# 3343 Analysis of Algorithms – Fall 10

# Schedule

(subject to change)

| Date | Material |
|---|---|
| Th 8/26 | **Analyzing algorithms (Ch. 2.2)**<br>Best case and worst case runtimes; insertion sort, incremental algorithm |
| Tu 8/31 | **Asymptotic notation (Ch. 3, Ch. A)**<br>$O$, $\Omega$, $\Theta$, $o$, limit-theorem; runtime for code-snippets<br>*Homework 1 assigned* **Recitation: Homework 1** |
| Th 9/2 | **Asymptotic notation (Ch. 3, Ch. A)**<br>$O$, $\Omega$, $\Theta$, $o$, limit-theorem; runtime for code-snippets **Recitation: Homework 1** |
| Tu 9/7 | **Heapsort (Ch. 6)**<br>Abstract data types (ADT), priority queue, heap, heapsort, linear-time buildheap<br>*Homework 1 due; homework 2 assigned* **Recitation: Homework 2** |
| Th 9/9 | **Recursion trees and induction (+)**<br>Recursive algorithms. Guess solution of recurrence using recursion trees and prove the correctness of the solution using induction. **Recitation: Homework 2** |
| Tu 9/14 | **Divide-and-conquer (Ch. 2.3) and recurrences (Ch. 4.3, 4.4)**<br>Divide-and-conquer, merge sort, binary search; Runtime recurrences. Big-Oh induction (substitution method)<br>*Homework 2 due; homework 3 assigned* **Recitation: Homework 3** |
| Th 9/16 | **Master theorem (Ch. 4.5)**<br>Use of master theorem to solve recurrences. **Recitation: Homework 3** |
| Tu 9/21 | **More divide-and-conquer (Ch. 31.6 pages 956–957; 4.2)**<br>Repeated squaring for exponentiation, Strassen's matrix multiplication.<br>*Homework 3 due; homework 4 assigned; project 1 assigned*<br>**Recitation: Homework 4** |
| Th 9/23 | **Probability, random variables and expected values (Ch. C.2, C.3)**<br>Probability, random variables, expected values. **Recitation: Homework 4** |
| Tu 9/28 | **Randomized algorithms (Ch. 5.1–5.3)**<br>Hiring problem; Expected runtime analysis.<br>*Homework 4 due; homework 5 assigned* **Recitation: Review test 1** |
| Th 9/30 | **Quicksort (Ch. 7.1–7.4)**<br>Quicksort, best-case and worst-case runtimes, randomized quicksort.<br>**Recitation: Review test 1** |
| Tu 10/5 | **Test 1**<br>Material until 9/21 (inclusive) **Recitation: Homework 5** |
| Th 10/7 | **Sorting (Ch. 8.1, 8.2, 8.3)**<br>Decision trees, lower $\Omega(n \log n)$ bound for comparison sorts, counting sort, radix sort<br>**Recitation: Homework 5** |
| Tu 10/12 | **Order statistics (Ch. 9)**<br>Order statistics (find $i$-th smallest element); Randomized selection, deterministic selection in linear time<br>*Homework 5 due; homework 6 assigned* **Recitation: Homework 6** |
| Th 10/14 | **Red-black trees (Ch. 13.1, 13.2, 13.3)**<br>Red-black tree property, rotations, insertion; abstract data types, ADT dictionary<br>**Recitation: Homework 6** |
| Tu 10/19 | **B-trees (Ch. 18.1, 18.2)**<br>$k$-ary search trees, B-tree def., height, insertion<br>*Homework 6 due; homework 7 assigned* **Recitation: Homework 7** |

| Date | Material |
|---|---|
| Th 10/21 | **Dynamic programming (Ch. 15.4, +)** <br> Fibonacci, binomial coefficient, LCS: fill table, then construct solution from the table.           **Recitation: Homework 7** |
| Tu 10/26 | **Dynamic programming (Ch. 15.3, 15.4., 16.2, +)** <br> 0-1 Knapsack; general outline of dynamic programming: Optimal substructure (recurrence), overlapping subproblems, fill table bottom-up or by memoization. <br> *Homework 7 due; homework 8 assigned; project 1 due* **Recitation: Homework 8** |
| Th 10/28 | **Greedy algorithms (Ch. 16.2, problem 16-1 on page 402)** <br> Greedy algorithms (greedy-choice property, optimal substructure). Making change, fractional knapsack.        **Recitation: Homework 8** |
| Tu 11/2 | **Elementary Graph Algorithms (Ch. 22.1–22.2)** <br> Representations of graphs, breadth-first search (BFS) <br> *Homework 8 due; homework 9 assigned; project 2 assigned* <br>             **Recitation: Review test 2** |
| Th 11/4 | **Elementary Graph Algorithms (Ch. 22.3–22.4)** <br> Depth-first search (DFS), topological sort     **Recitation: Review test 2** |
| Tu 11/9 | **Minimum Spanning Trees (Ch. 23)** <br> Prim (grows single tree), Kruskal (grows forest; uses union/find data structure) <br>             **Recitation: Homework 9** |
| Th 11/11 | **Test 2** <br> Material from 9/23 until 10/26 (inclusive) <br>             **Recitation: Homework 9** |
| Tu 11/16 | **Single-source shortest paths (Ch. 24 without 24.4)** <br> Optimal substructure, triangle inequality, relaxation step; Dijkstra (only for non-negative edge weights), predecessor tree (shortest path tree); Bellman-Ford, detection of negative-weight cycles; Shortest paths in a DAG <br> *Homework 9 due; homework 10 assigned*     **Recitation: Homework 10** |
| Th 11/18 | **All-Pairs Shortest Paths (Ch. 25.2)** <br> Dynamic programming: Floyd-Warshall <br> ONLINE TEACHING EVALUATIONS, FIRST DAY     **Recitation: Homework 10** |
| Tu 11/23 | **P and NP (Ch. 34)** <br> Decision problems, definition of classes P and NP, polynomial-time reductions, NP-hardness, NP-completeness; Show that problems are NP-complete by reducing from other problems <br> *Homework 10 due; homework 11 assigned* **Recit. (voluntary): Homework 11** |
| Th 11/25 | **Thanksgiving** <br> No class |
| Tu 11/30 | **P and NP (Ch. 34)** <br> TSP, Clique, Independent Set, Vertex Cover, Hamilton Path, Hamilton Circuit <br>             **Recitation: Review final exam** |
| We 12/1 | **Drop deadline to drop with a 'W'** |
| Th 12/2 | **Review for Final Exam** <br> Review for final exam <br> *Homework 11 due; project 2 due*       **Recitation: Review final exam** |
| Su 12/5 | ONLINE TEACHING EVALUATIONS, LAST DAY |

Chapter numbers refer to the CLRS book, 3rd edition. "+" indicates additional material.


**The comprehensive final exam will be on Thursday 12/9, 10:30am − 1pm.**