Computing Science Course Outlines

CMPT 706 - G100 Design and Analysis of Algorithms for Big Data

Instructor(s): Andrei Bulatov  SFU Burnaby

Calendar Objective/Description:
Concepts and problem-solving techniques that are used in the design and analysis of efficient algorithms. Special consideration and adaptations for big data applications will be emphasized. Students with credit for CMPT 705 may not take this course for further credit.

Instructor’s Objectives:
This course is primarily a course on problem solving - choosing good approaches and recognizing when a solution is a good solution. The objective of this course is to introduce concepts and problem-solving techniques that are used in the design and analysis of efficient algorithms for big data applications.

Prerequisites:
None

Topics:
- Algorithms with Large Numbers: Asymptotics, Cryptography, Hashing, Randomization
- Divide-and-Conquer: Recurrences, Sorting, Selection, Lower bounds
- Graphs: Graph searches and applications, Trees, Shortest paths, Priority queues
- Greedy Algorithms: Spanning trees, Amortized analysis, Huffman encoding
- Dynamic Programming: Shortest paths, Longest subsequences, Knapsacks, Memoization
- Algorithms for Large-Scale Graphs: Vertex-centric and edge-centric approaches
- Algorithm Design for Map-Reduce: Complexity analysis and trade-offs
- Consistency in Large Distributed Systems: Paxos consensus, CAP theorem
- Algorithms for Large Datasets: Time-accuracy trade-offs

Grading:
To be discussed during the first week of classes.

Required Books:

Reference Books:
Algorithm Design, J. Kleinberg, E. Tarados, Addison Wesley, 2006, 9780321295354

Academic Honesty Statement:
Academic honesty plays a key role in our efforts to maintain a high standard of academic excellence and integrity. Students are advised that ALL acts of intellectual dishonesty will be handled in accordance with the SFU Academic Honesty and Student
Conduct Policies (http://www.sfu.ca/policies/gazette/student.html).