CSCE 222-200 Discrete Structures for Computing

Fall 2024

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Topics covered in Final Exam

The final exam will be held on Monday, December 9, 1:00 pm - 3:00 pm, in HRBB 126. The exam is taken in class, and open-book and open-notes.

Remark: hints/answers of Practice Exercises are given in the textbook.

1. Proof by contradiction, by induction, and by other methods

Basic Requirement: Be able to *formally* present *valid* proofs using the techniques.
References: Lecture Notes #1 and #2, Textbook: Sections 1.7-1.8, 5.1-5.2.
Practice Exercises: Textbook: Questions **27, 29** (p. 96); **39** (p. 119); **15, 17, 19** (p. 351).

2. Propositional and predicate logic

Basic Requirement: Understand basic definitions and terminologies in propositional logic and predicate logic, and be able to derive logic equivalences.
References: Textbook: Sections 1.1-1.6, and the handout "Checklist in Logic".
Practice Exercises: Textbook: Questions **39** (p. 16); **45, 47** (p. 26); **49, 51** (p. 59); **27** (p. 71); **27** (p. 84); 3, 7, 23, 25, 29, 31, 37 (pp. 117-119).

3. Sets, functions, sequences, sums

Basic Requirement: Understand basic definitions and terminologies in set theory, functions, sequences, and formulas for sums of arithmetic/geometric sequences.
References: Textbook: Sections 2.1-2.4.
Practice Exercises: Textbook: Questions **11, 13, 19, 23, 37** (p. 132); **31, 33, 37** (p. 145); **21, 23, 35** (pp. 162-163); **37, 39** (p. 179); 3, 5, 7, 9, 13, 19, 23, 25 (pp. 197-198).

4. Algorithms and complexity

Basic Requirement: Understand the big-O notation, and be able to write simple algorithms and analyze their complexity.
References: Textbook: Sections 3.1-3.3.
Practice Exercises: Textbook: Questions **3, 7, 17** (p. 214); 7, 9, 17, 21, 25 (pp. 228-231); 1, 3, 15 (pp. 241-243); 9, 15, 17, 21 (p. 246).

5. Recursive algorithms and recurrence relations

Basic Requirement: Be able to write simple recursive algorithms, give and solve recurrence relations for the time complexity of recursive algorithms.

References: Textbook: Sections 5.3.2 and 5.4.
Practice Exercises: Textbook: Questions **9, 23** (p. 379); 7, 9, 11, 29, 45 (pp. 391-392); 55, 69 (pp. 402-403).

6. Permutations and combinations

Basic Requirement: Understand basic counting techniques and the pigeonhole principle, and be able to count using permutations and combinations.
References: Textbook: Sections 6.1-6.4.
Practice Exercises: Textbook: Questions **9, 11, 25, 29** (p. 417); 7, 11, 37 (pp. 426-428); 3, 15, 17, 35, 41 (pp. 435-437); 5, 7, 9,19, 27, 29 (pp. 443-445).

7. Probability theory

Basic Requirement: Understand basic definitions: probability space, event, conditional probability, random variable, expectation, variance, linearity of expectations.
References: Textbook: Sections 7.1, 7.2, 7.4.
Practice Exercises: Textbook: Questions 7, 21, 37 (pp. 475-476); 11, 13, 23, 25 (pp. 492-493); **1, 3, 13, 27** (p. 518).

8. Boolean algebra and satisfiability

Basic Requirement: Understand basic definitions: Boolean operations and functions, CNF and DNF for Boolean functions, Boolan circuit, the satisfiability problem.
References: Textbook: Sections 1.3.5-1.3.7, 12.1-12.3, and the instructor's ppt presentation.
Practice Exercises: Textbook: Questions **65** (p. 39); **9, 13, 25** (p. 854); **3, 11** (p. 858).

9. Finite-state automata and Turing machines

Basic Requirement: Understand the definitions of deterministic and nondeterministic finite-state automaton, and of Turing machines, and be able to design DFA for simple languages.
References: Textbook: Sections 13.3, 13.5.
Practice Exercises: Textbook: Questions **17, 19, 23, 25, 33** (pp. 914-915).