CS 420: Advanced Algorithm Design and Analysis
Spring 2015 – Lecture 21

Department of Computer Science
University of British Columbia

March 24, 2015

Announcements

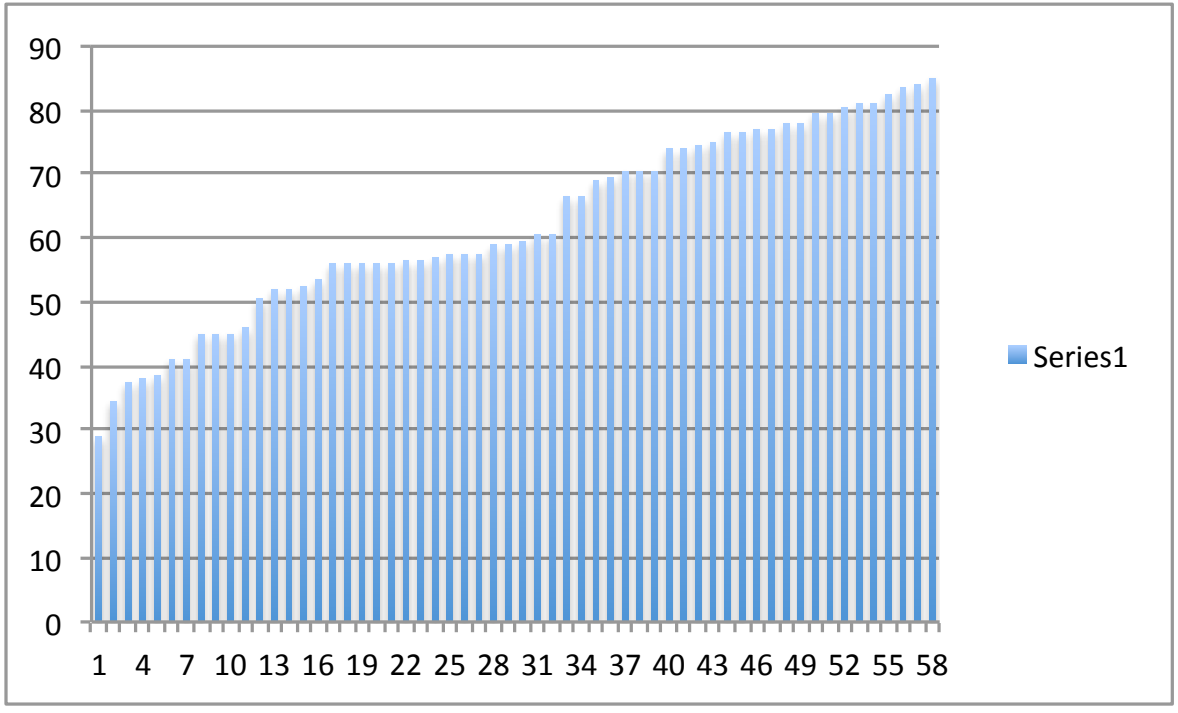
Assignments...

- Asst6/7 sample solutions posted
- Asst8/9 out Thursday (due April 9)

Midterm II...

- back today
- average 62; median 59

Midterm II Distribution



Announcements (cont.)

Midterm III...

- Q/A session...today, March 24; 5:30-7:00; DMPT 110
- Exam...tomorrow, March 25; 5:30-7:00; DMPT 110
- ...on *all* course material up to and including March 19 lecture

Readings...

- matchings and network flows [Kleinberg&Tardos, Chapt. 7], [Cormen et al., Chapt. 26], [Dasgupta et al., Chapter 7]
- reductions and NP-hardness [Kleinberg&Tardos, Chapt. 8, 11], [Cormen et al., Chapt. 34,35]

Last class...

Coping with **NP**-hardness

- approximate solutions
- heuristics (empirically effective algorithms)
- restriction (exploiting structure of certain input classes)

Approximations?

- VERTEX-COVER
  - 2-approximation via maximal matching
  - best approx known
- KNAPSACK
  - $(1+\epsilon)$-approximation (via dynamic programming)
  - *polynomial-time approximation scheme*
- COLORING
  - approximation factor n^{ϵ}, for some fixed ϵ, cannot be achieved, unless **P**=**NP**

Today...

Finding extrema revisited...

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Finding extrema revisited... convex hulls (in 2 and higher dimensions)

- "equivalence" 2-d convex hull and sorting problems
  - $O(n \lg n)$ time algorithms following various sorting paradigms
  - $\Omega(n \lg n)$ lower bound by reduction from sorting

Today...

Finding extrema revisited... convex hulls (in 2 and higher dimensions)

- "equivalence" 2-d convex hull and sorting problems
  - $O(n \lg n)$ time algorithms following various sorting paradigms
  - $\Omega(n \lg n)$ lower bound by reduction from sorting
- breaking the "equivalence"...output-size sensitive algorithms

Coming up...

- low-dimensional linear programming
- two-dimensional searching...planar point location
- motion planning problems