

Outline of Topics, Math 1165

1. Theory of Numbers
 - (a) Division Algorithm
 - (b) Alternate Representations
 - (c) Integer and rational number arithmetic
 - (d) Euclidean Algorithm, GCD, and LCM
 - (e) Modular Arithmetic
 - (f) The Fundamental Theorem of Arithmetic
 - (g) Irrationality of logs and radical expressions
2. Theory of Sets
 - (a) Set Operations, sets versus sequences
 - (b) Subsets
 - (c) The Inclusion-Exclusion Principle
 - (d) Cardinality
 - (e) Countable Sets
 - (f) Cantor's Diagonalization procedure
3. Sequences of numbers
 - (a) Proof by mathematical induction
 - (b) Sequences defined by recursion
4. The theory of Counting (Combinatorics)
 - (a) Two Fundamental Principles, Addition, Multiplication
 - (b) Counting of samples from a population, combinations and permutations
 - i. Does Order Matter?
 - ii. Can Items be Repeated?
 - (c) Pascal's triangle
 - (d) Polya's block walking model
 - (e) Probability
5. Theory of Binary Relations
 - (a) The three models: Sets, Matrices, Digraphs

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- (b) The four properties, reflexivity, symmetry, antisymmetry, and transitivity
 - (c) Equivalence relations
 - (d) Partially Ordered Sets
6. Also see <http://www.math.uncc.edu/~hbreiter/m1165/summary.htm> for a summary of lectures.
7. Some semesters topics in Combinatorial Games (Nim), the Pigeonhole Principle, Fibonacci Numbers, and Recurrence Relations are also included.