Algorithms and Data Structures I

- Algorithm analysis techniques
- Basic data structures
- Searching
- Sorting
- Algorithm design techniques
- Graphs
- Weighted graphs

Algorithm analysis techniques

- Analysis methodologies
  - pseudo code, counting primitives, worst cases, ...
- Asymptotic notations
  - big/little-Oh, big/little-Omega, big-Theta
  - definitions and properties
- Mathematical tools
  - summations, log/exp identities, ...
- Justification techniques
  - (counter)example, contrapositive, induction, invariant,...
- Amortized analysis

Basic data structures

- Data structures
  - motivation, examples, applications
  - interface: ADT methods
  - implementation: design and analysis
- Basic data structures
  - stacks, queues, vectors, lists, sequences, ...
  - trees, tree traversals, binary trees, ...
  - priority queues, heaps, selection/insertion/heap-sort, ...
  - dictionaries, hash tables, hash collision, ...

Searching

- Searching in basic data structures
  - motivation, examples, applications
- Binary search trees
  - binary search tree properties
  - searching, insertion, removal
  - performance analysis
- AVL trees (balanced trees)
  - AVL tree properties
  - searching, insertion, removal
  - performance analysis

Sorting

- Merge-sort
  - divide-recur-conquer
- Set ADT
- Quick-sort
  - randomized quick-sort
- Sorting: a lower bound
  - comparison-based sorting
- Bucket-sort and radix sort
- Selection

Algorithm design techniques

- Greedy method: why greed works?
  - fractional knapsack
  - task scheduling
  - Dijkstra shortest-path tree
- Divide-and-conquer
  - recurrence equations
  - master theorem
- Dynamic programming: why not divide/conquer
  - 0-1 knapsack
  - Floyd-Warshall

Graphs

- Graph ADT
  - motivation, examples, applications
  - interface: Graph ADT
  - implementation: design and analysis
    - node, edge, adjacency
- Graph traversal
  - DFS, BFS
- Directed graph (digraph)
  - digraph traversal, transitive closure, DAG

Weighted graphs

- Motivation, examples, applications
- Single-source shortest paths
  - Dijkstra: why/when it works and how
  - Bellman-Ford
  - DAG
- All-pairs shortest paths
- Minimum spanning tree
  - Prim-Jarnik
  - Kruskal
  - Baruvka

What's next?

- Computer Science is about Algorithms
- More Algorithms courses from UVic CS
  - CSC320: Foundations of Computer Science
  - CSC326: Algorithms and Data Structures II
  - CSC425: Analysis of Algorithms
  - CSC426: Computational Geometry
  - CSC428: Computational Biology Algorithms
  - Topics courses:
    - Graph Algorithms
    - Randomized Algorithms

What's more?

- Systems courses from UVic CS
  - CSC360: Operating Systems
  - CSC361: Computer Networks
    - changed from CSC450
  - CSC460: Embedded/Real-Time Systems
  - CSC461: Multimedia Systems
  - CSC462: Distributed Systems
  - CSC463: Wireless Mobile Networks
  - CSC465: Advanced Communication Networks
  - CSC466: Advanced Computer Networks

http://www.csc.uvic.ca/courses/undergrad.html