COMP 163: Discrete Structures (Section 001)
Fall 2013 Course Information & Syllabus

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Lectures: MWF 10:25 – 11:15 am in IES-110.
Sometimes lecture notes or a summary may be available on the web. Other than that, if you have to miss a class, get notes from another student; mine are typically pieced together from more than one place with a lot of metacomments, which makes it hard for anybody but me to follow them. Also get copies of any missed handouts (available on the web site). The handouts are numbered sequentially, starting with handout 0. On handout 0, you need to fill in some information and return it to me promptly so you can be on the email list and get access to the web site for the course.

Office Hours: In LH-104: Mon./Wed./Fri. 11:30am–1:00 pm.
These are the guaranteed times to find me except as announced in advance. You should also feel free to look for me at other times or make appointments.

Course Objectives: This course covers elements of discrete mathematics relevant to the design of computer hardware and software and especially to the design and analysis of algorithms. Topics to be covered include logic, sets, functions, relations, induction, modular arithmetic, elementary combinatorics, graphs and trees, elementary probability, boolean algebra, and finite-state machines. We will also cover asymptotic notation and recurrences and use these tools to analyze a few algorithms for fundamental computing tasks.

Prerequisites: None (but facility with basic high school mathematics is expected).

Textbook: Richard Johnsonbaugh. *Discrete Mathematics*. Pearson Prentice Hall, seventh edition, 2009.

Course Requirements: There will be several homework assignments, four tests, and a final. The weightings within the semester grade will be: Homework: 22%, Tests 1–4: 12% each, and Final exam: 30%.

Homework: Only homework turned in by the due date is guaranteed to be graded. Any special circumstances that cause difficulty in meeting the deadlines should be brought to the attention of the instructor in advance. Homework must be handed in at the beginning of class, since solutions may be discussed in the same class on occasion. Homework will generally be submitted through a specified online mechanism. Anything that does get submitted on paper would need to go under the door of my office before class.

Exams: The schedule tentatively calls for four 50 minute tests in week 4, week 7, week 10, and week 14. The final exam is scheduled for 9:00–11:00am on Monday, December 9.

Collaboration: *No* collaboration is permitted on exams. *Collaboration* on homework is acceptable, but *copying* is not! (Safeguard your files and printouts.) You may discuss solution techniques with other students, but you must write up your solutions independently. If you obtain a solution through research, e.g., in the library, credit your source and write up the solution in your own words.

Tentative Course Outline and Approximate Schedule:

Recommended readings from the text are shown on a weekly basis. (When selected sections or subsections are listed, it is assumed that you will include the introduction of the corresponding chapter or section.)

1. (8/26) Administrivia. Logic and Proofs. Sections 1.2–6 and 2.1–2.
2. (9/4) Nested quantifiers review. Induction. Sections 2.4–5.
3. (9/9) Sets. Section 1.1. Sequences & Strings. Sections 3.2. Review for Exam I.
4. (9/16) Relations. Sections 3.3–4. Exam I (Friday) on Sections 1.2–6, 2.1–2, and 2.4.
5. (9/23) Functions, modular arithmetic. Section 3.1.
6. (9/30) Elementary algorithms. Sections 4.1–2. Analysis of algorithms. Section 4.3. Review for Exam II.
7. (10/9) Exam II (Wednesday) on Sections 1.1 and 3.1–4. Recursive algorithms, Fibonacci numbers. Section 4.4. Euclidean algorithm. Sections 5.1 and 5.3. (The beginning of Section 5.2 through Figure 5.2.2 is also good basic material to be familiar with; COMP 264 covers most of the material in Section 5.2 and more.)
8. (10/14) Counting principles, permutations and combinations. Sections 6.1–2. Generalized permutations. Section 6.3 before Example 6.3.4. Binomial coefficients, pigeonhole principle. Sections 6.7–8.
9. (10/21) Inclusion and exclusion (not directly in text). Discrete probability. Sections 6.5–6 prior to "Conditional Probability". Review for Exam III.
10. (10/28) Exam III (Wednesday) on Chapters 4–6 except probability. Recurrence relations and solution methods. Sections 7.1–2.
11. (11/4) Using recurrences for analysis of algorithms. Section 7.3. Start on graphs.
12. (11/11) Graphs. Sections 8.1–2 and 8.5. Trees. Sections 9.1–3.
13. (11/18) Review for Exam IV.
14. (11/25) Exam IV (Monday) on Sections 6.5–6 and Chapters 7–8. Combinatorial circuits and Boolean Algebras. Sections 11.1–4.
15. (12/2) Finite-state machines. Sections 12.1–2. Turing machines, undecidability of the halting problem. Not in text. Review for final exam.

Essential and Important IDEA Objectives:

In accordance with the new IDEA course evaluation system being introduced this semester, the following are the most important learning objectives:

Essential:

- Learning fundamental principles, generalizations, or theories

Important:

- Gaining factual knowledge (terminology, classifications, methods, trends)
- Learning to apply course material (to improve thinking, problem solving, and decisions)
- Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course.

Core Learning Outcomes:

This course contributes towards the following QUANTITATIVE ANALYSIS Knowledge Area Learning Objectives:

- Represent and interpret quantitative information symbolically, graphically, numerically, verbally, and in written form.
- Recognize the limitations of mathematical and statistical models.
- Develop an understanding of the nature and history of mathematics, its role in scientific inquiry and technological progress, and its importance in dealing with issues in the public realm.
- Develop an understanding of the rudiments of statistics, including sampling and hypothesis testing, and the uses of statistical reasoning in everyday life.

This course supports the following Skill Area Learning Objectives:

QUANTITATIVE AND QUALITATIVE ANALYSIS AND RESEARCH METHODS

- Represent and interpret quantitative information symbolically, graphically, numerically, verbally, and in written form.
- Recognize the power and limitations of mathematical and statistical models.
- Develop an understanding of the nature and history of mathematics, its role in scientific inquiry and technological progress, and its importance in dealing with issues in the public realm.
- Develop an understanding of the rudiments of statistics, including sampling and hypothesis testing, and the uses of statistical reasoning in everyday life.

TECHNOLOGICAL LITERACY

- Demonstrate knowledge of the operation, application, and limitations of technologies important to his/her discipline.
- Select tools of technology appropriately in decision-making or to solve a problem.

CRITICAL THINKING SKILLS AND DISPOSITIONS

- Analyze relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express beliefs, judgments, experience, reasons, information, or opinions.