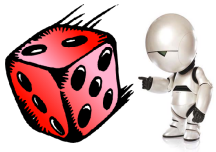
CSE 312: Foundations of Computer Science, II

- **Instructor**
  Anna R Karlin (karlin@cs.washington.edu)

- **TAs**
  Cyrus Rashtchian (grad)
  ?? (undergrad)



- **Course website**
  http://www.cs.washington.edu/312/

- **Calendar will have everything on it!**

CSE 312: Foundations of Computer Science, II

- **Probability, statistics, and algorithms**
  First ~23 lectures: prob/stats in CS
  Last ~7 lectures: algorithms & intractability

- **Books**
  Introduction to Probability (2nd ed.)
  Bertekas and Tsitsiklis [required]
  Discrete Mathematics and its Applications
  Rosen [optional]
  Algorithms
  Dasgupta, Papadimitriou, and Vazirani [online]

- **Slides**
  Most are minor mutations of slides prepared by previous instructors of this course: James Lee, Larry Ruzzo, Pedro Domingos

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- **Homeworks ~ 40%**
  Weekly (Out Wed, due next Wed)
  we will grade a random subset of problems.

- **Daily problem ~ 5-10%**
  shouldn't take more than 5-10 minutes.
  due at the beginning of most classes.
  can skip it 4 times during the quarter.

- **Midterm & Final ~20% & 35%**

syllabus

- **Probability**
  Counting
  Basic probability
  Conditional probability
  Random variables
  Discrete and continuous distributions
  Expectation and variance
  Tail bounds and the central limit theorem

+ Algorithms and NP-completeness

- **Statistics**
  Maximum-likelihood estimation
  Bayesian estimation
  Hypothesis testing
  Linear regression
  Machine learning

pretend you're a doctor

You are trying to diagnose the probability that a woman with a positive mammogram has breast cancer, even though she's in a low-risk group: 40-50 years old.

- Probability of a woman having breast cancer is **0.8%**.
- If someone has cancer, probability of a positive mammogram is **90%**.
- If someone doesn't have cancer, probability of a positive mammogram is **7%**.

A woman walks into your office with a positive test.

What's the probability that she has breast cancer?

pretend you're a lawyer

OJ simpson murder trial

Prosecutors:
"A slap is a prelude to homicide."

Defense:
"Less than 1 in 2500 men who commit domestic abuse go on to commit homicide."

Both were considering the wrong question:
If a woman is murdered and she has been domestically abused, the chances are 90% that her husband is the killer.

Bayes rule

$$\Pr[A \mid B] = \frac{\Pr[A \wedge B]}{\Pr[B]}$$

why this course is important

- **Reasoning under uncertainty**
- **Understanding massive data**
- **Learning patterns**
- **Exposing liars and idiots**
- **The line between tractable and intractable problems**
- **Making $$$ without coding**

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