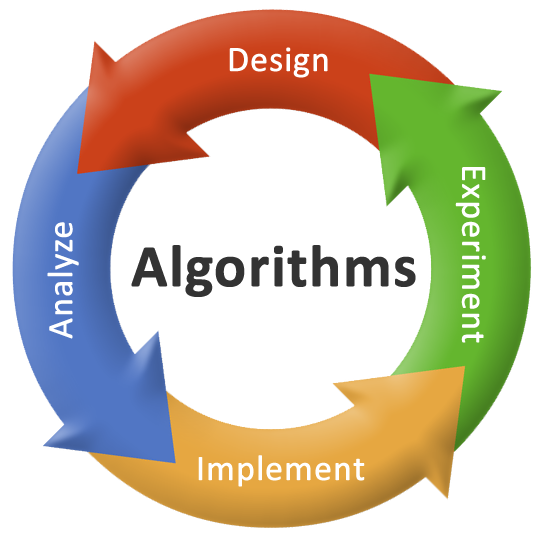
**http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms**

* \[OpenClassroom](http://openclassroom.stanford.edu/MainFolder/HomePage.php)



**CS 161 - Design and Analysis of Algorithms**

**Prof. Tim Roughgarden**

**COURSE DESCRIPTION**

**Course Overview:** Introduction to fundamental techniques for designing and analyzing algorithms, including asymptotic analysis; divide-and-conquer algorithms and recurrences; greedy algorithms; data structures; dynamic programming; graph algorithms; and randomized algorithms.

**Required textbook:** Kleinberg and Tardos, Algorithm Design, 2005. We will be covering most of Chapters 4–6, some parts of Chapter 13, and a couple of topics not in the book.

**Prerequisites:** Introduction to proofs, and discrete mathematics and probability (e.g., CS 103 and Stat116). If you have not taken a probability course, you should expect to do some independent reading during the course on topics including random variables, expectation, conditioning, and basic combinatorics.

**1. INTRODUCTION (1/4/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Why are you here?](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Example: Internet Routing](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Shortest-Path Algorithms](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Example: Sequence Alignment (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Example: Sequence Alignment (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Beating Brute Force Search](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Administrivia](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Recursive Algorithms for Integer Multiplication](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Gauss's Trick](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L1P9&speed=100)

**2. BASIC DIVIDE & CONQUER (1/6/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Merge Sort: Motivation](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Merge Sort: Formal Definition](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Running Time of Merge](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Running Time of Merge Sort (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Running Time of Merge Sort (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Guiding Principles of CS161 (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Guiding Principles of CS161 (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Review of Asymptotic Notation](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Asymptotic Notation: Example #1](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P9&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Asymptotic Notation: Example #2](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P10&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Big-Omega and Big-Theta](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L2P11&speed=100)

**3. THE MASTER METHOD (1/11/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Integer Multiplication Revisited](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L3P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Master Method: Formal Statement (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L3P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Master Method: Formal Statement (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L3P2b&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Master Method: Examples](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L3P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of Master Method (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L3P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of Master Method (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L3P4b&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Master Method: Interpretation of the Three Cases](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L3P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of Master Method (Part 3)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L3P6&speed=100)

**4. LINEAR-TIME MEDIAN (1/13/2011)**

*We apologize for the poor audio quality in this video.*

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Selection Problem](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Partitioning Around a Pivot](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [A Generic Selection Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Median of Medians](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Recap](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Rough Recurrence](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Key Lemma (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Key Lemma (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Substitution Method](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P9&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Analysis of Rough Recurrence](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L4P10&speed=100)

**5. GRAPH SEARCH & DIJKSTRA'S ALGORITHM (1/18/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Graph Primitives](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Representing Graphs: Adjacency Matrices and Lists](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Breadth-First and Depth-First Search](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dijkstra's Algorithm (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dijkstra's Algorithm (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dijkstra's Algorithm: Example](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dijkstra's Algorithm: Proof of Correctness (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dijkstra's Algorithm: Proof of Correctness (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Undirected Connectivity](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L5P9&speed=100)

**6. CONNECTIVITY IN DIRECTED GRAPHS (1/20/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Strongly Connected Components](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [SCCs: A Two-Pass Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Depth-First Search Revisited](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Example (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Example (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Two-Tier Structure of Directed Graphs](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Correctness of Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Correctness Intuition](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of Key Lemma](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P9&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Structure of the Web, Small World Property, and PageRank](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L6P10&speed=100)

**7. INTRODUCTION TO GREEDY ALGORITHMS (1/25/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Course Roadmap](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L7P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Application and Final Exam Info](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L7P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [A Scheduling Problem](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L7P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Two Greedy Algorithms](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L7P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Correctness Proof](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L7P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Cost-Benefit Analysis](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L7P6&speed=100)

**8. MINIMUM SPANNING TREES (1/27/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Introduction](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Prim's Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Graph Theory Preliminaries](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Feasibility of Prim's Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Cut Property](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of Cut Property](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Key Exchange Argument](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Naive Running Time and Heap Review](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Implementing Prim with Heaps (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P9&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Implementing Prim with Heaps (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P10&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [New Running Time Analysis](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L8P11&speed=100)

**9. KRUSKAL'S ALGORITHM AND UNION-FIND (2/1/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Kruskal's Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of Correctness (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of Correctness (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Naive Running Time](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Union-Find Data Structure](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Union by Rank](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Rank and Size of Subtrees](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Open Research Question](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Path Compression](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P9&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Path Compression and the Ackermann Function](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L9P10&speed=100)

**10. PATH COMPRESSION AND CLUSTERING (2/3/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Union-Find Review](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L10P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Path Compression](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L10P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Rank Blocks](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L10P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Counting Pointer Updates](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L10P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Clustering](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L10P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [A Greedy Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L10P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Correctness of Greedy Algorithm (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L10P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Correctness of Greedy Algorithm (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L10P8&speed=100)

**11. INTRODUCTION TO RANDOMIZED ALGORITHMS (2/8/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Min Cut Problem](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L11P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Contraction Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L11P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Probability Review](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L11P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Analysis of Contraction Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L11P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Success Through Independent Trials](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L11P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Final Comments](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L11P6&speed=100)

**12. QUICKSORT (2/10/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The QuickSort Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Best-Case and Worst-Case Pivots](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Running Time of Randomized QuickSort](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Probability Review Part 2](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Linearity of Expectation](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Counting Comparisons](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Crux of Proof](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Final Calculations](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Lower Bound of Comaprison-Based Sorting](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L12P9&speed=100)

**13. HASHING (2/15/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Hashing: Introduction](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Hashing: High-Level Idea](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Running Time](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [How to Analyze Hashing](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Universal Hashing](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of O(1) Running Time](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [A Universal Family](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Universality: Proof Idea](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Bloom Filters](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L13P9&speed=100)

**14. BALANCED SEARCH TREES AND SKIP LISTS (2/17/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Review of Binary Search Trees](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L14P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Deleting from a BST](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L14P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Red-Black Trees](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L14P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Height of Red-Black Trees](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L14P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Rotations](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L14P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Insertion to a Red-Black Tree](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L14P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Skip Lists: High-Level Idea](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L14P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Skip Lists: Intuition for Analysis](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L14P8&speed=100)

**15. INTRODUCTION TO DYNAMIC PROGRAMMING (2/22/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dynamic Programming: A First Example](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L15P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Structure of Optimal Solution](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L15P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [A Recursive Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L15P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Bottom-Up Formulation](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L15P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Reconstruction Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L15P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Knapsack Problem](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L15P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dynamic Programming Solution](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L15P7&speed=100)

**16. SEQUENCE ALIGNMENT (2/24/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Sequence Alignment](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L16P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Optimal Substructure](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L16P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dynamic Programming Solution](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L16P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dynamic Programming Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L16P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Shortest Paths with Negative Edge Lengths](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L16P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [On Negative Cycles](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L16P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Optimal Substructure (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L16P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Optimal Substructure (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L16P8&speed=100)

**17. SHORTEST PATHS: BELLMAN-FORD AND FLOYD-WARSHALL (3/1/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Single-Source Shortest Paths Revisited](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L17P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Bellman-Ford Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L17P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Negative Cycle Checking](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L17P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Space Optimization](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L17P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Floyd-Warshall Algorithm (Part 1)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L17P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Floyd-Warshall Algorithm (Part 2)](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L17P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Dynamic Programming Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L17P7&speed=100)

**18. NP-COMPLETE PROBLEMS (3/3/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Polynomial Time Algorithms and P](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Traveling Salesman Problem](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Reductions](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Completeness](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [NP-Completeness](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Many Problems are NP-Complete](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Does P=NP?](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Coping with NP-Completeness](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [The Vertex Cover Problem](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P9&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Smarter Brute-Force Search](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L18P10&speed=100)

**19. APPROXIMATION ALGORITHMS (3/8/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Performance Guarantees for Heuristics](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L19P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [A Greedy Knapsack Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L19P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Proof of Performance Guarantee](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L19P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Final Exam Info](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L19P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Better Performance via Dynamic Programming](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L19P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Accuracy Analysis](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L19P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Running Time Analysis](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L19P7&speed=100)

**20. THE WIDER WORLD OF ALGORITHMS (3/10/2011)**

* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Bipartite Matching](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P1&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Stable Matching](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P2&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Gale-Shapley Proposal Algorithm](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P3&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Maximum Flow](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P4&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Selfish Flow and Braess's Paradox](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P5&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Linear Programming](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P6&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Computational Geometry](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P7&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Approximation and Randomized Algorithms](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P8&speed=100)
* http://openclassroom.stanford.edu/MainFolder/images/playbutton.jpg [Complexity and Epilogue](http://openclassroom.stanford.edu/MainFolder/VideoPage.php?course=IntroToAlgorithms&video=CS161L20P9&speed=100)

**RESOURCES**

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