

Syllabus: COSC 3100: Data Structures and Algorithms 2

Spring 2018

Instructor: Thomas Schwarz, SJ

Office Hours: MWF 15:00 - 16:00 and by appointment

Text book (required): Thomas Cormen, Charles Leiserson, Ronald Rivest, Clifford Stein:
Introduction to Algorithms, MIT, 2009

Contents:

1. Finite Automata and Regular Expressions (3 hr total) (January 14 - 18, 2018)
 1. Deterministic finite automata 2/3 h
 2. Non-deterministic finite automata 2/3 h
 3. Regular Expression 2/3 h
 4. Mealy and Moody Machines 2/3 h
2. Growth of Algorithms (Repetition) (total 10 hrs)
 1. Asymptotic run-times (1 hr)
 2. Analysis of recursive factorial (1 hr)
 3. Analysis of Euclidean algorithm (2 hrs)
 4. Divide et Impera Algorithms
 1. Maximum subarray problem (1 hr)
 2. Strassen (1 hr)
 3. Recursions (2 hr)
 5. Probabilistic Algorithms
 1. Hiring Problem (1 hr)
 2. Randomized Algorithms (1 hr)
3. Analysis of Fast Data Structures (total 11 hrs)
 1. Analysis of stacks and queue operations (3 hrs)
 2. Analysis of binary search trees (1 hr)
 3. B- and B+ trees (3 hrs)
 4. Linear Hashing (2 hrs)
 5. Fibonacci Heaps (2 hrs)
4. Analysis of Graph Algorithms
 1. Elementary graph algorithms (total 5 hrs)
 1. Graph representations (1 hr)
 2. Breadth first search (1 hr)
 3. Depth first search (1 hr)
 4. Topological Search (1 hr)
 5. Strongly connected components (1 hr)
 2. Single Source Shortest Path (total 5 hrs)
 1. Bellman Ford algorithms (1 hr)
 2. Single source shortest paths in directed acyclic graphs (1 hr)
 3. Dijkstra's algorithm and its correctness (3 hrs)
5. Limits of Computability — Impossibility Results (5.5 hrs total)
 1. Turing Machines 2 hr
 1. Definition
 2. Turing machines with different types of tapes
 2. Church Turing Thesis 1 hr
 3. Halting Problem 2 hrs
 4. Philosophical Implications 1/2 hr

6. Complexity Classes (2.5 hrs total)
 1. Classes P, NP 1 hr
 2. Existence of Cryptography 1hr
 3. $P \neq NP$ hypothesis 1/2 hr

Grading:

Daily individual and group quizzes	10%
Weekly programming and homework assignments	10%
2 Examinations	80% (40% + 40%)

Accommodations, absences, plagiarism cases, etc. will be dealt with strictly according to Marquette University's policies and regulations.