CSCI 1900 Final Exam – Topic Outline

Fall 2014

# Exam Date and Time

Section 001 Monday, 8 December 10:30 p.m. – 12:30 p.m.

# Test Format

Part 1 – Definitions

I will give you a list of terms and a list of definitions; you must match the term with the **best** definition. *(~10 points)*

Part 2 – Short answer questions

For each question, you will be given a series of statements; you must pick the one that is true *(~ 15 points)*

Part 3 – Computations

**You must show work to receive credit**. *(~ 75 points; ~25 from material before Test 2, ~50 from material after Test 2)*

# Topics

The test will cover material from the lectures and the textbook. The following is a high-level overview of the topics that were covered; consider it a starting point for your preparation. **This list is not intended to be an all inclusive detailed list of the test questions.**

**Previously Tested Material:** Material for which competency was **not** demonstrated

1. Definition: Union and Intersection of two sets
2. Definition: Countable (wrt sets)
3. Does a specified string belong to a given regular expression
4. Definition: Rule of Inference
5. Definition: Relatively Prime
6. DeMorgan’s Law in the context of **sets**
7. DeMorgan’s Law in the context of **logical propositions**
8. Converting integers from one base to another
9. Remainder theorem
10. Conjunction / Disjunction definitions.
11. Negation of: AND, OR, IMPLICATION, and EQUIVALENCE.
12. Matrix Multiplication
13. Simple proofs on the properties of integers

**Lectures Covered: Post Test 2**

1. Lecture 11: Proof by Induction
   1. Summation notation
   2. Know the formal structure of a proof by induction and be able to fill in the steps
2. Lecture 12: Permutations and Combinations
   1. Four cases
      1. Order matters & Duplicates are allowed – Multiplicative Principle of Counting
      2. Order matters & Duplicates are not allowed – nPr
      3. Order doesn’t matter & Duplicates are not allowed –  nCr
      4. Order doesn’t matter & Duplicates are allowed – (n+r-1)Cr
   2. Distinguishable Permutations
   3. Factorial Function
3. Lecture 13: Elements of Probability
   1. Sample space
   2. Event
   3. Disjoint events
   4. Probability as the ratio of the cardinality of the event space to the sample space
   5. Properties of Probabilities
   6. Pigeonhole Principle
   7. Extended Pigeonhole Principle
4. Lecture 14: Relations
   1. Definition of a Cartesian product
   2. Cardinality of a Cartesian product
   3. Definition of a relation
   4. Definition of domain and range of a relation
   5. Diagraph of a relation
      1. Definition of vertex
      2. Definition of edge
      3. Definition of the in-degree of a vertex
      4. Definition of the out-degree of a vertex
   6. Properties of relations
      1. Reflexive
      2. Symmetric
      3. Transitive
   7. Definition of an equivalence relation
5. Lecture 15: Functions
   1. Definition of a function
   2. Composition of *f* and *g* – (*g* ○ *f*)(a) = *g*( *f*(a) )
   3. Special function types
      1. Everywhere define
      2. Onto
      3. One-to-one
      4. Bijection
      5. One-to-one correspondence
6. Lecture 16: Complexity of Functions
   1. Functions in CS
      1. mod
      2. factorial
      3. floor
      4. ceiling
      5. exponential
      6. logarithm
   2. Definition of Big-Oh
   3. Definition of Big-Theta
   4. Growth of functions
      1. Standard functions (in order of increasing run-time)  
          constant → log(n) → n → n log(n) → n2 → n3 → … → an → n!
7. Lecture 17: Trees
   1. Connected graph
   2. Cycle (in a graph) / acyclic
   3. Definition of a tree
   4. Rooted tree
   5. Tree properties
      1. level
      2. parent
      3. child
      4. sibling
      5. descendant
      6. height
      7. leaf
   6. Binary tree
8. Lecture 18: Tree Traversal
   1. Definition of traverse
   2. Pre-order traversal
   3. In-order traversal
   4. Post-order traversal
   5. Definition of encode
   6. Huffman encoding / Huffman tree
   7. Using a Huffman tree to encode or decode a message
9. Lecture 19: Minimal Spanning Trees
   1. Definition of a weighted graph
   2. Definition of a spanning tree
   3. Definition of a minimal spanning tree
   4. Relationship between the number of vertices and edges in a tree
   5. Definition of adjacent vertices
   6. Definition of nearest neighbor
   7. Definition of a greedy algorithm
   8. Prim’s algorithm
   9. Kruskal’s algorithm
10. Lecture 20: Finite State Machines
    1. Definition of a machine
    2. Definition of a finite state machine
    3. Verify a given finite state machine accepts strings belonging to a regular expression
    4. Design a finite state machine to accept a specified regular expression.

**Suggested Order of Study**

* 1. Carefully review the lectures, for the purpose of making a list of the above terms and their definitions.
  2. Learn those definitions.
  3. Review all homework problems. Problems in Part 3 of the test will be similar to but not identical to the homework.
  4. Work the review problem, without referring to your notes, your book, or previously worked homework problems. Use the review problems as a tool to identify weaknesses.
  5. Download clean copies of the ALSs relevant to the test. Complete the ALSs without referring to your notes, your book, or previously worked homework problems.
  6. Review the lecture slides and your class notes.
  7. Get a good night sleep.