Design and Analysis of Algorithms

CS218, Spring 2018

Instructor

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• Office hours: Monday 3:10-4:30pm
  WCH 325
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Grader

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• Office hours: TBA
  WCH 110
  (or by appointment)

Web

• Course homepage
  – http://www.cs.ucr.edu/~stelo/cs218spring18/
  – Schedule, slides, homework, exams (no grades)

• iLearn
  – http://www.ilearn.ucr.edu/
  – Only grades
Textbook

Cormen, Leiserson, Rivest, Stein,
*Introduction to Algorithms*,
MIT Press (“white book”), 2009

Reference (1/2)

Kleinberg, Tardos, *Algorithm Design*,
Addison Wesley (“black book”), 2005
Reference (2/2)


Course Format

- Eight homework, posted on Wednesday, due a week later on Wednesday as a PDF (LaTeX) via GradeScope
- No collaboration is allowed on homework: copying the solution from other students or any source on-line/off-line is considered cheating
- Exams (closed book, closed notes)
  - Entrance exam (Apr 9, one week from today, in class)
  - Midterm exam (May 16, in class)
  - Final exam (June 11, 3-6pm, in class)
Grading

- Entrance exam (e) – 5%
- Homework (h) – 16% (2% each)
- Midterm exam (m) – 30%
- Final exam (f) – 49%

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Grade</th>
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<tbody>
<tr>
<td>100 – 90</td>
<td>A+</td>
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<tr>
<td>85 – 89.999</td>
<td>A</td>
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<td>80 – 84.999</td>
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<tr>
<td>60 – 64.999</td>
<td>C</td>
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<tr>
<td>0 – 59.999</td>
<td>D/F</td>
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Tentative list of topics (1/2)

- Analysis of algorithms: worst-case time complexity, asymptotic notation, lower bounds, recurrence relations, amortized analysis
- Divide and conquer: linear time selection (randomized and deterministic), matrix multiplication (Strassen), fast Fourier transform, polynomial multiplication, integer multiplication (Karatsuba and FFT)
- Greedy: activity selection, single-source shortest path (Dijkstra), minimum spanning tree (Kruskal, Prim), Union-find
Tentative list of topics (2/2)

• Midterm
• Dynamic programming: 0-1 knapsack, longest common subsequence, single-source shortest path (Bellman-Ford), all-pairs shortest path (Floyd-Warshall)
• Flow & matching: flow networks, max flow (Ford-Fulkerson, Edmonds-Karp), maximum bipartite matching
• Final

Prerequisites by topic (CS 141-equiv)

• Discrete Math: asymptotic notation, basic summation formulas, sets (operations on sets, relations, functions), counting (permutations, sets, combinations)
• Basic Data Structures: array, list, queue, stack, binary search trees, balanced search trees, heap
• Sorting and Searching: quicksort, mergesort, heapsort, radixsort, binary search
• Graph algorithms: DFS, BFS, connected components, biconnected components
• Digraph algorithms: DFS, BFS, strongly connected components, transitive closure, topological sorting
Entrance exam

- Monday, April 9th – in class
- 30 minutes (closed book, closed notes)
- Three problems
  1. Answer six T/F questions
  2. Write three definitions
  3. Design one simple algorithm

Entrance exam: Examples of Qs

- T/F questions
  - \( \frac{6n \log n}{\sqrt{n}} \in \Omega(\sqrt{n}) \)
  - BFS can be sometimes slower than \( O(n+m) \), where \( n \) is the number of nodes and \( m \) is the number of edges
  - Topological sorting runs in \( O(n+m) \) time, where \( n \) is the number of nodes and \( m \) is the number of edges
  - The transitive closure of a strongly connected directed graph is a complete directed graph
- Definitions (write a formal definition)
  - Worst-case time complexity
  - \( f(n) \) is \( \Theta(g(n)) \)
  - Strongly connected component of a directed graph