

# Engr 694-60: Research Method in CS

## Lecture Notes, Fall 2017

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### Contents

**Lecture Notes** **1**

I maintain these notes as text in the Pandoc's dialect of Markdown using embedded LaTeX markup for the mathematical formulas and then translate the notes to HTML, PDF, and other formats as needed.

**Advisory:** The HTML version of this document requires use of a browser that supports the display of MathML. A good choice as of November 2017 is a recent version of Firefox from Mozilla.

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### Lecture Notes

1. (21 Aug) Examining the syllabus and course organization
2. (21 Aug) Motivating the need to improve scientific writing
  - a. Calvin and Hobbes on Academic Writing. Comic by Bill Waterson. Blog entry by Jame Preller.
  - b. Anguished English quotations collected by Richard Lederer (from *Anguished English: An Anthology of Accidental Assaults Upon the English Language*, Dell, 1989)
3. (21, 23 Aug, for Assignment #1 reference) Writing six-word essays
  - a. Six-word memoirs
  - b. SMITH Magazine
  - c. The Race Card Project
4. (23, 28 Aug, TBD) Being a graduate student in computer science

- a. Reading: Chapter 1 “Introduction” and Chapter 2 “Getting Started” in Justin Zobel’s *Writing in Computer Science*, Third Edition
  - b. Ph.D. Students Must Break Away from the Undergraduate Mentality by Jason Hong, Carnegie Mellon University (from *BLOG@CACM, Communications of the ACM*, vol. 56, no. 7, pp. 10-11, July 2013). We discuss how graduate (in particular, PhD) study is different from undergraduate study
    - temporary local copy
    - George H. Heilmeier’s “Critical Questions for Research Proposals (Heilmeier’s Catechism)
  - c. How to Have a Bad Career in Research/Academia, by David Patterson, University of California Berkeley
  - d. Notes on the PhD Degree, by Doug Comer, Purdue University
  - e. (for reference) You and Your Research, by Richard Hamming (a transcription of a Bell Communications Research Colloquium Seminar on 7 March 1986):  
[PDF] [YouTube]
  - f. (for reference) How to Be a Successful PhD Student (in Computer Science (in NLP/ML)), by Mark Dredze (Johns Hopkins) University and Hanna M. Wallach (University of Massachusetts Amherst)
  - g. (for reference) Graduate Study in the Computer and Mathematical Sciences: A Survival Manual, by Dianne Prost O’Leary, University of Maryland College Park
  - h. (for reference) How to Succeed in Graduate School: A Guide for Students and Advisors, by Marie desJardins, University of Maryland Baltimore County (from *Crossroads*, issues 1.2, December 1994, and 1.3, January 1995)
  - i. (for reference) CMU Advice on Research and Writing
  - j. (for reference) The Ph.D. Grind: A Ph.D. Student Memoir, by Philip Guo (University of Rochester, based on his experiences as a PhD student at Stanford University).  
[book PDF] [tl;dr Edition]
  - k. (for reference) The Hitchhiker Guides to Surviving Computer Science Graduate School, by Ronald T. Azuma (based on his experiences as a PhD student at the University of North Carolina Chapel Hill)
5. (25 Aug) No class because of meetings
  6. Improving scientific writing

- a. Reading: Chapter 6 “Good Style” and Chapter 7 “Style Specifics” in Justin Zobel’s textbook *Writing for Computer Science, Third Edition*, for discussion of writing style in computer science. This is background for the next 3 weeks of discussion of scientific writing.
  - b. (28, 30 Aug) Actors and Actions  
[Powerpoint] [handout] [worksheet in Word]
  - c. (30 Aug, 1 Sep) Learning from previous students’ mistakes.
    - Comments on first three assignments in the 2013 offering of this course
    - Suggestions inspired by student papers in a 1991 Engr 660 Software Engineering seminar course (My view of writing in first person has changed in recent years.)
  - d. (1, 6 Sep) Cohesion, Coherence, and Emphasis  
[Powerpoint] [handout] [worksheet in Word]
  - e. (6, 8 Sep) Concision and Simplicity  
[Powerpoint] [handout] [worksheet in Word]
  - f. (8, 11 Sep) Rewriting a paper abstract  
[handout]
  - g. (11, 13 Sep) More on Cutting Clutter and Using Strong, Precise Verbs  
[Powerpoint] [handout]
  - h. (for reference) Clinical Chemistry Guide to Scientific Writing, American Association for Clinical Chemistry
  - i. (for reference) Free Courses or course materials on scientific writing
    - SciWrite: Writing in the Sciences, by Kristin Sainani, Stanford University Medical School. Prof. Cunningham took the Coursera version of this course while on sabbatical in Fall 2012. The target students are scientists and physicians writing to communicate with each other.
    - Principles and Practice of Science Communication, by John Durrant, Spring 2006 course STS.014 (MIT OpenCourseWare: Massachusetts Institute of Technology). This course targets students writing about science for a general audience.
    - Science Writing and New Media: Elements of Science Writing for the Public, by Karen Boiko. Spring 2013 course 21W.035 (MIT OpenCourseWare: Massachusetts Institute of Technology). This course targets students writing about science for a general audience.
7. (for Assignment #2 reference) Interviewing computer scientists

- a. ThoughtCo English Grammar
    - Interview (The Examples and Observations section gives interviewing tips from Chapter 12 of William Zinsser’s *On Writing Well*, one of the suggested books for this course.)
    - Journalist’s Questions (5 Ws and an H)
    - Listening
    - Note-Taking
  - b. Purdue University Online Writing Laboratory (OWL)
    - Interviewing
    - Creating Good Interview and Survey Questions
  - c. 30 Tips on How to Interview Like a Journalist, by David Spark at Spark Minute
  - d. Free Management Library, Authenticity Consulting:
    - General Guidelines for Conducting Interviews, by Carter McNamara
    - How to Improve Your Listening Skills, by Carter McNamara
  - e. Interviewing Scientists
  - f. Journalism Tutorials, Silver Stringers citizen journalists (a project originally associated with the MIT Media Lab)
8. Using repetition and parallelism
- a. Reading: “Repetition and Parallelism” section, pages 105-6, in Chapter 7 of Justin Zobel’s textbook *Writing for Computer Science*, Third Edition
  - b. (13 Sep) Parallel Structure, Purdue University Online Writing Laboratory (OWL)
  - c. (13 Sep) Self Teaching Unit: Parallel Structure, Towson University, online writing support
  - d. (for reference) Parallelism 101: Add Clarity and Balance to Your Speeches, by Andrew Dlugan
  - e. (20 Sep) Guide to Grammar and Writing, Capitol Community College Foundation:
    - Parallel Form
    - Biblical Passages in Parallel Form (KJV)
    - Abraham Lincoln’s Gettysburg Address

9. (15 Sep, for Assignment #3) Attending **Department seminar. Valerie Polgar. “Media Art: Relationship Between Art and Tech”, 3:00 PM, Friday, September 15, 2017**
10. (18 Sep) Refereeing and editing for conferences and journals
  - a. Reading: Chapter 3 “Reading and Reviewing” in Justin Zobel’s Writing for Computer Science, Third Edition
  - b. **Guest presentation on Scientific Peer Review (2017 PDF), (2013 slides), Dr. Yixin Chen, Professor, Computer and Information Science**
  - c. (for reference) The Task of the Referee, by Alan Jay Smith (from IEEE Computer, vol. 23, no. 4, pp. 65-71, April 1990)  
[local copy]
  - d. (for reference) A Guide to New Referees in Theoretical Computer Science, by Ian Parberry (from ACM SIGACT News vol. 20, no. 4 (1989): 92-99,  
1989)  
[local copy]
  - e. News item: Publishers Withdraw More Than 120 Gibberish Papers, by Richard Van Noorden (from Nature, 24 February 2014)
11. (20 Sep) Avoiding misuse of words
  - a. Reading: “Misused Words” section, pages 110-13, in Chapter 7 of Justin Zobel’s textbook Writing for Computer Science, Third Edition
  - b. Commonly Confused Words, Oxford Dictionaries
  - c. Words Often Confused and Spelling, Weber State
  - d. Less Versus Fewer, Grammar Girl’s Quick and Dirty Tips
  - e. Shall Versus Will, Grammar Girl’s Quick and Dirty Tips
12. (20 Sep) Using punctuation effectively
  - a. Reading: Chapter 8 “Punctuation” in Justin Zobel’s textbook Writing for Computer Science, Third Edition
  - b. The Punctuation Guide
  - c. (for reference) Punctuation, Purdue University Online Writing Laboratory (OWL)
13. (22 Sep, Assignment #3) **Listening to Chancellor Jeffrey Vitter in Engr 400 class, Brevard 134**

14. (25, 27 Sep, for Assignment #4 reference) Writing tutorials (how-to, or process, essays)
  - a. The Process Essay, Capital Community College Foundation
  - b. Writing a Process Essay, Literacy Education Online, St. Cloud State University
  - c. Videos by David Taylor
    - How to Write the “How-to” Essay (Process Essay)
    - The Five Paragraph Essay (This approach is a good illustration of how to write short essays. However, the formula is too restrictive for some of the papers we write in this class. Adapt it for your needs.)
  - d. (for reference) Technical Writing: How-To's, Tutorials, and Directions, Teacher Tap, Professional Development Resources for Teachers and Librarians
  - e. (27 Sep) How to Write a Tutorial, practical suggestions on tutorial writing at wikiHow.com
  - f. (for reference) How to Write an Effective Manual, essay by Don Norman Break)
  - g. (27 Sep, focus on examples) Pandoc: A Universal Document Converter [website] [User Guide] [Markdown]
 

Examples:

    - Haskell Notes
    - For files, the `.md` extension denotes a Pandoc Markdown source, `.html` the generated HTML, `.tex` the generated LaTeX, and `.pdf` the LaTeX processed to a PDF by `pdflatex`.
    - Files `makechapter`, `maketoc`, `makenotoc`, and `makeslidy` are my Bash scripts for building the documents.
  - h. (for reference) Markdown Tutorial
15. (29 Sep for Assignment #5 reference) Writing critiques of papers
  - a. Reading: Chapter 3 “Reading and Reviewing” in Justin Zobel’s Writing for Computer Science, Third Edition
  - b. Reading a Computer Science Research Paper, by Philip W. L. Fong (from ACM SIGCSE Bulletin Vol. 41, No. 2, pp. 138-140, 2009)
  - c. Critically Analyzing Information Sources, Cornell University Library
  - d. Notes on Writing Critiques (adapted from a paper by Pamela B. Lawhead)

- e. See Cunningham's feedback on student writing above
16. (2 Oct) Using quotation and paraphrasing correctly
    - a. Reading: "Quotation" section, pages 90-2, in Chapter 6 and "Quotations" section, pages 128-9, in Chapter 8 of Justin Zobel's textbook Writing for Computer Science, Third Edition
    - b. Quoting, Paraphrasing, and Summarizing, Purdue University Online Writing Laboratory (OWL)
  17. (2 Oct) Avoiding plagiarism
    - a. Reading: "Plagiarism" section, pages 257-9, in Chapter 17 of Justin Zobel's textbook Writing for Computer Science, Third Edition
    - b. Avoiding Plagiarism, Purdue University Online Writing Laboratory (OWL)
    - c. (for reference) UM Plagiarism and Academic Honesty Video
  18. (4 Oct) Finding references and using library resources
    - a. **Guest presentation on using the UM Williams Library, by Brian Young, Assistant Professor, Engineering reference librarian**
    - b. UM Williams Library Computer Science Research Guide
    - c. (for reference) Other scholarly search engines and directories
      - Google Scholar UM login [outside]
      - CiteseerX
      - DBLP Computer Science Bibliography
      - arXiv.org Computing Research Repository (CoRR)
      - Directory of Open Access Journals
  19. (6 Oct) Selecting citation and article styles
    - a. Reading: "Reference and Citation" section, pages 86-90, in Chapter 6 of Justin Zobel's textbook Writing for Computer Science, Third Edition
    - b. Referencing, Murdoch University, resources for IEEE, APA, Chicago, MLA, and other styles
    - c. IEEE style: [style manual] [IEEE style @ Murdoch University]
      - article templates page
      - Microsoft Word [template]
      - LaTeX class files (local copies) [readme] [how to use] [templates]

- BibTeX style files (local copies) [readme] [how to use] [templates]
- d. ACM journals style
    - Word templates
    - LaTeX templates: local copies ACM Small Journal LaTeX
  - e. ACM proceedings style
  - f. (for reference) Chicago-Style Citation Quick Guide, The Chicago Manual of Style Online
  - g. (for reference) Citation Resources, University of Maryland, resources for APA , MLA, and Chicago styles
20. (9 Oct) Formatting documents with LaTeX
    - a. Getting to Grips with LaTeX, by Andrew Roberts
    - b. (for reference) LaTeX Workshops, Tammy Stitz, University of Akron
    - c. (for reference) The Not So Short Introduction to LaTeX2e, by Tobias Oetiker, Hubert Partl, Irene Hyna, and Elisabeth Schlegl
    - d. Revealing the Secrets of David Parnas, by H. Conrad Cunningham [PDF] [LaTeX source] [BibTeX database]
    - e. A Little Language for Surveys, by H. Conrad Cunningham [PDF] [LaTeX source] [BibTeX database] [2007 ACM proceedings class file]
    - f. LaTeX Project website
    - g. TeX User Group (TUG) website (general TeX resources, not just LaTeX)
    - h. CTAN, the Comprehensive TeX Archive Network
    - i. Finding, Installing and Using LaTeX Software, Tammy Stitz, University of Akron
    - j. Adler Lab image has MiKTeX 2.9.4 installed in Spring 2014 (TBD check current)
    - k. Apple Mac OS X: [MacTeX]
    - l. Microsoft Windows: [MiKTeX] [TeXstudio integrated environment] (On Windows, TeXstudio requires a previous TeX installation such as MiKTeX.)
    - m. LaTeX Templates
  21. (11 Oct) **Guest Presentaion on LaTeX Skills by David Troendle**
    - a. Troendle's LaTeX tutorials



- b. See the references above for LaTeX
22. (13 Oct) No class. Work on assignments.
23. Understanding intellectual property and technology transfer
- a. Reading: “Intellectual Creations” section, page 257, in Chapter 17 of Justin Zobel’s *Writing for Computer Science*, Third Edition
  - b. (16 Oct) **Guest presentation on “Patents, Trademarks, and Copyrights: Protecting Your Work and Technology Transfer at UM” by Allyson M. Best, MBA, Director, Division of Technology Management**, Office of Research and Sponsored Programs (ORSP) [Similar slides from 2013]
  - c. References on intellectual property:
    - i. Chapter 6 of the book *Blown to Bits* textbook (<http://www.bitsbook.com/>).
    - ii. What is Intellectual Property? by World Intellectual Property Organization (WIPO).
    - iii. What is a Trade Secret? by World Intellectual Property Organization (WIPO).
    - iv. Copyright and Fair Use, Stanford University Libraries Note: meaning of “public domain” and “fair use”.
    - v. Bitlaw Legal Resource, by Daniel A. Tysver.
    - vi. Making Sense of Software Licensing, by Ariel Gilbery-Knight, TechSoup Global.
    - vii. Open source software
      - The Open Source Definition, Open Source Initiative (OSI) [licenses]
      - The Philosophy of the GNU Project, the original open source movement.
      - Software Freedom Law Center resources. (SFLC describes itself as providing “pro-bono legal services to developers of Free, Libre, and Open Source Software.”)
      - Creative Commons describes itself as “a global nonprofit organization that enables sharing and reuse of creativity and knowledge through the provision of free legal tools.”
      - Creative Commons USA
    - viii. The University of Mississippi Department of Licensing oversees the use of University copyrights, trademarks, logos, scripts, im-

- ages, etc. and licensing their use to other organization and individuals.
- ix. Nondisclosure agreements, a form of contract to protect trade secrets: NOLO Law for All, Wikipedia
  - x. Software piracy, the unauthorized copying of software in violation of licenses and/or copyright law: Webopedia.
  - xi. Reverse engineering, extracting design information about a product for the purpose of reproducing or enhancing it or otherwise using the information in another design: Wikipedia, NC State Ethics in Computing.
  - xii. Patents, Copyrights, and the Law of Intellectual Property, Jeffrey Meldman and Steven Bauer, Spring 2013 course 15.628J (MIT OpenCourseWare: Massachusetts Institute of Technology)
24. (18, 20, 23 Oct) Writing a research paper
    - a. Reading: Chapter 5 “Writing a Paper” in Justin Zobel’s Writing for Computer Science, Third Edition
    - b. How to Write a Great Research Paper, by Simon Peyton Jones (from his research skills page)  
[Powerpoint] [handout] [video]
    - c. (for reference) How to Write Papers so that Others Can Read Them, by Derek Dreyer, POPL2016
    - d. (for reference) How to Write Math Papers Clearly, Igor Pak’s blog.
  25. (23 Oct) Writing the introduction to a paper  
This document discusses how to write effective introductions and revises the introduction to Cunningham’s paper “A Little Language for Surveys” to better satisfy the suggestions.
  26. (25 Oct, for Assignment #6 reference) Creating annotated bibliographies
    - a. Annotated Bibliographies, Purdue University Online Writing Lab
    - b. How to Prepare an Annotated Bibliography, Cornell University Library
    - c. The Writer’s Handbook: Annotated Bibliography, University of Wisconsin Madison, Writing Center
    - d. How to Write an Annotated Bibliography, online audiovisual presentation from University of Maryland University College
    - e. LaTeX/BibTeX styles for annotated bibliographies
      - plain-annot.bst (modified plain style), University of Denver Mathematics Department: [local copy of style file]

- IEEEannot.bst (modified IEEE style), by Titus Barik: [local copy of style file]
  - ACM-Reference-Format-Journals-annot.bst (modified ACM journal style), developed by Yang Chen and Bryan Nevis, Portland State University: [local copy of style file]
- f. Annotated Bibliography for the Tutorial on “Exploring Typed Language Design in Haskell”, by Oleg Kiselyov and Ralf Lammel (draft January 13, 2010): [local copy]  
 Note: This draft annotated bibliography has a good format, but some of the references lack annotations.
- g. Domain-Specific Languages: An Annotated Bibliography, by Arie van Deursen, Paul Klint, and Joost Visser (from *Sigplan Notices*, Vol. 35, No. 6, pp. 26-36, 2000): [local copy]  
 Note: The van Deursen paper contains a good annotated bibliography except the annotations are not complete sentences as required for the Annotated Bibliography assignment.
- h. Cunningham’s LaTeX/BibTeX Example of the “Revealing the Secrets of David Parnas” article  
 Note: This bibliography is only partially annotated. The purpose is to show how to use the BibTeX styles.
- partially annotated bibliography using the modified plain style file above
  - partially annotated bibliography using the modified IEEE style file above
  - partially annotated bibliography using the modified ACM journal style file above
- Note: For the modified ACM style, the latex source file must have the definition of the annotation environment as shown at the beginning of the `ClassicParnasRevisionAnnotated.tex` file

## 27. Presenting

- a. Reading: Chapter 16 “Presentations” in Justin Zobel’s *Writing for Computer Science*, Third Edition
- b. (25 Oct) Epic Welcome Speech (full version), by Nick Selby, Georgia Institute of Technology
- c. (27 Oct) How to Give a Good Research Talk, by Simon Peyton Jones (from his research skills page)  
 [Powerpoint] [handout] [paper] [two-page guide] [YouTube]
- d. (3 Nov) How to Give a Bad Talk, by David Patterson, University of California at Berkeley

- e. (for reference) Powerpoint Presentation Skills for Scientists, by Whitney Wiltshire, University of Mississippi Medical Center
  - f. (for reference) Giving an Academic Talk, by Jonathan Shewchuk, University of California at Berkeley
  - g. (for reference) How to Give a Talk, by Bruce Donald, Duke University
  - h. (for reference) Six Minute Speaking and Presentation Skills, by Andrew Dlugan
  - i. (for reference) COMM 101: Public Speaking, course at Saylor.org Academy
  - j. (for reference) LaTeX Beamer class for presentation slides (included in most LaTeX distributions)
    - A Beamer Quickstart, by Rouben Rostamian, University of Maryland Baltimore County
    - The Beamer Class: User Guide
28. (1 Nov) No class meeting. Work on annotated bibliography assignment
29. Critiquing example speeches
- a. (for reference) Speech Analysis Series, at Six Minute Speaking and Presentation Skills, by Andrew Dlugan  
[#1] [#2] [#3] [#4] [#5]
  - b. (30 Oct video, 3 Nov analysis) How to Speak: Lecture Tips from Patrick Henry Winston, Massachusetts Institute of Technology Note: This is an excellent lecture about giving an effective lecture! Although from 1997, it still has relevance today.  
[YouTube] [Vimeo]
  - c. (for reference) Last Lecture: Really Achieving Your Childhood Dreams, by Randy Pausch, Carnegie Mellon University  
[YouTube]
  - d. (for reference) Stanford Commencement Speech 2005, by Steve Jobs, Apple Computer  
[YouTube]
  - e. (for reference) The Best Stats You've Ever Seen, 2006 TED talk by Hans Rosling, Karolinska Institute and GapMinder Foundation  
[YouTube]
  - f. (for reference) The Art of Choosing, July 2010 TED talk by Sheena Iyengar, Columbia University (no critique)
30. Behaving ethically and professionally

- a. (8 Nov) Reading: Chapter 17 “Ethics” in Justin Zobel’s Writing for Computer Science, Third Edition
  - b. (6 Nov) Ethical Analysis Framework (from CSci 300)
  - c. (6 Nov) Drinking on the Job Case (from CSci 300)
  - d. (6 Nov) Research Ethics, from the Sociology, History, and the Philosophy of Science (SHiPS) Resource Center, University of Minnesota  
Discuss the ethical case studies.
  - e. (for reference) Online Ethics Center for Engineering and Science.  
(This site has a number of resources such as the Drinking on the Job case study.)
  - f. (8 Nov) Association for Computing Machinery (ACM) Code of Ethics.
  - g. (8 Nov) UM’s Institutional Review Board (IRB) “reviews all proposed research involving human subjects to ensure that subjects are treated ethically and that their rights and welfare are adequately protected.”
  - h. (for reference) ACM/IEEE-CS Software Engineering Code of Ethics and Professional Practice.
  - i. (for reference) IEEE Code of Ethics.
31. Considering how native language and culture affect our communication style and assumptions
- a. (TBD) The Art of Choosing, July 2010 TED talk by Sheena Iyengar, Columbia University
  - b. (for reference) Writing English as a Second Language, by William Zinsser (Point of Departure blog, American Scholar, Winter 2010)  
Note: We discussed linguistic, cultural, and political factors affecting English writing style of non-native speakers
  - c. (for reference) Making by Making Strange: Defamiliarization and the Design of Domestic Technologies, by Genevieve Bell, Mark Blythe, and Phoebe Sengers, ACM Transactions on Computer-Human Interaction (TOCHI) Vol. 12, No. 3, pp. 149-173, 2005
  - d. (for reference) COMM 311: Intercultural Communication, course at Saylor.org Academy
- 
32. (for reference) Lies, Damned Lies, and Scans presentation, linked from David Kriesel’s blog post titled “Xerox scanners/photocopiers randomly alter numbers in scanned documents”
33. (TBD) Exploring issues in computer science publication: Articles from Tagide: Software and Musings, a blog by Cristina (Crista) Videira Lopes

(University of California Irvine). These were mentioned but not discussed in depth.

- a. The Evolution of CS Papers, 8 February 2014
  - b. The Story of a Journal Proposal, 9 November 2013
  - c. Conferences vs. Journals: The Hidden Assumptions, 21 April 2013
  - d. Research in Programming Languages, 2 March 2012
34. (TBD) Discussing the maxim “Know the business” where the business is being a university faculty member
  35. (TBD) Discussing PhD and MS program requirements, history of the CIS PhD program, getting faculty jobs, and how success of academic departments is judged from various perspectives
  36. (TBD) Reviewing final project requirements and setting presentation schedule
  37. (4 Dec) Presenting Final Projects
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38. (Used in 2013 and 2014, not 2016) Writing grant proposal
    - a. Reading: “Grant Applications” section, pages 183-4, in Chapter 12 of Justin Zobel’s Writing for Computer Science, Third Edition
    - b. **Guest presentation on Grant Writing for Computer Scientists, by Jason Hale, Office of Research and Sponsored Programs (ORSP)** [2013 slides]
    - c. (for reference) How to Write a Great Research Proposal, by Simon Peyton Jones his research skills page [Powerpoint] [handout]
    - d. (for reference) How to Write a Grant Proposal for Industry, blog post by Matt Welsh, Google Software Engineer, former Computer Science professor at Harvard University, April 11, 2011
  39. (Used in 2013 and 2014, not 2016) Understanding the nature of research in computer science
    - a. Reading: Chapter 4 “Hypotheses, Questions, and Evidence” in Justin Zobel’s Writing for Computer Science, Third Edition
    - b. (for reference) Reading: Chapter 14 “Experimentation” in Justin Zobel’s Writing for Computer Science, Third Edition
    - c. A Criticism of Computer Science: Models or Modeles? blog post by Daniel Lemire

- d. What Makes Good Research in Software Engineering, by Mary Shaw (from International Journal of Software Tools for Technology Transfer (STTT), Springer, Vol. 4, pp. 1-7, 2002) [local copy]
  - e. (for reference) A Preliminary Analysis of the Products of HCI Research, using Pro Forma Abstracts, by William Newman (from Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 278-284, ACM, 1994) [local copy]
  - f. (for reference) Tutorial: Research Methods in Computer Science, by Serge Demeyer, University of Antwerp
  - g. (planned for 2014, but not used) Chapter 1 “Answering Questions: What is Science” in Answering Questions with Internet Data: Computational Tools for Social Studies Analysis, by Richard Catrambone and Mark Guzdial. Course notes for the Computational Freakonomics course at Georgia Tech [local copy] [local slides]
  - h. (for reference) Status of Empirical Research in Software Engineering, by Andreas Hofer and Walter Tichy, University of Karlsruhe (In Empirical Software Engineering Issues. Critical Assessment and Future Directions, pp. 10-19. Springer Berlin Heidelberg, 2007) [local copy]
  - i. (for reference) Empirical Research Methods in Computer Science 2005 course, by Noah Smith and David Smith, Johns Hopkins University
  - j. (Used 2013, but not 2014 or 2016) Three Paradigms of Computer Science Research, by Amnon H. Eden (from Minds and Machines, Vol. 17, No. 2, pp. 135-167, 2007) [local copy]  
Brief discussion on each paradigm focusing on methods, ontology, and epistemology
  - k. The Philosophy of Computer Science, Stanford Encyclopedia of Philosophy
40. (Used 2013, but not 2014 or 2016) Assessing papers quickly. In this in-class exercise each student examines an assigned paper for five to ten minutes, then reports to class what it is about
41. Using statistics, graphs, figures, and tables
- a. Reading: Chapter 11 “Graphs, Figures, and Tables,” in Justin Zobel’s textbook Writing for Computer Science, Third Edition
  - b. Reading: Chapter 14 “Experimentation” in Justin Zobel’s textbook Writing for Computer Science, Third Edition
  - c. Reading: Chapter 15 “Statistical Principles” in Justin Zobel’s textbook Writing for Computer Science, Third Edition
  - d. How to Lie with Statistics, by Darrell Huff (W. W. Norton, 1954)

- e. How to Lie, Cheat, Manipulate, and Mislead Using Statistics and Graphical Displays
  - f. How Not to Lie with Statistics: The Correct Way to Summarize Benchmark Results, by Philip J. Fleming and John J. Wallace (from CACM, vol. 29, no. 3, pp. 218-221, 1986) [local copy]
  - g. Producing Wrong Data Without Doing Anything Obviously Wrong! by Todd Mytkowicz, Amber Diwan, Mahtias Hauswirth, and Peter Sweeney (from ACM Sigplan Notices, vol. 44, no. 3, pp. 265-276, 2009) [local copy]
  - h. Six Simple Techniques for Presenting Data, Andrew Dlugan’s analysis of Hans Rosling’s 2006 TED talk “The Best Stats You’ve Ever Seen” [direct to video]
  - i. (for reference) Free courses or course materials on statistics
    - Probabilistic Systems Analysis and Applied Probability, John Tsitsiklis, Fall 2013 course 6.041SC (MIT OpenCourseWare: Massachusetts Institute of Technology)
    - Statistics and Visualization for Data Analysis and Inference, by Ed Vul and Mike Frank, January 2009 course RES.9-0002 (MIT OpenCourseWare: Massachusetts Institute of Technology) This courses focuses on statistics needed by behavioral science researchers.
    - CS 106/MA 121: Introduction to Statistics, course at Saylor.org Academy
    - MA 251: Statistics II, course at Saylor.org Academy
  - j. (for reference) Free books on statistics
    - Think Stats: Probability and Statistics for Programmers, by Allen Downey (O’Reilly, 2011)
    - Think Bayes: Bayesian Statistics Made Simple, by Allen Downey (O’Reilly, 2013)
42. Creating posters
- a. Creating Effective Posters, by George Hess, Kathryn Tosney, and Leon Liegel (hosted at North Carolina State University)
  - b. Poster Sessions, The Writing Studio at Colorado State University
  - c. Designing Conference Posters, by Colin Purrington
  - d. LaTeX poster templates: [LaTeX Templates site]] [Brian Amberg]
43. Searching for faculty, research, and advanced developer positions jobs



- a. Getting an Academic Job, by Michael Ernst, University of Washington, Computer Science
- b. Volatile and Decentralized blog posts by Matt Welsh, Google Software Engineer, former Computer Science professor at Harvard University
  - How to Get a Faculty Job, Part 1: The Application, December 9, 2012
  - How to Get a Faculty Job, Part 1b: How to Get an Interview, December 19, 2012
  - How to Get a Faculty Job, Part 2: The Interview, December 27, 2012
  - How to Get a Faculty Job, Part 3: Negotiating the Offer, January 3, 2013
  - Your Field Guide to Industrial Research Labs, January 21, 2014
  - Getting a Job at Google for PhD Students, January 30, 2014
- c. How to Interview for a Faculty Position (video)
- d. Reflections on My Tenure-track Assistant Professor Job Search, blog post by Philip Guo, April 2013
- e. How to Get a Teaching Job at a Liberal-Arts College, by Gary DeCoker, Chronicle of Higher Education, August 12, 2009  
Note: The reader comments give useful alternative perspectives.
- f. How to Get a Teaching Job at a Primarily Undergraduate Institution, by A. Malcolm Campbell, Davidson College; Omar A. Quintero, University of Richmond; and Jennifer Frederick, Yale University (American Society of Cell Biology, 2012)
- g. Curriculum Vitae, Colorado State University, The Writing Studio
- h. Curriculum Vitae, by Alison Doyle, About.com Job Searching
- i. Resume Tips for Computer Science Students, a blog post by Patrick Cozzi
- j. How to Write a Research Statement, by Michael Ernst, University of Washington, Computer Science
- k. Research Statement, University of Pennsylvania, Career Services
- l. Dr. Karen's Rules of the Research Statement, by Karen Kelsky, The Professor is In blog, August 30, 2012
- m. Writing a Winning Teaching Statement, Columbia University, Graduate School of Arts and Sciences Teaching Center

- n. How to Write a Statement of Teaching Philosophy, by Gabriella Montell, *The Chronicle of Higher Education*, March 27, 2003
  - o. Writing the Teaching Statement, by Rachel Narehood Austin, Bates College, *Chemistry*, in *Science*, April 14, 2006
  - p. The Dreaded Teaching Statement: Eight Pitfalls, by Karen Kelsky, *The Professor is In* blog, September 16, 2011
  - q. Writing a Statement of Teaching Philosophy for the Academic Job Search, by Chris O’Neal, Deborah Meizlish, and Matthew Kaplan, University of Michigan, Center for Research on Teaching and Learning
44. Teaching at the college level
- a. Teaching Ideas, Cornell University, Center for Teaching Excellence
  - b. Design and Teach a Course, Carnegie-Mellon University, Eberly Center for Teaching Excellence and Innovative Education
  - c. Best Practice Articles, University of North Carolina Charlotte, Center for Teaching and Learning
  - d. Strategies for Online Teaching, University of Michigan, Center for Research on Learning and Teaching
  - e. What Was It Like to Teach a MOOC? by Armando Fox, University of California Berkeley, EECS
  - f. University Teaching 101, Johns Hopkins University, Coursera MOOC
  - g. Revised Bloom’s taxonomy for designing learning objectives (Also see articles in listings at Cornell, Carnegie-Mellon, and UNC Charlotte above.)
    - A Model of Learning Objectives (interactive graphic), Iowa State University, Center for Excellence in Learning and Teaching
    - Bloom’s Digital Taxonomy, extensive explanation and application at the Educational Origami wiki on 21st Century Teaching and Learning
  - h. Tulane University document on Student Learning Outcomes
  - i. Auburn University’s ABET Outcomes Explained Using Bloom’s Taxonomy [local PDF]
  - j. Rubrics (Also see articles in listing at Cornell, Carnegie-Mellon, and UNC Charlotte above.)
    - Create Rubrics for Your Project-Based Learning Activities, Rubistar, a free tool to help teachers develop rubrics
    - Developing Rubrics, presentation by Gloria Rogers, Managing Director, Professional Services, ABET

- k. Constructivism in Computer Science Education, by Mordechai Ben-Ari, Weizmann Institute of Science (from Journal of Computers in Mathematics and Science Teaching, vol. 20, no. 1, pp. 45-73, 2001) [local copy]
  - l. The Torch or the Firehose: A Guide to Section Teaching, by Arthur Mattuck, Massachusetts Institute of Technology
  - m. Teaching Engineering, a book by Phillip C. Wankat and Frank S. Oreovicz, Purdue University
  - n. Teaching College-Level Science and Engineering, by Janet Rankin, Fall 2012 course 5.95J (MIT OpenCourseWare: Massachusetts Institute of Technology)
45. Locating computer science teaching and learning resources
- a. Ensemble Computing Portal, Connecting Computing Educators (sponsored by NSF)
  - b. Computer Science Open Educational Resources (OER)
  - c. Kinesthetic Learning Activities for Computer Science Education
  - d. Computer Science Unplugged
  - e. CS10K Community “seeks to have 10,000 well-trained computer science teachers in 10,000 high school across the United States.”
  - f. Computer Science Teaching Resources from the Exploring Computer Science (a program funded by the National Science Foundation, hosted at the University of California at Los Angeles)
  - g. CSTA Source Web Repository: K-12 Computer Science Teaching and Learning Materials, from the Computer Science Teachers Association (CSTA)
  - h. BootStrap project
  - i. Code.org
  - j. Free programming language textbooks (Prof. Cunningham’s list)
  - k. Finding Open Educational Resources, Open Professionals Education Network (OPEN)
  - l. Saylor.org Academy, courses in various fields, including computer science
  - m. Khan Academy]
  - n. MIT OpenCourseWare
  - o. Open CourseWare Consortium
  - p. Class Central, a Massive Open Online Course (MOOC) aggregator

q. Interaction Design Foundation, open educational materials

46. Reasoning

a. Prof. Cunningham's lecture notes developed for CSci 550 (Program Semantics and Derivation) or CSci 555 (Functional Programming)

- A Programmer's Introduction to Predicate Logic (CSci 550)
- Translating English into Predicates (CSci 550)
- Notes on Program Semantics and Derivation (CSci 550)
- Program Verification Heuristics (CSci 550)
- Notes on Functional Programming with Haskell (CSci 555) Chapters 2, 11, and 12 concern proofs of functional programs.

b. Gary Hardegree's online notes at the University of Massachusetts Amherst

- Symbolic Logic: A First Course (2nd Edition) (Phil 110)
- Symbolic Logic: A Second Course (Phil 310)
- Notes on the Philosophy of Science (Phil 382)
- Introduction to Modal Logic (Phil 511)
- Notes on Mathematical Logic (Phil 513)
- Compositional Semantics (Phil 595s)
- Set Theory (Phil 595t)

c. Online Materials for Introduction to Logic, by Rick Grush, University of California at San Diego

d. Saylor.org Academy

- PHIL 102: Logic and Critical Thinking, course at Saylor.org Academy
- CS 202: Discrete Structures, course at Saylor.org Academy

e. MIT OpenCourseWare

- Mathematics for Computer Science, Tom Leighton and Marten Dijk, Fall 2010 course 6.042J (MIT OpenCourseWare: Massachusetts Institute of Technology) [textbook]  
Note: Section I on Proofs (first 8 of 21 chapters) is especially relevant to mathematical/logical reasoning.
- Street-Fighting Mathematics, by Sanjoy Mahajan, January 2008 course 18.098 (MIT OpenCourseWare: Massachusetts Institute of Technology)

- f. How to Write a Proof, by Leslie Lamport (American Mathematical Monthly, vol. 102, no. 7, pp. 600-608, August-September 1995)

47. Miscellaneous

- a. How to Get a Paper Accepted at OOPSLA, a panel discussion by Ralph E. Johnson, Kent Beck, Grady Booch, William Cook, Richard Gabriel, and Rebecca Wirfs-Brock (from SIGPLAN Notices Vol. 28, No. 10, pp. 429-436, October 1993) [local copy]
- b. The Coming-of-Age of Software Architecture Research, by Mary Shaw (from Proceedings of the 23rd International Conference on Software Engineering, IEEE Computer Society, 2001) [local copy]
- c. Writing Good Software Engineering Research Papers: Minitutorial, by Mary Shaw (from Proceedings of the 25th International Conference on Software Engineering, IEEE Computer Society, 2003) [local copy]
- d. How (and How Not) to Write a Good Systems Paper, by Roy Levin and David Redell (from ACM SIGOPS Operating Systems Review, Vol. 17, No. 3, pp. 35-40, July, 1983) [local copy]