BOSTON UNIVERSITY
Metropolitan College

MET CS 248 – *Introduction to Computational Theory and Discrete Mathematics*

INSTRUCTOR Sven Skoog Manager – R101 UNIX Infrastructure, the MITRE Corporation

781.271.4891 (wk) sskoog@mitre.org
781.891.5523 (hm) sskoog@gweep.net <-- *preferred for class correspondence*
781.258.1159 (cell) sskoog@comcast.net

OBJECTIVE(s) This course will introduce students to classical and modern-day algorithms and approaches involving sets and counting theory, first-order propositional and Boolean logic, relations and functions, combinatorial and probability theory, graph theory, finite state automata, and other aspects of discrete mathematical theory. Real-world applications (compression, encryption, gated circuits, possibly others) will be tied in if/as appropriate.

Upon successful completion of this course, a student will (hopefully) get some glimpse of 'the man behind the curtain' – that is, a sense for the algorithms and structures at work behind commercial and custom tools/technologies in the workplace (databases, networking/telecom, etc.), as well as some sense for their underlying architecture and operation. Whereas this course will not incorporate hands-on design/programming assignments *per se*, the source material *will* impart additional means of replicating/reverse-engineering/troubleshooting those programs (besides brute-force debugging).

PREREQUISITE Only high-school algebra or equivalent background is required; realistically, some degree of mathematical sophistication (proofs, etc.) would be helpful. It is worth noting here that discrete math, moreso than perhaps any other computing curriculum, is a field where additional references can be invaluable (in the event that one proves incomplete/badly written/difficult to understand) – see instructor's recommendations below if you get stuck.

MATERIALS ***Discrete and Combinatorial Mathematics***, Ralph P. Grimaldi: Addison Wesley Longman, 2002, ISBN #0-201-19912-2. (Fifth Edition. Required. An "intermediate" textbook.)

Discrete Mathematics and its Applications, Kenneth H. Rosen: McGraw Hill, 1999. ISBN #0-07-289905-0. (A detailed, older text. More difficult to read. Very in-depth.)

Introduction to Discrete Mathematics, McEliece, Ash, and Ash: Random House, 1995, ISBN #0-07-100202-2. (Very easy/friendly reading. Out of print, newer editions???)

COURSEWORK Class sessions will be conducted through traditional lecture/discussion format, with supplementary pencil-and-paper assignments and formal papers/examinations. Extra credit assignments (i.e., projects/presentations) are traditionally difficult to put together with this kind of material, but we'll see what (if anything) we can do later in the term.

Homework ……	40% (6 – 8 assignments)
Midterm Exam ……	25%
Final Exam ……..	30%
Miscellaneous (class participation, extra homework, other) ….	5%

Unless otherwise noted, weekly assignments/projects are deliverable no later than 9:00 pm EST on the evening they are due. (Submit your work in timestamped FAX or email-attachment format if you will not be in attendance that night!) Extensions/makeups for missed assignments, examinations, and/or projects may be arranged *if and only if instructor consent is solicited beforehand*. (In general I will bend over backwards to help you in such cases, but *only* if you give me advance notification.) Assignments may be accepted after deadline with a 20%-to-50% credit deduction, situation-dependent.

The midterm and/or final examination(s) may be redefined/replaced by a takehome exam/ project so as to better distribute/schedule in-class lecture/content, at the instructor's option.

SCHEDULE *(very tentative)*	Session One	(4 September)	Introduction/Administrivia Mathematical Review Abstract/Survey of Topics
	Session Two	(11 September)	Logic – Propositions and Predicates Aside: Analysis of Algorithms Mathematical Rigor: Proofs
	Session Three	(18 September)	Set Theory: Counting, Inclusion/Exclusion Aside: Recursion, Recurrence Relations Proof by Induction
	Session Four	(25 September)	Permutations and Combinations Boolean Algebra, Sum-of-Products Gated Logic, Circuits, Karnaugh Maps
	Session Five	(2 October)	Functions and Relations Algorithmic/"Greedy"/Numeric Game Theory Sequences and Summations
	Session Six	(9 October)	Matrix Theory: Linear Algebra Midterm Review
	Session Seven	(16 October)	Midterm Examination
	Session Eight	(23 October)	Number Theory: Fermat and Sun Tzu Asides: Random Numbers, RSA Encryption Modulo Congruences, Properties of Primes
	Session Nine	(30 October)	Graph Theory – Directed/Undirected Search/Traversal: Breadth-First, Depth-First Circuits and Paths: Euler, Hamilton, Dijkstra
	Session Ten	(6 November)	Trees: Binary Search Trees Trees: Infix, Prefix, Postfix Traversal Trees: Red-Black, B-Trees, Advanced Uses
	Session Eleven	(13 November)	Languages and Grammars Hash Tables: Hashing Algorithms, Chaining Finite State Machines, Regular Expressions
	Session Twelve	(20 November)	Language Theory Revisited Advanced Topic: Searching and Sorting Advanced Topic: Turing, Halting Problem
	Fall Break	*((week of) 27 November)*	*(Make fun of instructor, go to Vermont, etc.)*
	Session Thirteen	(4 December)	Extra Credit Presentations Special Topics / Catch-Up Final Review
	Session Fourteen	(11 December)	Final Examination Instruction Ends