Class Handouts; Exploration Project

The following readings have been selected as relatively clear and concise summary articles for specific topics. There is no textbook for the class. Of course, all students are expected to access the Internet to find additional information for any topic.

There will be a lot of reading material, and some of it will be fairly technical. Students are expected to read all of the class handouts before class. Students should scan each of the articles, read and study parts which are of interest, and ask questions in class about unclear areas.

In-Depth Exploration Project

Each student will explore in depth one particular topic, and report to the class their experiences while learning about that topic. The presentation should be a chronicle of experiences while exploring the topic, including high and low points, confusions, learnings, false paths, discovered treasures, treacherous territories, and an overall evaluation of the utility of the topic.

Efforts solely to impress the instructor or to generate a pretty report should be avoided. Efforts to clarify the ideas of the topic are encouraged, however, students will not be responsible for teaching the content of a topic to the class. Students who locate particularly good or interesting articles on a topic are encouraged to add these articles (or websites) to the class reading list.

Handouts

WEEK 1:

ClassNotes 1: Course Information, Variety of Formal Methods, References, Web Pointers

ClassNotes 2: Modeling with Logic, Proof Techniques, Quantification, Complexity, Boundary Techniques

ClassNotes 3: Proof Techniques Extended Example

Stuart Shapiro, Ed. (1987) *Encyclopedia of Artificial Intelligence*, Wiley
Articles on Pattern Matching, Predicate Logic, and Theorem Proving

John Lucas (1990) *Introduction to Abstract Mathematics Second Edition*
Ch 2 Mathematical Proof

David Gries (1981) *The Science of Programming*, Springer-Verlag
Part 0: Why Use Logic? Why Prove Programs Correct?

Randy Katz (1994) Contemporary Logic Design, Cummings
Figures from front cover

WEEK 2:

ClassNotes 4: Syllabus

ClassNotes 5: Handouts, Exploration Project

ClassNotes 6: Evolution of Tools

ClassNotes 7: Pattern Encoding

Jonathan Bowen (1996) Ten Commandments of Formal Methods
Oxford University Computing Lab Technical Memo
see http://www.comlab.ox.ac.uk/oucl/people/jonathan.bowen.html

William Bricken (1987) *Analyzing Errors in Elementary Mathematics,* Stanford University
Appendix I: The Canons of Formal Symbol Systems

Matt Kaufmann (1987) Skolemization explained simply,
Computational Logic Inc Internal Note #27

Peter Burke (1987) Naming and Knowledge, UCLA Computer Science Dept.

WEEK 3:

ClassNotes 8: Combinational Minimization Exercise

Bertram Meyer (1985) On Formalism in Specifications,
in *IEEE Software* 1/85

Thomas L. Floyd (1998) *Digital Fundamentals Fifth Edition*, Prentice-Hall
4.11 Digital System Application, The 7-Segment Display

Giovanni DeMicheli (1994) *Synthesis and Optimization of Digital Circuits*, McGraw-Hill
Ch 8 Multiple-level Combinational Logic Optimization

John Oldfield and Richard Korf (1995) *Field-Programmable Gate Arrays*, Wiley
Ch 4. Design Process Flows and Software Tools

WEEK 4:

ClassNotes 9: Domain Theories, Strings, Trees, Sets, Rational Numbers

ClassNotes 10: Induction and Recursion

Jean-Pierre Banatre and Daniel LeMetayer (1993) Programming by Multiset Transformation,
in *CACM* V36(1), 1/93

WEEK 5:

ClassNotes 10: Program Verification

ClassNotes 11: Mathematica

Stephen Wolfram (1996) *The Mathematica Book Third Edition*, Wolfram Media
A Tour of Mathematica, 2.3 Patterns,
Mathematica as a Programming Language (from Second Edition)

WEEK 6:

William Bricken (1994) Pattern-Matching and Function Theory,
Oz Incorporated Technical Memo

John Backus (1977) Turing Award Lecture: Can Programming be Liberated from the VonNeumann Style? A Functional Style and Its Algebra of Programs

J. Barkley Rosser (1984) Highlights of the History of Lambda-Calculus,
in *Annals of the History of Computing* V6(4) 10/84.

Guy Cousineau (1990) The Categorical Abstract Machine,
in Gerard Huet (Ed) *Logical Foundations of Functional Programming*, Addison-Wesley

WEEK 7:

ClassNotes 12: Relational Algebra

Peter Gray (1984) Logic, Algebra and Databases, Ellis Horwood
Ch 6 The Relational Model

J. Hoffman (1997) Introduction to Structured Query Language
http://w3.one.net/~jhoffman/sqltut.htm

WEEK 8:

William Bricken (1983) Fractal Dimensions, Atari Systems Research Internal Memo

Richard Feynman (1996) *Feynman Lectures on Computation*, Addison-Wesley
2.3, 5.4, 5.5 On Reversible Computation

WEEKS 9 and 10:

ClassNotes 13: Summary, Philosophical Dilemmas