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MACM 101 Syllabus

Overarching topic: MACM 101 is fundamentally an introduction to the notion of proof, with focus on the proof techniques specific to discrete mathematics.

- Topic #1 - Elementary Counting
 - Rules of Sum and Product
 - Permutations
 - Combinations; The Binomial Theorem
 - Combinations with Repetition
- • Topic #2 - Logical Connectives
 - Basic Connectives and Truth Tables
 - Logical Equivalence: Laws of Logic
 - Logical Implication: Rules of Inference
- • Topic #2a or #3a - A first application of proof methods, done after either Topic 2 or Topic 3. A chance to work with definitions; reasoning and proof; and perhaps quantifiers (if done after Topic 3). Specific application can be based on choice of textbook. One possible choice:
 - • Divisibility and primes
 - Divisibility, Division Algorithm, Prime Numbers
 - GCD and The Euclidean Algorithm
 - The Fundamental Theorem of Arithmetic
 - Integers Modulo n
- • Topic #3 - Proofs and Quantifiers
 - Predicates, [Un]bounded Variables, Quantifiers
 - Proofs of Quantified Theorems
- • Topic #4 - Set Theory
 - Sets and Subsets
 - Set Operations and Laws of Set Theory
 - Counting and Venn Diagrams
- • Applications:
 - Introduction to Finite Probability (required—will be reviewed in 201)
 - Inclusion-Exclusion (required—will be reviewed in 201)
- • Topic #5 - Induction
 - Well-Ordering Principle and Induction
 - Recursive Definitions
- • Topic #6 - Relations and Functions
 - Cartesian Products and Relations
 - Functions: Plain and 1-1
 - Onto Functions
 - Pigeonhole Principle
 - Composition and Inverses

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- Topic #7 - More Relations
 - Properties of Relations
 - Partial Orders; Hasse Diagrams
 - Equivalence Relations and Partitions
- - Topic #8 – Introduction to Trees
 - Definitions and Properties
 - Rooted Trees
 - Trees and Sorting
 - Weighted Trees; Prefix Codes
- Other topics: The above is a minimal list. Instructors are free to add other topics, so long as they don't duplicate material to be covered in MACM 201. Computational complexity and Big-O are not included in MACM 201 and so are eligible for 101, schedule permitting.