

**CSC 721      Algorithms      Fall 2017**

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

**Office Hours:** Mon. and Wed 3:30 to 4:30; Thu. 2:00 to 4:30, and by appointment.

**Text:** Algorithm Design by Jon Kleinberg and Eva Tardos

**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
    - 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.