# CSE 312, WI'11: Foundations of Computing II

**University of Washington**  
Computer Science & Engineering  

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Section A</th>
<th>Section B</th>
<th>Section C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture: MWF 1451</td>
<td>TTh 1:30-2:20</td>
<td>TTh 2:30-3:20</td>
<td>TTh 12:30-1:20</td>
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<tr>
<td>Instructors: Larry Razavi, vazoff@cs</td>
<td>Leilani Battle, leibatt@cs</td>
<td>Milda Zizyte, mizyte@cs</td>
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<td>&amp; Daniel Perelman, TBA</td>
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<tr>
<td>Office Hours</td>
<td>Location</td>
<td>Phone</td>
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<td>M 2:30-3:20</td>
<td>CSE 554</td>
<td>6298</td>
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<td>Course Email: <a href="mailto:cse312_wi11@uw.edu">cse312_wi11@uw.edu</a></td>
<td>Announcements and general interest in Q&amp;A about homework, 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.</td>
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<td>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.</td>
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<td>&amp; Discussion Board: Also feel free to use Catalyst GoPost to discuss homework, etc.</td>
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<td>Catalog Description: Examines fundamentals of enumeration and discrete probability, applications of randomness to computing; polynomial-time versus NP and NP-completeness.</td>
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<td>&amp; <strong>Learning Objectives:</strong> 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 &amp; 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 (reductio).</td>
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<td>&amp; Grading: Homework, Midterm, Final. Possibly some quizzes. Overall weights 55%, 15%, 30%, roughly.</td>
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**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:**  
- *Online:* The last few weeks of the quarter will use the following, available free online:  
  - *Reference* (little direct use of this, but if you already own a copy, keep it for reference)  

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http://www.cs.washington.edu/312
Empiricism

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

syn: Quackery, Charlatanry

[Merriam-Webster.com]
"Life is uncertain. Eat dessert first."

- Ernestine Ulmer
SYLLABUS

Counting, Probability, Random Variables

- Sum and product rules, inclusion-exclusion, product tree
- Pigeonhole principle
- Permutations & Combinations, binomial coefficients, binomial theorem
- Intro to prob. Sample spaces, events, simple examples: coins, dice, program bugs, poker hands
- Conditional probability, Bayes rule, examples: false positive/false negative, spam detection
- Independence, random variables
- Expectation, bernoulli trials, binomial distribution
- Variance, tail bounds (Chebyshev inequality)
- Chernoff bounds
- Application: Entropy and data compression
- Continuous random variables; exponential and normal distributions, Poisson approximation

Applications, Central Limit Theorem, Statistics

- The Central Limit Theorem
- Lying with statistics
- Parameter estimation, confidence intervals, bias
- Monte-carlo simulation, polling, sampling
- Maximum likelihood estimation
- Bayesian estimation, Bayes classifier, machine learning

Polynomial Time and NP-completeness

- Polynomial-time algorithms: Discussion, explanation, simple examples
- Divide-and-conquer
- Dynamic programming (least squares, edit distance)
- Search problems vs. decision problems, the class NP
- NP-completeness, SAT
- Reductions
- Practical implications of NP-completeness
CS Applications (some examples)

- Performance analysis: "events" happen randomly, workload varies, failures unpredictable, ...

- "Knowledge Discovery", Data mining, AI
  statistical description 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 approach.
Beyond CS

Read the paper, listen to the news. People throw statistics at you all the time — most of it phrased so as to bias the conclusion they hope you'll draw. Defend yourself!