

SM230 Probability with Naval Applications

Spring 2008 Syllabus

Goal

After taking this course, students will be capable of making better analytical decisions for military purposes, in their academic courses, and in their personal lives. Students will be proficient in important practical career skills for a Naval officer including computer-assisted analysis and decision making.

Assumptions and additional notes

Students are generally sophomores, are group III majors, and have a strong background in Calculus. This course will teach enough theory to do some genuinely useful probabilistic analysis. The focus is more practical than mathematical. Topics in inferential statistics are not covered in this course. Students requiring a more extensive treatment of statistics should consider taking SM219, *Introduction to Statistics*.

Text

Custom printing of:

(D) Devore, *Probability and Statistics for Engineering and the Sciences 7e*, chapters 1-4

(AW) Albright and Winston, *Spreadsheet Modeling and Applications: Essentials of Practical Management Science 1e*, chapters 1, 2, 8, and 9.

Stewart *Calculus, Early Transcendentals* (Appendix E only).

USNA Math Department handouts

Software and course resources

Students will use the following tools in the course extensively:

- TI V200 calculator with **Stats w/List Editor** installed.
- Microsoft **Excel 2003** (Excel 2007 is acceptable, but all examples are shown using 2003) with Palisade **DecisionTools and StatTools Suite** (student edition included with text).
The course software is available in the MI-003 and MI-006 computer labs, and should be installed on student's personal computers.
- **WebAssign** online homework system at www.webassign.net

Honor concept

Assignments and exams may be similar or identical between the various sections and instructors in this course. Unless your instructor explicitly tells you otherwise, assignments and exams may not be discussed *in any way* with anyone except the instructor, to include

trivial questions such as, “did you finish it yet?”, and “was it difficult?” If there is ever any doubt in your mind about what is permitted, it is your responsibility to ask the instructor immediately.

Collaboration and peer assistance may be allowed and encouraged on some assignments. Your instructor will have specific instructions for you regarding collaboration in this course.

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Sections covered	Topics
Week 1 (7-11 Jan) AW1-2	Introduction, decision making, military and real-world applicability Computer-based tools: Microsoft Excel, Calculator Stats w/ List Editor, StatTools, @Risk
Week 2 (14-18 Jan) D1.1-1.4 Stewart App E	Descriptive statistics Population, sample, Σ summation notation Data types: Quantitative vs. qualitative data, categorical, numeric, discrete, continuous Measures of center: mean, median, measures of spread (variability): range, variance, standard deviation, Z-scores, percentiles, quartiles, outliers Representing data graphically: histograms, stem and leaf plots, dot plots, box plots, skew
Week 3 (21-25 Jan) D1 review D2.1	note: no class 21 Jan (Martin Luther King Jr. Day) Set theory Venn diagrams, sample spaces, null set, universal set, union, intersection, complement, DeMorgan's laws, exclusive events, partitions (mutually exclusive and collectively exhaustive events)
Week 4 (28Jan-2/1) D2.2-2.3	Probability Axioms of probability, factorial operation, additive rule Counting, permutations, combinations, games of chance
6 Feb	EXAM 1
Week 5 (4-8 Feb) D2.4	Conditional probability, Bayes' Theorem
Week 6 (11-15 Feb) D2.4	Multiplicative rule, independent events Search and detection
Week 7 (18-22 Feb) D3.1-3.3	note: no class on 18 Feb (Washington's Birthday). Tue 19 Feb follows a Monday class schedule. Discrete Random Variables Random Variables (RVs), bernoulli RV, discrete vs. continuous RVs Pdf, pmf, cdf, parameters, notation: step function, strictly less than Expected value, variance, and standard deviation of an RV
Week 8 (25-29 Feb) D3.4-3.6	Binomial, hypergeometric, negative binomial, Poisson RVs
Week 9 (3-7 Mar) D4.1	Continuous Random Variables Introduction to continuous RVs, continuous pdf, cdf, continuous uniform RV
7 Mar	EXAM 2
8-16 Mar	Spring Break
Week 10 (17-21 Mar) D4.2-4.3	Expected value, variance, and standard deviation of an continuous RV Normal distribution
Week 11 (24-28 Mar) D4.4	Exponential distribution and its relation to the Poisson Sampling distribution of the mean, Central Limit Theorem
Week 12 (31 Mar-4/1) AW8.1-8.5	Introduction to analytical decision making Maximin, minimax, EMV, decision trees, PrecisionTree software, Bayes' Theorem in decision analysis, introduction to sensitivity analysis, expected value of sample information, expected value of perfect information

9 Apr	EXAM 3
Week 13 (7-11 Apr) AW8.5	Continued: sensitivity analysis, expected value of sample information, expected value of perfect information
Week 14 (14-18 Apr) AW9.1-9.4	Introduction to simulation and modeling Spreadsheet models, probability distributions
Week 15 (21-25 Apr) AW9.5	Simulation using @RISK software

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