

# Everyday Computational Thinking: our course..

Harry Hochheiser

Towson University  
Department of Computer and Information Sciences

410 704 3090

<http://triton.towson.edu/~hhochhei/>

# Everyday Computational Thinking

- Use familiar situations from everyday life to motivate the study of abstractions, recursion, algorithms, computability, complexity, approximations, heuristics, graph theory, and other concepts from computing.
- These approaches will be used to model and answer questions about these everyday questions.
- This course will focus on questions of problem representation, evaluation of the suitability of representations for specific tasks.
- Prior experience with computer programming is not necessary.

# Course Content

- Focusing on Relevant Details: Abstraction
- Breaking problems into pieces: Decomposition & recursion
- Recipes & Directions: Algorithms
- Ways of describing problems: Representations
- Which problems can I solve? Computability
- Comparing the efficiency of solutions: Complexity
- How can I get a ``good enough'' answer? Heuristics, and approximation
- Who's in my network? Social Networking and graph theory
- Error handling
- Codes and encryption
- Coordination: concurrency, transactions, and parallelism
- What will happen if? simulation, & queuing
- How can I find it? Search and information retrieval, precision vs. recall
- How can I choose? Decision & risk analysis
- Programs as data, data as programs
- Who should solve the problem? The computer or the human?

# Example Exercise: Social Networks

- Recreate Milgram's Six Degrees Experiment via email on campus
- Theorize - what do we expect for extent of graph?
- Collect data, build social network, analyze. Visualize
- To be prototyped in Gail Kaplan's Honors Math Course this spring.

# Example Exercise: Dimensionality Reduction

- RateMyprofessor.com: 5, 5-point scales
  - Easiness, Helpfulness, Clarity, Rater Interest
- Propose methods for comparisons across these 5 scales? which is best?
  - average
  - weighted average
  - visualization
  - similarity to ideal
- Open-ended problem - no single solution?
- Similar to many complex "optimization" choices
  - choosing a house to buy/rent
- Use available web-based software tools?

# Research Project

- Identify and explore an everyday problem or situation that can be modeled, discussed, and possibly solved through the use of computational thinking.
- Discuss existing solutions
- Propose alternatives
- Proposal to be approved
- 8-10 page report
- 5 minute in-class presentation

# Readings

- Lecture notes on Abstraction under development
- E.R. Tufte *Visual and Statistical Thinking: Display of Evidence for Making Decisions*
- J. Travers and S. Milgram. An experimental study of the small world problem. *Sociometry*, 32(4):425- 443, December 1969.
- Jon Kleinberg. The convergence of social and technological networks. *Commun. ACM*, 51(11):66-72, 2008.
- G. Pólya *How to Solve it*. Princeton University Press, 2004
- D. Watts. *Six Degrees: The Science of a Connected Age*. WW. Norton and Company, 2003
- J. Weizenbaum. *Computer Power and Human Reason: From Judgment to Calculation*. W.H. Freeman and Company, 1976.
- Mark Newman. Maps of the 2008 us presidential election results. <http://www-personal.umich.edu/~mejn/election/2008/>
- D. Harel and Y. Friedman. *Algorithmics: The Spirit of Computing*. Addison-Wesley, 2004
- Dr. Seuss' *Too Many Daves* & King Looie Katz

## Suggestions?