**Syllabus**[Help](https://class.coursera.org/algo-005/help/pages?url=https%3A%2F%2Fclass.coursera.org%2Falgo-005%2Fwiki%2FSyllabus" \t "_blank" \o "Click here if you're experiencing technical problems or found errors in the course materials.)

**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)***

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| **Week 1 (May 5-11)**    **Topics**   * Introduction * Merge Sort * Asymptotic Notation * Guiding Principles of Algorithm Analysis * Divide & Conquer Algorithms | **Homework**   * **Due May 18:** * 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 (May 12-18)**    **Topics**   * Master Method * QuickSort | **Homework**   * **Due May 25:** * 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 (May 19-25)**    **Topics**   * Final Thoughts on Sorting & Searching * Introduction to Graph Algorithms : Graph Representations & Mininum Cuts in Graphs | **Homework**   * **Due June 1** * Problem Set #3: Randomized Selection & Minimum Cuts in Graphs * Programming Assignment #3: Karger's Minimum Cut Algorithm | **Suggested Readings:**   * 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 (May 26-June 1)**    **Topics**   * Graph Search: Breadth-First Search, Depth-First Search * Applications: Topological Sort, Connected Components | **Homework**   * **Due June 8** * 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 (June 2-June 8)**    **Topics**   * Dijkstra's Shortest-Path Algorithm * Data structures and how to use them * Heaps * Binary Search Trees * Balanced BSTs | **Homework**   * **Due June 15** * Problem Set #5: Dijkstra, Heaps, Search Trees * Programming Assignment #5: Dijkstra's Algorithm | **Suggested Readings:**   * CLRS Chapter 6,11,12,13 24 (Sections 3,4) * DPV Section 1.5 * KT Section 4.4 * SW Section 3.3, 3.4, 4.4 |
| **Week 6 (June 9-15)**    **Topics**   * Hash Tables: Applications and Implementation * Bloom Filters | **Homework**   * **Due June 22** * Problem Set #6: Hashing, Bloom Filters * Programming Assignment #6: Data Structure Applications | **Suggested Readings:**   * CLRS Chapter 11 * KT Chapter 13 (Section 13.6) * SW Section 3.5 |
| **Final Exam (June 16-29)** |  |  |

## Syllabus[Help](https://class.coursera.org/algo2-003/help/pages?url=https%3A%2F%2Fclass.coursera.org%2Falgo2-003%2Fwiki%2Fsyllabus" \o "Click here if you're experiencing technical problems or found errors in the course materials." \t "_blank)

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##### KT - Kleinberg and Tardos, Algorithm Design

##### SW - Sedgewick and Wayne, Algorithms (4th edition)

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| June 30-July 6  Topics  * Two Motivating Applications (Sequence Alignment and Internet Routing) * Selected Review from Part I (Optional) * Introduction to Greedy Algorithms * A Scheduling Application * Prim's Minimum Spanning Tree Algorithm | Homework  * **Due July 13:** * Problem Set #1: Greedy algorithms and MSTs * Programming Assignment #1: Greedy scheduling and Prim's MST algorithm | Suggested Readings:  * CLRS: Chapter 16 (Sections 1 and 2) and Chapter 23 * DPV: Sections 5.1.1, 5.1.2, and 5.1.5 * KT: Sections 4.1, 4.2, 4.3, and 4.5 * SW: Section 4.3 |
| July 7-13  Topics  * Kruskal's Minimum Spanning Tree Algorithm * Clustering * Advanced Topics: On the Union-Find Data Structure * Huffman Codes | Homework  * **Due July 20:** * Problem Set #2: More MSTs, and Huffman codes * Programming Assignment #2: Clustering | Suggested Readings:  * CLRS Chapter 16 (Section 3), Chapter 21, and Chapter 23 (Section 2) * DPV Sections 5.1.3, 5.1.4, and 5.2 * KT Sections 4.5-4.8 * SW Sections 1.5, 4.3, and 5.5 |
| July 14-20  Topics  * Dynamic Programming and Applications * The Knapsack Problem * Sequence Alignment * Optimal Search Trees | Homework  * **Due July 27:** * Problem Set #3: Dynamic Programming * Programming Assignment #3: The Knapsack Problem | Suggested Readings:  * CLRS Chapter 15 * DPV Chapter 6 * KT Sections 6.1-6.6 |
| July 21-27  Topics  * More Dynamic Programming and Shortest Paths * SIngle-Source Shortest Paths, Revisited * The Bellman-Ford Algorithm * Internet Routing * The All-Pairs Shortest Paths Problem * The Floyd-Warshall Algorithm * Johnson's Algorithm | Homework  * **Due August 3:** * Problem Set #4: Shortest Paths * Programming Assignment #4: All-Pairs Shortest Paths | Suggested Readings:  * CLRS Section 24.1 and Chpater 25 * DPV Sections 4.6, 4.7, 6.1, 6.6 * KT Sections 6.8-6.10 |
| July 28-August 3  Topics  * P, NP, and What They Mean * Reductions Between Problems * NP-Complete Problems * The P vs. NP Problem * Solvable Special Cases of NP-Complete Problems * Smarter (But Still Exponential-Time) Search Algorithms for NP-Complete Problems | Homework  * **Due August 10:** * Problem Set #5: NP-Complete Problems and Smarter Search Algorithms for Them * Programming Assignment #5: The Traveling Salesman Problem | Suggested Readings:  * CLRS Chapter 34 * DPV Section 8.1, 8.2, 9.1 * KT Sections 8.1-8.4, 8.10, 10.1, 10.2 |
| August 4-10  Topics  * Heuristics with Provable Guarantees * Greedy and Dynamic Programming Heuristics for the Knapsack Problem * Local Search: General Principles, Max Cut, and 2SAT | Homework  * **Due August 17:** * Problem Set #6: Approximation Algorithms and Local Search * Programming Assignment #6: 2SAT | Suggested Readings:  * CLRS Sections 35.1-35.3 * DPV Section 9.2, 9.3 * KT Sections 11.1-11.3, 11.8, 12.1, 12.4, 12.5 |
| Final Exam (August 11-24) |  |  |