CPE 349 Final Study Guide Kearns

The following is not exhaustive but is a list of topics that have appeared on previous finals

Basic Knowledge: Lectures, Labs, Readings, Homework

Vocabulary

- Graphs: directed, in-degree, out degree, weighted, path, acyclic, path length, depth, Euler path, Hamilton Path. source, sink, flow network, flow, flow value, cut, cut capacity, DFS and BFS (tree, back, forward, cross edges)
- Trees: leaf, height, spanning tree, minimal spanning tree
- Min Heap, Max Heap, sift down, sift up
- Dynamic Programming: optimal substructure, common subsequence, increasing subsequence, path in a 2 dimensional grid
- NP vs P, NP complete, problem reduction

Sections from the text and topics from lecture and lab

Analysis knowledge

- Analysis framework – know steps and be able to apply
- Asymptotic notations and their properties, **Formal definitions** of O(), Ω() and Θ()
- Properties of logarithms, number of elements of n element set, permutations and combinations, summation formulas for arithmetic and geometric sequences, summation rules,
- Recurrence relations and their solutions using back substitution and recursion tree, Be able to use Master Theorem – it will be provided if needed.

Brute force

- Traveling Salesperson and Knapsack problems
- Bread first search
- Depth first search

Basic data structure problems

- Topological Sort – both DFS and Source removal algorithms
- Recursive algorithms for generating subsets and permutations
- Partitioning, Heaps, Heap Sort (includes construction of heap)

Divide and conquer

- Merge Sort, Quick Sort, Closest Pair

Greedy approach

- Weighted Average Time to Completion
- Prim's algorithm MST Dijkstra's Algorithm Shortest path Cut property Proofs of correctness

Dynamic programming

- Coin row problem, Robot coin collection
- Longest increasing subsequence
- Longest common subsequence
- Knapsack 0-1, Knapsack with repeats
- Matrix chain multiplication, Edit Distance

Iterative Improvement

- Ford-Fulkerson Shortest Augmenting Path Algorithm, Max-Flow, Min Cut Theorem
- Stable Marriage

Backtracking, Branch and Bound, Approximation

- Backtracking: Subset Sum
- Branch and Bound:, Knapsack Problem
- Approximations for TSP and Knapsack, Twice around the tree, proof: Twice around the Tree is a 2 approximation

P, NP, NP complete

- P and NP
- NP complete and Problem Reduction (Min Vert Cover, Max Clique, Max Independent Set)

Thought problems

- Choose 2-3 of 3-5 problems provided. Describe and analyze the algorithms that solve the problems you select. These problems will be closely related to problems either covered in class, labs, or assignments