CS 64 Discrete Structures Fall 2009
Course Syllabus

Instructor: Robert R. Snapp, email: `snapp@cs.uvm.edu`, office: 353 Votey, phone: 802–656–0735.

Office Hours: Tue 1:30–2:30 PM, Wed 1:30–3:00 PM, Fri 10:00–11:00 AM, and by appointment.

Teaching Assistant: Tianyu Cao, office & office hrs., *TBA*, email: `Tianyu.Cao@uvm.edu`.

Lectures: MWF, 4:05 – 4:55 p.m. in 209 Votey Hall.

Web Page: `www.cs.uvm.edu/~snapp/cs64/`

Description: Introduction to analytic and formal methods of computer science with practical examples, including analysis of data structures, recursion relations, proof methods, and logic programming.

Corequisites: One semester of programming and Math 20 or 22.

Textbooks: Most of the course will be based on two books which can be downloaded from the world-wide web (links are available on the CS64 course web site):

I. Edward A. Bender and S. Gill Williamson, *A Short Course in Discrete Mathematics*, Dover, Mineola, NY, 2005, (248 pages).

II. Edward A. Bender and S. Gill Williamson, *Mathematics for Algorithm and Systems Analysis*, Dover, Mineola, NY, 2005, (248 pages).

Time permitting, we will also study portions of

III. Charles Petzold, *The Annotated Turing: A Guided Tour through Alan Turing's Historic Paper on Computatbility and the Turing Machine*, Wiley, New York, 2008, (372 pages),

which should be available at the UVM University Bookstore.

Grading Policy: The final letter grade you receive on your transcript will be an absolute measure of your achievement and understanding, as follows:

Percentage	Grade	Percentage	Grade
98 – 100	A+	78 – 79	C+
92 – 97	A	72 – 77	C
90 – 91	A–	70 – 71	C–
88 – 89	B+	68 – 69	D+
82 – 87	B	62 – 67	D
80 – 81	B–	60 – 61	D–
		0 – 59	F

The course grade will be based on

- graded homework (20%),
- quizzes (20%, after dropping the lowest quiz),
- first midterm exam (15%),
- second midterm exam (15%), and the
- final exam (30%).

Homework: Homework exercises will be assigned and collected on a weekly basis. Late homework will be penalized 20% credit per calendar day.

Quizzes: An unknown number of "pop" quizzes will be given during the term. Each quiz will consist of one or two short exercises that are usually similar to recent homework problems. The lowest quiz grade will be dropped. There will be no make-ups for missed quizzes.

Midterm Exams: Two midterm exams will be given in class: the first, on Wednesday, ***October 7***; and the second, on Friday, ***November 13***. The material covered on each exam will be announced one week in advance.

Final Exam: The final exam for this course is scheduled for 3:30–6:30 PM, Friday, ***December 18, 2009***.

Students entitled to special accommodation must notify the instructor by the second week of the semester.

Collaboration: You are *encouraged* to share your knowledge, discoveries, and ideas with other students outside of class. However, all work (e.g., ideas, opinions, analyses, algorithms, data, etc.) generated by others should be properly cited, preferably with an archival source (e.g., a printed book or a peer-reviewed article). In general, sources that appear only on the internet (such as *Wikipedia*) are not sufficient. Every phrase that is not your own should appear between quotation marks, with a footnote or end-note that indicates the source.

Do not plagiarize. Do not cheat. Do not collude. Do not fabricate. Absolutely no collaboration or unauthorized material is allowed during any quiz or exam. All violations will be forwarded to the University Coordinator of Academic Honesty, following the *new* policy of Academic Integrity posted at

`www.uvm.edu/~uvmppg/ppg/student/acadintegrity.pdf`

The first deliberate violation of academic integrity by an undergraduate normally results in a course grade of XF; the second, with a second XF and expulsion.

Etiquette: The the use of cell phones or other personal electronic devices (MP3s, iPods, radios, etc.) is not allowed. *Absolutely no calculators, laptops, phones, or other electronic devices are allowed during quizzes or exams.*

Religious Holidays: An official policy of the University of Vermont states:

> Students have the right to practice the religion of their choice. Each semester students should submit in writing to their instructors by the end of the second full week of classes their documented religious holiday schedule for the semester. Faculty must permit students who miss work for the purpose of religious observance to make up this work.

Topics

The number (under n) in the second column estimates the number of lectures allocated to each topic. In the fourth column, the Roman numeral **I** refers to the first textbook, Edward A. Bender and S. Gill Williamson, *A Short Course in Discrete Mathematics*, Dover, Mineola, NY, 2005, which is available from the URL,

`http://math.ucsd.edu/~ebender/DiscreteText1/index.html`

Likewise, Roman numeral **II** refers to the second textbook, Edward A. Bender and S. Gill Williamson, *Mathematics for Algorithm and Systems Analysis*, Dover, Mineola, NY, 2005, which is available from the URL,

`http://math.ucsd.edu/~ebender/DiscreteText2/index.html`,

and **III** refers to the third book, Charles Petzold, *The Annotated Turing: A Guided Tour through Alan Turing's Historic Paper on Computatbility and the Turing Machine*, Wiley, New York, 2008.

Thus, the first reading assignment "**I**:BF1," designates Unit BF, Section 1, in *A Short Course in Discrete Mathematics*; and the reading assignment for Counting Tricks, "**I**:89–92, **II**:CL1,CL2," designates pages 89–92 of *A Short Course in Discrete Mathematics*, followed by Sections 1 and 2 of Unit CL in *Mathematics for Algorithm and System Analysis*.

N.B., The following sequence of topics, and assigned reading, may be modified during the course of the semester.

TOPIC	n	DESCRIPTION	READING
Introduction	1	Why are formal methods are necessary?	
Boolean Functions	2	Definitions, truth tables, algebraic rules, DeMorgan's laws, Disjunctive Normal Form (DNF), Conjunctive Normal Form (CNF), Boolean circuits, Karnaugh maps, parity.	**I**:BF1
Computer Arithmetic	1	Radix arithmetic (base 2, 8, 10, 16, etc.), 1's and 2's complement.	**I**:BF2
Propositional Logic	2	Symbolic logic, connectives, truth tables (again!), proofs of equivalence.	**I**:Lo1
Predicate Logic	2	Predicates, variables, quantifiers ($\forall, \exists$).	**I**:Lo2
Proof Strategies	2	Rules of inference, on the nature of proofs, logic programming.	*TBA*
Set Theory	2	Set definitions of sets, subsets, partitions, power sets, set algebra, DeMorgan's law, Venn diagrams, proofs.	**I**:SF1, **II**:CL3
Functions	2	Definition of functions, hash functions, permutation operations.	**I**:SF2, **II**:Fn1,Fn2
Counting Tricks	3	Sum and product principles, permutations, combinations, binomial coefficients, Pascal's triangle, multisets, multinomial coefficients. Bell & Stirling numbers.	**I**:89–92, **II**:CL1,CL2
Number Theory	2	prime vs. composite, modulus arithmetic, gcd, Euclid's algorithm, infinity of primes, perfect squares, irrationality of $\sqrt{2}$, floor, ceiling, diagonalization proofs.	**I**:NT1
Cryptography	2	Public key, discrete logarithms, RSA algorithm.	**I**:NT2
Induction	3	Mathematical induction, strong induction, geometric series, linear recurrences, Tower of Hanoi.	**I**:IS1,IS2
Graph Theory	3	Graphs, subgraphs, paths, trees, etc.	**II**:GT1,GT2,GT3
Rates of Growth	2	Analysis of algorithms, Master theorem.	**II**:GT4
Turing Machines	6	Introduction to computability and Turing's model of computation.	**III**:57–298