TEST II REVIEW

MATH 4300

This is an outline of the main topics to be covered on Test II. It is not an exhaustive list. Thus, most of the questions in the exams usually come from the topics on this review, but this cannot be guaranteed.

Key Definitions and Main Concepts:

- Trees, non-identical trees, leaves, minimum weight spanning trees, rooted trees, levels, height of a tree, children, parent, ancestors, descendants, binary trees, codes, coding, weighted path-length of a coding.
- Networks, capacity of an edge, legal flow, value of a flow, source-separating set of vertices, cut associated with a source-separating set, capacity of a cut, augmenting paths.
- Eulerian circuits, open eulerian trails.
- Hamiltonian cycles, hamiltonian paths, hamiltonian graphs, traceable graphs, Ore-type graphs, traveling salesman problem, minimum salesman walk, Hamilton connected graphs, panconnected graphs, pancyclic graphs, forbidden subgraphs.

Main Algorithms:

- Kruskal's minimum weight spanning tree Algorithm
- Prim's minimum weight spanning tree Algorithm
- Prüfer's Tree Encoding & Tree Decoding Algorithms
- Huffman's Optimal Coding Algorithm
- Ford-Fulkerson Algorithm
- Dinic's Algorithm
- Fleury's Algorithm
- Hierholzer's Algorithm
- Shortest Insertion Algorithm

Main Results:

- Characterizations of Trees (Theorem 3.1.2)
- There are p^{p-2} different (non-identical) trees on p distinct vertices. (Cayley's theorem)
- The maximum possible value of a flow in a network is equal to the minimum capacity of the cut which separate the source and sink. (Max Flow-Min Cut Theorem)
- Characterizations of eulerian graphs (Theorem 5.1.1)
- The connected graph G has an open eulerian trail if and only if G has exactly two vertices of odd degree.
- If $\deg x + \deg y \geq p$ for all pairs of non-adjacent vertices x and y in G and $p \geq 3$, then G has a hamiltonian cycle. (Ore's Theorem)
- If G is a graph of order $p \geq 3$ such that $\delta(G) \geq \frac{p}{2}$, then G is hamiltonian. (Corollary to Ore's Theorem; a.k.a. Dirac's Theorem)
- If $\deg x + \deg y \geq p - 1$ for all pairs of non-adjacent vertices x and y in G and $p \geq 3$, then G has a hamiltonian path. (Corollary to Ore's Theorem)
- G is hamiltonian if and only if $CL(G)$ is hamiltonian.
- If G is 2-connected $\{K_{1,3}, Z_1\}$-free graph, then G is hamiltonian.
- 1. If G is connected and $\{K_{1,3}, N\}$-free, then G is traceable.
  2. If G is 2-connected and $\{K_{1,3}, N\}$-free, then G is hamiltonian.