NEW YORK CITY COLLEGE OF TECHNOLOGY
The City University of New York

DEPARTMENT:	Mathematics
COURSE:	MAT 2440
TITLE:	Discrete Structures and Algorithms I
DESCRIPTION:	This course introduces the foundations of discrete mathematics as they apply to computer science, focusing on providing a solid theoretical foundation for further work. Topics include functions, relations, sets, simple proof techniques, Boolean algebra, propositional logic, elementary number theory, writing, analyzing and testing algorithms.
TEXT:	Discrete Mathematics and its Applications, 7th edition Kenneth H. Rosen McGraw-Hill
CREDITS:	3 (2 class hours, 2 lab hours)
PREREQUISITES:	CST 2403 and MAT 1375
	Prepared by Prof. A. P. Taraporevala Fall 2011

A. Testing Guidelines:
The following exams should be scheduled:
1. A one-hour exam at the end of the First Quarter.
2. A one session exam at the end of the Second Quarter.
3. A one-hour exam at the end of the Third Quarter.
4. A one session Final Examination.

B. A Computer Algebra System (CAS) is used in class and for assignments (suggested problems are marked with an asterisk). This is a writing intensive course.

Course Intended Learning Outcomes/Assessment Methods

Learning Outcomes	Assessment Methods
1. use the rules of logic to understand mathematical statements and prove propositions using • A direct proof. • An indirect proof. • A proof by contradiction. • Mathematical induction.	Classroom activities and discussion, homework, exams.
2. Write simple algorithms using pseudocode.	Classroom activities and discussion, homework, exams.
3. • Traverse trees. • Represent an expression using a binary tree and write it in prefix, postfix, and infix notation. • Build spanning trees.	Classroom activities and discussion, homework, exams.
4. Use computer technology to assist in the above.	Classroom activities and discussion, homework, exams.

General Education Learning Outcomes/Assessment Methods

Learning Outcomes	Assessment Methods
1. Gather, interpret, evaluate, and apply information discerningly from a variety of sources.	Classroom activities and discussion, homework, exams.
2. Understand and employ both quantitative and qualitative analysis to solve problems.	Classroom activities and discussion, homework, exams.
3. Employ scientific reasoning and logical thinking.	Classroom activities and discussion, homework, exams.
4. Communicate effectively using written and oral means.	Classroom activities and discussion, homework, exams.
5. Utilize computer based technology in accessing information, solving problems and communicating.	Classroom activities and discussion, homework, exams.
6. Work with teams. Build consensus and use creativity.	Classroom activities and discussion, homework.
7. Acquire tools for lifelong learning.	Classroom activities and discussion, homework, exams.

Mathematics Department Policy on Lateness/Absence

A student may be absent during the semester without penalty for 10% of the class instructional sessions. Therefore,

If the class meets:	The allowable absence is:
1 time per week	2 absences per semester
2 times per week	3 absences per semester

Students who have been **excessively absent and failed the course at the end of the semester will receive either**

- the WU grade if they have attended the course at least once. This includes students who stop attending without officially withdrawing from the course.
- the WN grade if they have never attended the course.

In credit bearing courses, the WU and WN grades count as an F in the computation of the GPA. While WU and WN grades in non-credit developmental courses do not count in the GPA, the WU grade does count toward the limit of 2 attempts for a developmental course.

The official Mathematics Department policy is that two latenesses (this includes arriving late or leaving early) is equivalent to one absence.

Every withdrawal (official or unofficial) can affect a student's financial aid status, because withdrawal from a course will change the number of credits or equated credits that are counted toward financial aid.

New York City College of Technology Policy on Academic Integrity

Students and all others who work with information, ideas, texts, images, music, inventions, and other intellectual property owe their audience and sources accuracy and honesty in using, crediting, and citing sources. As a community of intellectual and professional workers, the College recognizes its responsibility for providing instruction in information literacy and academic integrity, offering models of good practice, and responding vigilantly and appropriately to infractions of academic integrity. Accordingly, academic dishonesty is prohibited in The City University of New York and at New York City College of Technology and is punishable by penalties, including failing grades, suspension, and expulsion. The complete text of the College policy on Academic Integrity may be found in the catalog.

MAT 2440 Discrete Structures and Algorithms I **Text:** Discrete Mathematics and its Applications, 7th edition, by K. H. Rosen

Week	Discrete Structures and Algorithms I	Homework
1	**1.1** Propositional Logic **pages** 1 – 12 **1.3** Propositional Equivalences **pages** 25 – 34 Introduction to CAS	**P. 12**: 1, 2, 3, 6 , 9, 11, 14, 23, 27 - 31, 37, 44 **P. 34**: 3, 4, 6, 9 Does MATLAB recognize irrational numbers? Why? Is the decimal representation a rational number? Is 1.55555… a rational number? Why?
2	**1.4** Predicates and Quantifiers **pages** 36 – 52 **1.5** Nested Quantifiers **pages** 57 – 64 **1.6** Rules of Inference **pages** 69 – 78 CAS Logic	**P. 53**: 1, 3, 4, 7 – 13 odd, 19, 30, 36 **P. 64**: 10, 27, 31, 33 **P. 79**: 19, 20, 35 (written assignment)
3	**1.7** Introduction to Proofs **pages** 80 – 90 **2.1** Sets **pages** 115 – 125 **2.2** Set Operations **pages** 138 – 152 CAS Sets	**P. 91**: 1 – 4, 9 – 12, 17 ,18, 35 **P. 125**: 11, 19 (a) & (b), 27, 29, 31, 35 **P. 136**: 3, 15 (b), 17 (b), 21 - 23, 26, 46, 47, 49 (written assignment), 52 - 55, 57
4	**First Examination** **2.3** Functions **pages** 133 – 146 CAS Floor and ceiling functions	**P. 146**: 3, 8, 10 – 12 all, 15, 20 (written assignment), 23, 24, 30, 33, 39, 42 - 44, 58 – 61
5	**2.4** Sequences and Summations **pages** 156 – 167 **2.5** Cardinality of Sets **pages** 170 – 176 **3.1** Algorithms **pages** 191– 195 CAS m-files (maximum, linear search)	**P. 167**: 3, 25, 29, 30, 31, 33, 35 – 39 all, 43 **P. 176**: 1, 3, 11 **P. 177**: 1, 3*, 5*, 7*, 11*, 13, 14, 16*, 17*, 18*, 27*
6	**3.1** Algorithms **pages** 196 – 198 MATLAB m-files (binary search)	**P. 203**: 34, 35, 36, 37*, 38 – 41 all, 42*, 43*
7	**3.1** Algorithms **pages** 198 – 202 **4.1** Divisibility and Modular Arithmetic **pages** 237 – 244 **4.2** Integer Representations and Algorithms **pages** 245 – 254 CAS m-files (bubble sort)	**P. 208**: 47, 48, 50, 52, 53, 57 (written assignment) **P. 244**: 15, 21, 29, 26, 27, 28, 30*, 31, 32 **P. 255**: 1 – 14 all, 25, 27, 32, 34, 47, 53*, 54, 55*, 56

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Week	Discrete Structures and Algorithms I	Homework
8	**Mid-semester Examination** **4.3** Primes and Greatest Common Divisor **pages** 257 – 272 **4.5** Applications of Congruences **pages** 287 – 292 **4.6** Cryptography **pages** 294 – 303 CAS m-files (insertion sort)	**P. 272**: 3, 16, 25, 28, 33, **P. 292**: 2, 3, 6, 8* **P. 304**: 1 – 5 odd
9	**5.1** Mathematical Induction **pages** 311 – 329 **5.2** Strong Induction and Well-Ordering **pages** 333 – 341 CAS m-files (Constructing Base b)	**P. 329**: 1, 3 – 12, 15, 21, 25 **P. 341**: 7, 11, 13
10	**5.3** Recursive Definitions and Structural Induction **pages** 344 – 357 **5.4** Recursive Algorithms **pages** 360 – 370 CAS m-files (Euclidean Algorithm)	**P. 357**: 1 – 7 odd, 30, 33 - 35 all, 43, 44, MATLAB definition of Ackermann's function, 48*, 51*, 60, 61 **P. 370**: 1 – 5 odd, 7*, 8*, 9*, 10*, 16, 29, 30, 36*, 46, 50, 51, 52*
11	**5.5** Program Correctness **pages** 372 – 376 **Third Examination**	**P. 377**: 3, 7
12	**10.1** Graphs and Graph Models **pages** 641 – 649 **10.2** Graph Terminology and Special Types of Graphs **pages** 651 – 665 **10.4** Connectivity **pages** 678 – 689 CAS Recursive Algorithms	**P. 649**: 3 - 9 all, 33 **P. 665**: 20, 59, 61, 67, 71, 72 **P. 689**: 1 – 5 all, 11
13	**11.1** Introduction to Trees **pages** 745 – 755 **11.2** Applications of Trees **pages** 757 – 769 **11.3** Tree Transversal **pages** 772 – 772 CAS Presentation	**P. 755**: 1 – 10 all , 17 – 20 all, 21 (written Assignment), 27, 28, 33, 34, 38 – 41 all **P. 769**: 1- 7 odd, 11, 19, 21, 22, 37 **P. 783**: 1, 3, 6, 7, 9, 10, 12, 13, 15, 22 – 24 all
14	**11.4** Spanning Trees **pages** 785 – 795 **11.5** Minimum Spanning Trees **pages** 797 – 802 (optional) CAS Presentation	**P. 795**: 2 – 6, 13 – 15, 16, 27, 28, 30 **P. 802**: 1, 2, 3, 6, 7
15	Review/ CAS Presentation **Final Examination**	

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Discrete Structures and Algorithms I	Homework
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1.4 Predicates and Quantifiers **pages** 36 – 52 **1.5** Nested Quantifiers **pages** 57 – 64 **1.6** Rules of Inference **pages** 69 – 78 CAS Logic	**P. 53**: 1, 3, 4, 7 – 13 odd, 19, 30, 36 **P. 64**: 10, 27, 31, 33 **P. 79**: 19, 20, 35 (written assignment)
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First Examination **2.3** Functions **pages** 133 – 146 CAS Floor and ceiling functions	**P. 146**: 3, 8, 10 – 12 all, 15, 20 (written assignment), 23, 24, 30, 33, 39, 42 - 44, 58 – 61
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3.1 Algorithms **pages** 196 – 198 CAS m-files (binary search)	**P. 203**: 34, 35, 36, 37*, 38 – 41 all, 42*, 43*
3.1 Algorithms **pages** 198 – 202 **4.1** Divisibility and Modular Arithmetic **pages** 237 – 244 **4.2** Integer Representations and Algorithms **pages** 245 – 254 CAS m-files (bubble sort)	**P. 208**: 47, 48, 50, 52, 53, 57 (written assignment) **P. 244**: 15, 21, 29, 26, 27, 28, 30*, 31, 32 **P. 255**: 1 – 14 all, 25, 27, 32, 34, 47, 53*, 54, 55*, 56

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Discrete Structures and Algorithms I	Homework
Midterm Examination **4.3** Primes and Greatest Common Divisor **pages** 257 – 272 **4.5** Applications of Congruences **pages** 287 – 292 **4.6** Cryptography **pages** 294 – 303 CAS m-files (insertion sort)	 **P. 272**: 3, 16, 25, 28, 33, **P. 292**: 2, 3, 6, 8* **P. 304**: 1 – 5 odd
5.1 Mathematical Induction **pages** 311 – 329 **5.2** Strong Induction and Well-Ordering **pages** 333 – 341 CAS m-files (Constructing Base b)	**P. 329**: 1, 3 – 12, 15, 21, 25 **P. 341**: 7, 11, 13
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5.5 Program Correctness **pages** 372 – 376 **Third Examination**	**P. 377**: 3, 7
10.1 Graphs and Graph Models **pages** 641 – 649 **10.2** Graph Terminology and Special Types of Graphs **pages** 651 – 665 **10.4** Connectivity **pages** 678 – 689 CAS Recursive Algorithms	**P. 649**: 3 - 9 all, 33 **P. 665**: 20, 59, 61, 67, 71, 72 **P. 689**: 1 – 5 all, 11
11.1 Introduction to Trees **pages** 745 – 755 **11.2** Applications of Trees **pages** 757 – 769 **11.3** Tree Transversal **pages** 772 – 772 CAS Presentation	**P. 755**: 1 – 10 all , 17 – 20 all, 21 (written Assignment), 27, 28, 33, 34, 38 – 41 all **P. 708**: 1- 7 odd, 11, 19, 21, 22, 37 **P. 783**: 1, 3, 6, 7, 9, 10, 12, 13, 15, 22 – 24 all
11.4 Spanning Trees **pages** 785 – 795 **11.5** Minimum Spanning Trees **pages** 797 – 802 (optional) CAS Presentation	**P. 795**: 2 – 6, 13 – 15, 16, 27, 28, 30 **P. 802**: 1, 2, 3, 6, 7
Review/ CAS Presentation **Final Examination**	