1. Analysis of algorithms, asymptotic complexity measures

2. Algorithm design strategies: common ideas used in a variety of algorithms
   (a) Divide and conquer / Balancing
   (b) Backtracking
   (c) Greedy algorithms
   (d) Dynamic Programming
   (e) Monte Carlo & Las Vegas methods

3. Commonly used algorithms for important problems.
   (a) Matrix multiplication (Strassen’s algorithm)
   (b) Graph Algorithms, depth-first search, depth-first spanning tree, classifying edges (tree, back, cross), strongly connected components, topological sort, minimal spanning tree, single source shortest paths, all-points shortest path.
   (c) Union-Find problem and application to Kruskal’s Algorithm
   (d) RSA encryption
   (e) The Fast Fourier Transform and the convolution theorem
      i. Application to image processing
   (f) LUP-decomposition and implications for matrix operations
   (g) The max-flow / min-cut problem, solution by linear programming, and Ford-Fulkerson algorithm (if time allows).
   (h) Pattern matching: Knuth-Morris-Pratt
   (i) Parsing algorithms (LL1 predictive parsing)
   (j) Numerical algorithms: e.g., Multivariate Newton’s method (if time)
   (k) Fast (large) integer multiplication (if time allows)
   (l) Clustering (e.g., K-means, if time allows)

4. The Classes $\mathcal{P}$ and $\mathcal{NP}$, $\mathcal{NP}$-complete problems
   (a) Cook-Levin Theorem
   (b) Polynomial time mapping reduction
   (c) Survey of some well known $\mathcal{NP}$-complete problems
Expectations:

1. Class participation.
2. Communicate if things get complicated.
3. Your best effort.

Grading:
Two exams (65%), programming assignments (10 %) and take home problem sets (25%). Programming assignment(s) must be submitted ready to compile and run under Linux or Solaris.

Disability Notice:
If you have a disability that may require an accommodation for taking this course, then please contact the Learning Assistance Center (758-5929) within the first two weeks of the semester.

Pandemic Planning Notice:
The University has requested that faculty collect personal contact information as part of emergency planning and preparation. The information you provide is strictly confidential.