CS 312 Study Guide for Midterm Exam

The exam is closed book and will have a time limit of three hours. You will be allowed one page of notes. This is NOT meant to try to cram in all the information from the semester. The purpose of the page of notes is two fold: 1) to enhance your preparation through your deciding what to include and how to represent it, and 2) to obviate the need for memorizing details. The content of this page must be in large enough font (or similar concept if handwritten), to be easily readable. Note that for all algorithms you should be able to figure out time and space complexity.

The exam will consist of problems similar to those encountered on the homework. You should be prepared to answer questions over any of the material in the reading or that we covered in class. The following topic list gives a good, high-level coverage of the material for which you should be prepared to answer questions:

- Analyzing algorithms
  - correctness, complexity, can we do better?
- Asymptotic Analysis
  - Big O, Big Θ, and Big Ω
- Basic arithmetic algorithms and complexity
  - Addition, multiplication, modular arithmetic, modular exponentiation, modular inverse/division, Euclid's GCD
- Primality testing
  - Fermat's little theorem, probabilistic nature
- RSA
  - Public vs. private key encryption
  - Algorithm, probabilistic nature, compexity
- Divide and Conquer
  - Paradigm/How is speed up attained, mergesort, quicksort, multiply, matrix multiply, convex hull, selection (median)
- Master Theorem
  - How to use it, what does it tell us, geometric series intuition
- Graph connectedness
  - Graph representation, Depth First Search, search tree and pre/post order values, cycle-detection, DAGs, linearization, finding strongly connected components
- Graph paths
  - Breadth First Search, Dijkstra's algorithm, priority queue implementations/complexity, negative edges, Bellman-Ford, shortest DAG paths
- Greedy algorithms
  - Paradigm/philosophy, Minimum Spanning Tree with Kruskal's/Prim's, Huffman coding, Horn Formulas, Set Cover problem