Calculation of the Expectation and Variance, 3. Moment Generating Functions.

MIDTERM TEST I

CONTINUOUS DISTRIBUTIONS: 1. Probability Distribution Function (PDF), 2. Continuous Random Variables, 3. Exponential Random Variable Revisited. Gamma Random Variable, 4. Gaussian Random Variable. 5. Jointly Distributed Random Variables, 6. Marginal PDF's and Marginal Densities, 7. Independent Random Variables, 8. Sums of Independent Random Variables, 9. Correlation.

MIDTERM TEST II

RELIABILITY ANALYSIS. 1. Reliability Measures. 2. Reliability Measures of Special Distributions (Exponential, Weibull, Rayleigh). 3. Reliability of k -out-of- n Systems.

POINT AND INTERVAL ESTIMATION: 1. Point Estimation. Maximum Likelihood Estimators. Estimation of

Reliability Parameters. 2. The Central Limit Theorem, 3. Confidence Intervals, 4. Approximate Confidence Intervals and other Ramifications of the Central Limit Theorem, 5. The Difference in Means of Gaussian Populations.

MIDTERM TEST III

BAYES ANALYSIS. 1. Conditional distributions and densities. Conjugate Priors. 2. Bayes estimators.

NONPARAMETRIC METHODS: 1. Goodness-of-Fit -Test. 2. Testing Independence in Contingency Tables.

SIMPLE LINEAR REGRESSION (if time permits).

FINAL EXAM

Grading Policy. The overall score will be computed using 15% of each midterm test (a total of 45%), 20% for homework/projects, and 35% of the final exam. The final course grade will be based on the following grading table:

90-100% **A**

67-79.99% **C**

80-89.99% **B**

56-66.99% **D**

However, you still need to earn at least **85% in the final exam** to qualify for an A grade, even if your overall score is 90% or higher. Furthermore, to pass the course you need to score at least **50% in the final exam**.

You are strongly encouraged to attend **all classes**. You are responsible for the lecture materials and assignments. I will also discuss various problems, pertinent to those in the exams.

All examinations will be **closed book and closed notes**. The use of a **smart calculator** (like *N-Spire* by TI) or a **mobile phone** during the exams is strictly **prohibited**, because these devices are able to download course materials. If any of these devices are carried with you, an underlying exam will be cancelled.

The course also includes several projects using R programming (you need to master to some degree). Please know that the projects must be rendered independently. Mutually collaborated papers will not be accepted.