Spring 2020 COT 3100 Exam #1 Review

Exam Format

Several Free Response Questions, 75 points total

YOU WILL BE PROVIDED THE EXAM 1 REFERENCE SHEETS AND BLANK SCRATCH PAPER

Exam AID

One sheet of notes on 8.5" x 11" paper, front and back, written or typed.

Exam Outline

I. Logic and Proof
- a. Boolean variables, operators (xor not required)
- b. Implication and related statements
  - i. inverse
  - ii. converse
  - iii. contrapositive
- c. Truth Tables
- d. Bitwise Operators, Binary/Decimal Conversions
- d. Logic Laws and application
- e. Predicates and Quantifiers
- f. Nested Quantifiers
  - i. When order matters
  - ii. How to disprove a nested quantifier statement
- g. Rules of Inference
- h. Some Definitions and Preliminaries
  - i. Divisibility
  - ii. Mod
  - iii. Algebra with expressions
- i. Proof Techniques
  - i. Direct Proof
  - ii. Proof by Contradiction
  - iii. Proof of Contrapositive
  - iv. Proof by cases

II. Sets
- a. Definitions ($\in, \subseteq, \subset, \cap, \cup, \bar{A}, -, \times, \wp$)
- b. Set Table
- c. Laws
- d. Operations
- e. Use of Proof Techniques

III. Number Theory
- a. Definition of Division
- b. Divisibility Rules
- c. Mod rules
- d. Fast Modular Exponentiation
- e. Euclidean Algorithm
- f. Extended Euclidean Algorithm
- g. Modular Inverse
- h. Fundamental Theorem of Arithmetic
- i. gcd, lcm calculations with prime factorization
- j. Number of divisors of an integer
- k. Sum of divisors of an integer
- l. Number of times a prime p divides evenly into n!

IV. Sums, Matrices, Recursively Defined Sequences
- a. How to add, subtract, multiply matrices
- b. How to use recursively defined sequences
- c. Definition of a summation
- d. How to apply sum rules (split sum, change bounds, factor out const, etc.)
- e. Arithmetic Sequences
- f. Geometric Sequences
- g. Subtraction Trick for handling sums that are neither geometric nor arithmetic.
- h. Derivative Trick for handling sums that are neither geometric nor arithmetic.
- i. Using Integral to bound a summation from below and above.

V. General Math Review
- a. Log Rules, Problems with Logs, System of Equations with Logs
- b. Sum, Product of the Roots of a Quadratic Equation, Manipulation to find various quantities based on those roots.
- c. Distance = Rate x Time Problems (setting up equations, solving)

Exam Procedure

If you arrive early, do NOT sit in the first two rows.

Exams will start being passed out at 1:25 pm. Exam will be four separate sheets of paper, all front and back. First Pages 1,2 will be passed out. One TA will give this to all students, going through the rows in a predictable order. 30 seconds later, a second TA will follow the first, giving out pages 3,4 in the same order that pages 1,2 were passed out. 30 seconds after that a third TA will follow, with pages 5,6. Finally a fourth TA will follow, passing out pages 7,8.

After all exams are passed out, a call will be made for anyone not in the first two rows to see if they have pages missing. After those are handed out, you may begin the exam

Then, the TAs will give exams to the late students in the first two rows.Then, the TAs will pass out the formula sheet to everyone. Scratch paper will be available at the front. Anyone who wants to use it can walk up front and get it.