CSE 312 Foundations II

1. Introduction

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Computer Science & Engineering

CSE 312, Wi '11: Foundations of Computing II

Lecture:	MUE 153 (schematic)	MWF	1:30- 2:20
Section A:	EEB 054 (schematic)	Th	1:30- 2:20
Section B:	EEB 054 (schematic)	Th	2:30- 3:20
Section C:	MGH 238 (schematic)	Th	12:30- 1:20

		Office Hours		Location	Phone
Instructor:	Larry Ruzzo, ruzzo@cs	M	2:30- 3:20	CSE 554	543-6298
TAs:	Daniel Perelman, perelman@cs	TBA			
	Leilani Battle, leibatt@cs	TBA			
	Milda Zizyte, mzizyte@cs	TBA			

Course Email: cse312a_wi11@uw.edu. Announcements and general interest Q&A about homework, lectures, etc. The instructor and TAs are subscribed to this list. Enrolled students are as well, but probably should change their default subscription options. Messages are automatically archived.

For fastest response, questions not of general interest should be directed to the instructor and TAs collectively via the "course staff" link at left. Individual email addresses (above) may also be used, if needed.

Discussion Board: Also feel free to use Catalyst GoPost to discuss homework, etc.

Catalog Description: Examines fundamentals of enumeration and discrete probability; applications of randomness to computing; polynomial-time versus NP; and NP-completeness.

Prerequisites: CSE 311; CSE 332, which may be taken concurrently.

Credits: 4

Learning Objectives: Course goals include an appreciation and introductory understanding of (1) methods of counting and basic combinatorics, (2) the language of probability for expressing and analyzing randomness and uncertainty (3) properties of randomness and their application in designing and analyzing computational systems, (4) some basic methods of statistics and their use in a computer science & engineering context, (5) the distinction between tractable and (apparently) intractable computational problems and (6) methods and appropriate reasoning for showing tractability (e.g. dynamic programming) and intractability (reduction).

Grading: Homework, Midterm, Final. Possibly some quizes. Overall weights 55%, 15%, 30%, roughly.

Late Policy: TBA

Extra Credit: Assignments may include "extra credit" sections. These will enrich your understanding of the material, but at a low points per hour ratio. Do them for the glory, not the points, and don't start extra credit until the basics are complete.

Collaboration: Homeworks are all individual, not group, exercises. Discussing them with others is fine, even encouraged, but *you must produce your own homework solutions*. Follow the "Gilligan's Island Rule": if you discuss the assignment with someone else, don't keep any notes (paper or electronic) from the discussion, then go watch 30+ minutes of TV (Gilligan's Island reruns especially recommended) before you continue work on the homework by yourself. You may *not* look at other people's written solutions to these problems, not in your friends' notes, not in the dorm files, not on the internet, *ever*. If in any doubt about whether your activities cross allowable boundaries, *tell us before*, not after, you turn in your assignment. See also the UW CSE Academic Misconduct Policy, and the links there.

Textbooks:

Required:

A First Course in Probability (8 edition), Sheldon M. Ross, Prentice Hall, 2009. (Available from U Book Store, Amazon, etc.)

Online: The last few weeks of the quarter will use the following, available free online:

Algorithms, by S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani

Reference (little direct use of this, but if you already own a copy, keep it for reference):

Discrete Mathematics and Its Applications, (sixth edition) by Kenneth Rosen, McGraw-Hill, 2006. Errata. (Available from U Book Store, Amazon, etc.)

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Empiricism:

1. Relying on observation and experiment, esp. in the natural sciences
2. A former school of medical practice founded on experience *without the aid of science or theory*

Synonym: Quackery, Charlatanry

merriam-webster.com

Study Probability!

"Life is uncertain. ~~Eat dessert~~ first."

-- Ernestine Ulmer

syllabus

Counting & Binomial Coeffs: (1wk)

- Sum and product rules, product trees, Permutations and Combinations, Inclusion-Exclusion, Binomial Theorem, Pigeonhole Principle

Probability (5 wks)

- Basics: Sample spaces, events, (e.g. coins, dice, cards, program bugs?)
- Conditional probability & Bayes theorem, ex: false positive/negative, spam detection
- Random variables: independence, expectation, linearity of expectation, variance
- Bernoulli trials, binomial, multinomial? distributions; Poisson approximation
- Tail bounds (Markov, Chebyshev, Chernoff)
- Continuous random variables; exponential and normal, central limit theorem
- Applications: average case vs random algs, hashing, fingerprinting, load balancing, entropy and data compression

Statistics (3 wks)

- Parameter estimation: confidence intervals, bias; maximum likelihood: binomial, normal, EM?
- Hypothesis Testing: likelihood ratio, contingency tables & chi-squared test?
- Monte-Carlo simulation, polling and sampling?
- Bayesian estimation, Bayes classifier, machine learning
- How to lie with statistics

Algorithms & Complexity (? wks)

- Poly-time algorithms & examples, esp. non-obvious ones via divide-and-conquer, dynamic programming (least squares, edit distance)
- Search vs decision probs; the class NP
- NP-completeness, SAT
- Reductions
- Practical implications of NP-completeness: Why it is useful, important to crypto, etc. Overview what we know

CSE applications (some examples)

- Performance analysis: "events" happen randomly, unpredictable failures, unpredictable arrival of data, varying workloads, ...
- "Knowledge discovery," data mining, AI, ...

  statistical descriptions of patterns in data
- Scientific data analysis: measurement errors and artifacts
- Algorithm design and analysis: sometimes a randomized approach is simpler or better than any known deterministic one.

Read the paper, listen to the news, surf the web. You'll be bombarded with statistics – most of it phrased so as to bias the conclusion they hope you will draw.

Defend yourself!