University of Washington
Department of Computer Science and Engineering
CSE 521, Winter 1996

June 2, 1998

Final Exam, March 11, 1996

NAME: ____________________

Instructions:

- Closed book, closed notes, no calculators
- Time limit: 50 minutes
- Answer the problems on the exam paper.
- If you need extra space use the back of a page
- Problems are not of equal difficulty, if you get stuck on a problem, move on.

1	/10
2	/10
3	/10
4	/2
5	/10
6	/10
7	/10
8	/10
9	/8
Total	/80

Problem 1 (10 points):

What is a Matroid? Give two different examples.

Problem 2 (10 points):

What is the knapsack problem? What is the complexity of the dynamic programming algorithm for knapsack. Is this a polynomial time algorithm?

Problem 3 (10 points):

In what sense is a splay tree an efficient implementation of a binary search tree.

Problem 4 (2 points):

Correctly spell the name of a famous Dutch computer scientist.

Problem 5 (10 points):

What is the asymptotically best algorithm for the minimum spanning tree problem in the following situations? What run time does the algorithm achieve.

a) The graph $G = (V, E)$ is complete, so $|E| = n^2$.

b) The graph is sparse ($|E| = m$), and the edge costs are integers in the range $1, \ldots, 10$.

Problem 6 (10 points):

Given a schedule for the travelling tourist problem, what is the complexity of determining whether or not there exists a tour which visits all of the cities. (Note that we aren't interested in a good tour - just *some* tour.)

Problem 7 (10 points):

In network flow, the flow function $f : E \rightarrow R$ assigns a flow to each edge. What are the properties that the flow function must satisfy. Describe the properties mathematically - don't just give the names.

Problem 8 (10 points):

Let $B = b_1, \ldots, b_n$ be a set of integers, and $G = (V, E)$ be a graph with vertex set $v_1, \ldots, v_n$. A B-matching for G is a set of edges $M \subseteq E$, such that the vertex v_k is incident to exactly b_k vertices of M. (The perfect matching is the case where all of the b_k's are one.) For a given B and bipartite graph G, show how a network flow algorithm can be used to determine if G has a B-matching, and find the B-matching if it exists.

Problem 9 (8 points):

Draw the Voronoi diagram for the following set of points.