Introduction to Algorithms	**Approximate Syllabus**
CS 482 Spring 2000	**January 24, 2000**

This list of topics is meant to convey the course organization and the range of subjects covered in the course. With each topic we give a list of problems, applications, and sub-topics that we will discuss. The details are subject to change.

- Introduction
  - An opening problem: stable marriage
  - Range of problems we will consider
- General Algorithmic Techniques
  - Greedy algorithms
    - Finding optimal solutions with greedy methods
      (scheduling time intervals)
    - Finding near-optimal solutions with greedy methods
      (locating facilities)
  - The Divide and Conquer method
    (some basic primitives in computational geometry)
  - Dynamic Programming with many applications
    - weighted interval scheduling
    - knapsack problems
    - shortest paths
    - sequence alignment
      (including efficient implementation via divide and conquer)
- Flows and Cuts in Networks
  - The basic flow and cut problems
  - Basic methods: augmenting paths
  - Application to matching
  - Extensions to more general models
  - Applications to resource allocation, sequencing, and segmentation
- Computational Intractability
  - NP-completeness:
    hardness of problems in optimization and constraint satisfaction.

  - How to determine NP-completeness: reducibility
  - Examples including the traveling salesman problem, 3-dimensional matching, covering, packing, and partitioning problems.
  - PSPACE completeness:
    hardness of problems in artificial intelligence and game-playing.

- Algorithms for Hard Problems
  - Local search techniques
    * The Metropolis algorithm
    * Simulated annealing
  - Improved exponential methods
  - Approximation algorithms
    * Greedy methods
    * The application of linear programming
- Algorithms that run forever