ECE/CS 541
Computer System Analysis:
Intro to state-space methods

Mohammad A. Noureddine
Coordinated Science Laboratory
University of Illinois at Urbana-Champaign

Fall 2018

Learning Objectives

- Or what is this course about?

- At the start of the semester, you should have
  - Basic programming skills (C++, Python, etc.)
  - Basic understanding of probability theory (ECE313 or equivalent)

- At the end of the semester, you should be able to
  - Understand different system modeling approaches
    - Combinatorial methods, state-space methods, etc.
  - Understand different model analysis methods
    - Analytic/numeric methods, simulation
  - Understand the basics of discrete event simulation
  - Design simulation experiments and analyze their results
  - Gain hands-on experience with different modeling and analysis tools

Announcements and Reminders

- **HW2 is out today!**
  - Due by end of day on Sunday 10/07/2018

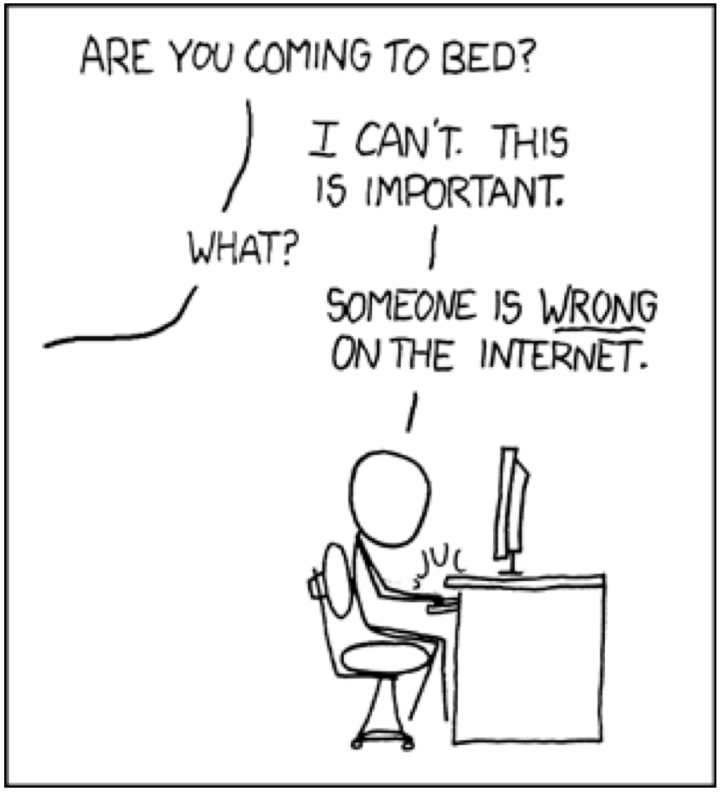
- **Project proposals description posted!**
  - Proposal due by end of day on 10/16/2018

- **Support for students with disabilities:**
  - University resources available through DRES
    - http://disability.illinois.edu/
  - Please see announcement on Piazza
    - https://piazza.com/class/jkvka0ddys4ee?cid=31

Announcements and Reminders

- **Next week is Informal Early Feedback**
  - Bring out your inner Internet troll
    - **Use it to improve the course content!**
  - Feedback will be anonymous
    - I will step out of the room while you fill them out

- **Show up to class and fill out the feedback form**
  - Receive 1 point on your participation grade!!



Probability Quiz

- Good performance overall
- Average score is 38
- Median score is 43
- If you scored less than 30, please come visit us during office hours!

Quiz and Homework Takeaways

- **One misconception I noted in the quiz**
  - "One of the coins is selected randomly and tossed *n* times yielding *n* straight tails"
  - This does **NOT** mean $P\left(n \text{ tails}\right) = 1$

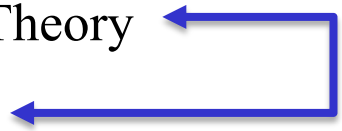
- Recall that always $\sum_{\omega \in \Omega} P(\{\omega\}) = 1$

- Use it as a sanity check!

- Homeworks
  - We are NOT testing your ability to search on stackoverflow!
  - Read the answer, make sure it's correct, understand it, reproduce it!
- Late policy
  - Let us know you want to use your late submission **before** we post the solution!

Tentative schedule

- Discrete Time Markov Chains (today and next lecture)
- Continuous Time Markov Chains
- Introduction to Game Theory
- Queuing Theory



- → **Midterm Exam**

- This concludes the theoretical part of the course, we'll move into simulation afterwards

Objectives for this Module

- Define and classify random processes
- Define Markov processes with focus on Markov chains
- Relax the independence assumption for modeling
  - Discrete Time Markov Chains (DTMC) modeling
  - Continuous Time Markov Chains (CTMS) modeling
    - Motivate queuing theory!
- Understand limitation of Markovian modeling
  - Higher level formalism (Petri-Nets, SANs)
- Markov chains in practice at Google