Syllabus

Note: the syllabus may undergo minor revisions throughout the course.

Abbreviations in suggested readings refer to the following textbooks:

- **CLRS - Cormen, Leiserson, Rivest, and Stein,** *Introdution to Algorithms (3rd edition)*
- **DPV - Dasgupta, Papadimitriou, and Vazirani,** *Algorithms*
- **KT - Kleinberg and Tardos,** *Algorithm Design*
- **SW - Sedgewick and Wayne,** *Algorithms (4th edition)*

Week 1 (July 1-7)

Topics

- Introduction
- Merge Sort
- Asymptotic Notation
- Guiding Principles of Algorithm Analysis
- Divide & Conquer Algorithms

Homework

- **Due July 14:**
- Problem Set #1: Divide & Conquer / Asymptotic Analysis
- Programming Assignment #1: Counting Inversions!

Suggested Readings:

- CLRS: Chapter 2, 3, and 4 (through Section 4.2), and Sections 28.1 and 33.4
- DPV: Sections 0.3, 2.1, 2.3, 2.5
- KT: Sections 2.1, 2.2, 2.4, 5.1, and 5.3-5.5
- SW: Sections 1.4 and 2.2

Week 2 (July 8-14)

Topics

- Master Method
- QuickSort

Homework

- **Due July 21:**
- Problem Set #2: QuickSort and the Master Method
- Programming Assignment #2: Counting Comparisons in QuickSort

Suggested Readings:

- CLRS Chapter 4 (Sections 4-6) and Chapter 7
- DPV Section 2.2
- KT Sections 5.2 and 13.5
- SW Section 2.3

Week 3 (July 15-21)

Topics

Homework

- **Due July 28**
- Problem Set #3:

Suggested Readings:

- Final Thoughts on Sorting & Searching
- Introduction to Graph Algorithms : Graph Representations & Mininum Cuts in Graphs

Randomized Selection & Minimum Cuts in Graphs
- Programming Assignment #3: Karger's Minimum Cut Algorithm

- CLRS Chapter 9, 22 (Only 22.1)
- DPV Chapter 3 (only 3.1)
- KT Chapter 13, Sections 13.2,13.5
- SW Chapter 4, Section 4.1

Week 4 (July 22-28)

Topics

- Graph Search: Breadth-First Search, Depth-First Search
- Applications: Topological Sort, Connected Components

Homework

- **Due August 4**
- Problem Set #4: Graphs, BFS, DFS, Topological Sort
- Programming Assignment #4: Computing SCCs

Suggested Readings:

- CLRS Chapter 22
- DPV Chapter 3
- KT Chapter 3, Section 3.5, 3.6
- SW Chapter 4, Section 4.1,4.2

Week 5 (July 29-August 4)

Topics

- Dijkstra's Shortest-Path Algorithm
- Data structures and how to use them
- Heaps
- Binary Search Trees
- Balanced BSTs

Homework

- **Due August 11**
- Problem Set #5: Dijkstra, Heaps, Search Trees
- Programming Assignment #5: Dijkstra's Algorithm

Suggested Readings:

- CLRS Chapter 6,11, 24 (Sections 3,4)
- DPV Section 1.5
- KT Chapter 13 (Section 13.6)
- SW Chapter 3 (3.4), Chapter 4 (4.4)

Week 6 (August 5-11)

Topics

- Hash Tables: Applications and Implementation
- Bloom Filters

Homework

- **Due August 18**
- Problem Set #6: Hashing, Bloom Filters
- Programming Assignment #6: Data Structure Applications

Suggested Readings:

- CLRS Chapters 12 and 13
- SW Chapter 3 (3.2,3.3,3.5)

Final Exam
(August 12-25)