These messages were sent to students in the class during Week 7 of the previous term.

Message 2

This is a follow-up to the email that I sent you yesterday concerning the textbook, emphases, difficulty level, and prerequisite background needed for the winter term 474 course.

Quiz (due oat first class meeting) The promised quiz is attached, both as a Word document and a PDF. You can either print it and complete it by hand or complete it electronically and then print it. Either way, you should bring your completed quiz to the first class meeting. One of the purposes of the quiz is to make sure that you get the textbook(new, used, or electronic) before the class begins. If you want to make arrangements to share the textbook with another student, that is fine with me; exams will be closed-book (but you will be allowed to bring a sheet of paper with notes), so textbook sharing with a student in the other 474 section should be okay.

Including logical symbols in Word (and other MS Office) documents. You can use Insert > Symbol … from the Word menu. I find this tedious, however, and I often find it easier to just enter the Unicode directly. This page (http://symbolcodes.tlt.psu.edu/bylanguage/mathchart.html) gives the Unicode values for common math symbols. In Word (Or PowerPoint, Outlook, etc.), type the code, then do Alt-X (hold down Alt and press X). For example, the key sequence 2200Alt-X results in the ∀ character.

Message 1

----- The message from yesterday --------

Important note: This message will be followed (possibly tomorrow) by a message entitled "MA/CSSE 474 Assignment due at the beginning of Day 1 Class". This assignment will ask you to read the first 45 pages of Appendix of the textbook, which reviews they prerequisite mathematical background needed for this course. Then you should complete a quiz over the basics of that material. How long the reading will take you depends on how much you recall form Discrete Math 1 and 2; I estimate that most students will need 2-5 hours. In addition to the reading time, I estimate that you will need 1-2 hours to complete the quiz. In order to do this assignment, **it will be necessary for you to procure the textbook well in advance of the start of the course**. As of today, you have **four weeks** to get the book, read the appendix, and complete the quiz.

Why give an assignment that must be done before the course begins? In the past we have had to spend too much class time on material that you are supposed to know before you get there. I want you to come into the course being aware of any prerequisite deficiencies and with a plan to do what it takes to overcome them.

Automata, Computability and Complexity: Theory and Applications

Elaine A. Rich

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Format: Cloth; 1120 pp

You can buy this textbook directly from the publisher (http://www.pearsonhighered.com/educator/product/Automata-Computability-and-Complexity-Theory-and-Applications/9780132288064.page), at the Rose-Hulman bookstore, on Amazon, or wherever you wish. **You can also get the book electronically through http://coursesmart.com .**

I think this is a very enlightening and relevant course. As the name implies, it is a theory course. There are many applications of this theory, and I chose a textbook that talks about many of them, but the theory itself will be the emphasis of this course. It is no accident that this course can be taken with either a MA number or a CSSE number. It really is a mathematical study of computation. How do we model computation mathematically so we can formally prove properties of computation? Given a specific model, what kinds of computations can be done, and which ones can't be done?

I believe that this course (required for CS majors) has some things in common with the Functions of a Real Variable course (required for Math majors):

* It is probably the most intellectually challenging course in the department. In my opinion, it is much tougher than PLC, Design and Analysis of Algorithms, or Formal Methods.
* It is where you REALLY learn to do complex proofs (or you die!).
* A high percentage of the HW and exam problems require you to do proofs.
* Many of the results are counter-intuitive.
* Notation and terminology are crucial to understanding and communicating about the material.
* The material is quite cumulative. If you get behind on understanding one segment of the course, you may be lost in the next segment.
* Students who don't do the reading and problems, make sure they understand it, and focus carefully on the notation and terminology form the beginning usually have to repeat the course.

Despite the difficulty level, Historically all but a few students treat the course very seriously from the beginning and end up with a good understanding and a good grade.
The main background for this course is from the two discrete math courses (MA 275 is probably more important than 375). For some of you, it has been a long time since you took those courses, or perhaps you did not understand that material very well when you took them.

The Rich book has help for you in Appendix A (Sections 1-7, about 45 pages). Appendix A is a review of the Mathematics needed to understand this textbook. I suggest that you read it carefully before the course starts. Almost all of this appendix should be things that you saw in Disco I & 2 courses. But there may be some things that were not emphasized by your instructor or that did not stick in your long-term memory. And it is good to get into this author's use of terminology, etc. before reading the book. Pay special attention to the section on proof techniques.

The contents of that appendix are approximately the background that I expect you to have as you come into this course. We will spend a little bit of time at the beginning of the course reviewing some highlights of Appendix A. I suggest that you look carefully at Appendix A before the course starts, and if there is a lot of material that is new or hazy to you, spend some time on it before the course begins.

You will be doing a number of proofs, including proofs by induction. If your previous courses did not bring you to a high comfort level with writing inductive proofs, I especially recommend that you work on that before the course begins. Many of the other proof techniques from Appendix A will be useful for the course also, so you should review all of them.

To give you an idea of whether you need to do some reviewing in order to be able to get a good start in the course, I am listing some of the topics from Appendix A. If a *few* of them are fuzzy or unfamiliar, a little extra work after the term starts should suffice to catch you up. If a *lot* of them are fuzzy or unfamiliar, you really ought to carefully read this appendix before the term begins.

- Logic
  - Boolean propositional logic
    - Well-formed formulas and propositions
    - Truth tables
    - Axioms and proofs
    - Modus ponens, modus tolens
  - First-order logic
    - Predicates, terms, expressions, free and bound variables,
    - Universal and existential quantifiers
    - Interpretations and models; valid, satisfiable, and unsatisfiable formulas
    - Quantifier exchange, universal instantiation, existential generalization Sets
  - Enumeration of a set
  - Finite, countable, and uncountably infinite sets
  - Subset, intersection, union, difference, power set
  - Partitions of a set
- Relations
  - Cartesian Product of two sets
  - Inverse of a relation, graph of a relation
  - Reflexive, transitive, symmetric, antisymmetric, equivalence relation, equivalence classes
  - Orderings and partial orderings
- Functions
  - Domain, range, arity, total and partial functions
  - Commutativity, associativity, distributivity, identity, inverse elements
  - One-to-one and onto functions
- Closures
  - What it means for a set to be closed under a property
  - Transitive and reflexive closures
  - Closure under functions
- Proof techniques.
  - Proof by:
    - Construction
    - Contradiction
    - Counterexample
    - Case Enumeration
    - Mathematical induction
    - Pigeonhole principle
  - Showing that two sets are equal
  - Showing that a set is finite or countably infinite
  - Diagonalization: Showing that a set is uncountable (this is not a prerequisite for 474)
  - Analyzing complexity (big-O and its cousins)

You should also read pages xii-xv in the preface.

The first reading assignment over new material after the course starts: You should read Chapters 1 and 2 (both are very short) before session 2 of the course.

More details about course requirements, due dates, etc. will be available on or before December 1 .

I look forward to working with you next term.

Claude Anderson