

Algorithms

Professor: Torgersen **E-mail:** *torgerse@wfu.edu* **Office Phone:** 758-5536

Office Hours: Monday, Wednesday, and Friday 3:00 to 4:30 and by appointment.

Text: Algorithms by S. Dasgupta, C. Papadimitriou, and U. Vazirani

Web Page: <http://menehune.opt.wfu.edu/csc721>

Goals and Topics:

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
 - (f) LUP-decomposition and implications for matrix operations
 - (g) The max-flow / min-cut problem, solution by linear programming, and Ford-Fulkerson algorithm.
 - (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:

Three 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.