## CSE 312 Foundations II

# I. Introduction

Winter 2017 W.L. Ruzzo



### University of Washington

**Computer Science & Engineering** 

#### CSE 312, Au '13: Foundations of Computing II

CSE Home

Administrative	Lecture:	MGH 241 (schematic)	MWF	1:30-2:20	
Schedule & Reading Course Email/BBoard Subscription Options Class List Archive E-mail Course Staff GoPost BBoard	Section A:	MGH 242 (schematic)	Th	1:30-2:20	Sonya Alexandrova
	Section B:	MGH 228 (schematic)	Th	2:30-3:20	Scott Lundberg
	Section C:	MEB 243 (schematic	Th	12:30-1:20	Yanling He
Lecture Notes					
			Office I	Hours	Location Phone
1: Intro 2: Counting	Instructor:	Larry Ruzzo,	Office I F		
1: Intro 2: Counting Lecture Recordings	Instructor:	Larry Ruzzo, ruzzo <sup>ę</sup> cs Sonya	-		Location Phone CSE 554 543- 6298
1: Intro 2: Counting	Instructor: TAs:	ruzzotes	-		CSE 554 543- 6298

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3:30-4:30 CSE 2xx

Yanling He,

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and their use in a computer science & engineering context.

Grading: Homework, Midterm, Final. Possibly some guizes, small programming assignments. Overall weights 55%, 15%, 30%, roughly.

Late Policy: Assignments are due at the start of lecture on the due date, either on paper or electronically. Late papers/e-turnin will be accepted (but penalized 25%) up to the start of the next lecture; not accepted thereafter, barring major emergencies.

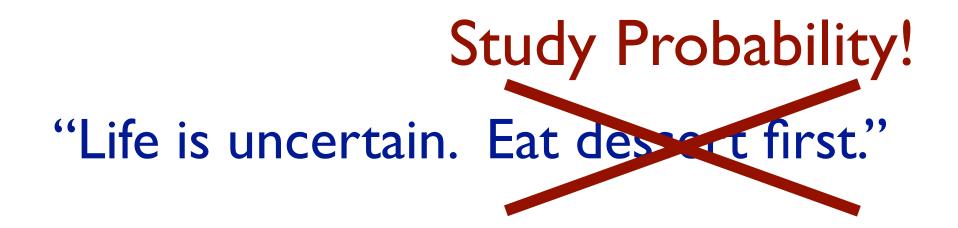
Extra Credit: Assignments may include "extra credit" sections. These will enrich your understanding of the material, but at a low points per hour ratio. Do them for the glory, not the points, and don't start extra credit until the basics are complete.

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 were and in the advertision of the interval of the advertision of the interval someone else, don't keep any notes (paper or electronic) from

### Empiricism:

- I. 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



### -- Ernestine Ulmer

### 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, ttest, contingency tables & chi-squared test?
- •Monte-Carlo simulation, polling and sampling?
- •Bayesian estimation, Bayes classifier, machine learning
- •How to lie with statistics

- 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
- Uncertainty: navigation and control with noisy sensors, ...
- 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 probability and statistics – most phrased to bias the conclusion they hope you will draw.

# Defend yourself!