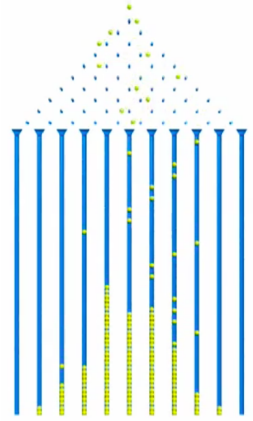
Course Description

Ve401 Probabilistic Methods in Engineering

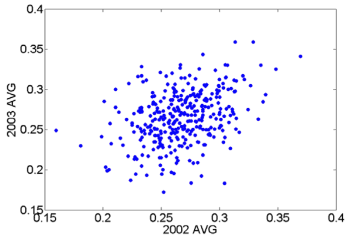
Prerequisites: Vv216 or Vv256 or Vv286 and the preceding calculus courses.

Gambling and Risk



Random Influences on Measurements

Statistics in the Middle Ages



Luck vs. Skill in Baseball

Intended Audience: ME and ECE undergraduate and graduate students.

Description: The first part of the course introduces some basic elements of probability theory and combinatorics, with proofs of theorems demonstrated as far as practical within the time constraints of the course. Students are expected to have a good knowledge of the standard calculus material of the first three terms, including, but not limited to, polar coordinates in higher dimensions, integration of single- and multiple-variable functions, the theory of convergence of series and sequences of functions, the theory of matrices and linear maps as well as systems of ordinary differential equations.

The second part of the course discusses some basic statistical methods for testing statistical hypotheses and analyzing means, variances and proportions. The results of the first part are applied to practical problems. Students are required to comprehend and interpret formulations of real-life situations, use their judgement and apply the correct procedure to find a suitable solution to a given problem. In this respect, the required skill sets are closer to a physics or engineering course than a mathematics course.

The third part of the course touches upon categorical data analysis, simple and multiple linear regression and analysis of variance (ANOVA). For regression problems in particular, familiarity with matrix calculus is required.

The course makes use of the Mathematica software, for which all JI students have a free license. The commands necessary for implementing statistical methods are given in the lecture at regular intervals.

The course will include two term projects, to be completed in groups of 4-5 students.

Keywords: Basic concepts in probability, discrete and continuous probability distributions, joint distributions, descriptive statistics, estimation, hypothesis testing, non-parametric methods, analysis of categorical data, simple and multiple regression analysis, model selection, introduction to analysis of variance and experimental design.

Literature:

[MA] Milton and Arnold, *Introduction to Probability and Statistics*, 4th Edition, McGraw Hill, International Edition 2004.

[HMGB] Hines, Montgomery, Goldsman and Borror, *Probability and Statistics in Engineering*, 4th Edition, 2003, J. Wiley & Sons.

Syllabus:

Lecture	Lecture Subject	Textbook Sections
1	Introduction to Probability and Counting	[MA] 1
2	Some Probability Laws	[MA] 2
3	Discrete Random Variables	[MA] 3
4	Discrete Random Variables	[MA] 3
5	Continuous Random Variables	[MA] 4
6	The Normal Distribution	[MA] 4
7	Reliability	[MA] 4
8	Bivariate Random Variables	[MA] 5
9	Descriptive Statistics	[MA] 6
10	Point Estimation and Estimators	[MA] 7
11	The Chi-Squared Distribution	[MA] 7
12	Interval Estimation of Mean and Variance	[MA] 7
13	**Midterm Exam**	[MA] 1-7
14	Fisher's Significance Test	[MA] 8
15	Neyman-Pearson Decision Theory	[HMGB] 11-1, 11-2; [MA] 8
16	T Test and Chi-Squared Test	[MA] 8
17	Non-Parametric Tests	[MA] 8
18	Inferences on Proportions	[MA] 8
19	Comparison of Two Variances	[MA] 10
20	Comparison of Two Means	[MA] 10
21	Categorical Data	[MA] 15
22	Categorical Data	[MA] 15
23	Simple Linear Regression	[MA] 11
24	Simple Linear Regression	[MA] 11
25	Multiple Linear Regression	[MA] 12
26	Multiple Linear Regression	[MA] 12
27	Analysis of Variance	[MA] 13
28	Analysis of Variance	[MA] 13
29	Analysis of Variance	[MA] 13
30	**Final Exam**	[MA] 9-13, 15

Course Grade Components:

- Midterm exam: 30%
- Final exam: 30%
- Term Project 1: 20%
- Term Project 2: 20%
- Course Work: 0% (see below)

Both term projects will be completed in groups of 4-5 students. The groups will be randomly assigned and will be different for both projects. The course work (weekly assignments) will not contribute to the course grade, but each students needs to obtain at least 60% of the total marks of the assignments in order to receive a passing grade for the course. The course work will be completed by groups of 3 students which will remain unchanged throughout the term.

Honor Code Policy:

Students should familiarize themselves with JI's Honor Code, found at

http://umji.sjtu.edu.cn/academics/academic-integrity/honor-code/.

The standard rules for examinations apply. Furthermore, in group work (both projects and the course work) Section 5 of the Honor Code is fully enforced: any violation of the Honor Code by a group will cause all group members to be sanctioned equally. Finally, while communication between members of a group is completely unrestricted, communication between groups (even oral communication) is strictly prohibited.
The Teachning Assistants will be happy to answer any any questions regarding the application of the Honor Code.