CS W3134: Data Structures in Java

Lecture #25: The End
12/9/04
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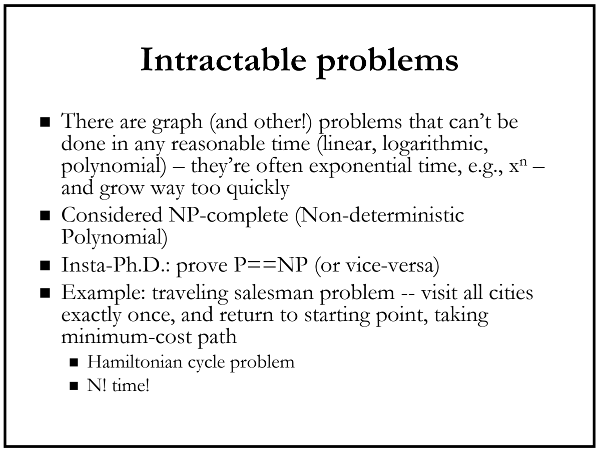
Administrivia

- HW#6 due on Monday
  - Note duetimes
  - Any questions?
  - Extra TA office hours planned for Monday, I'll let you know
  - No formal office hours after Monday, although I should be available for appointments
- Fill out recommendations

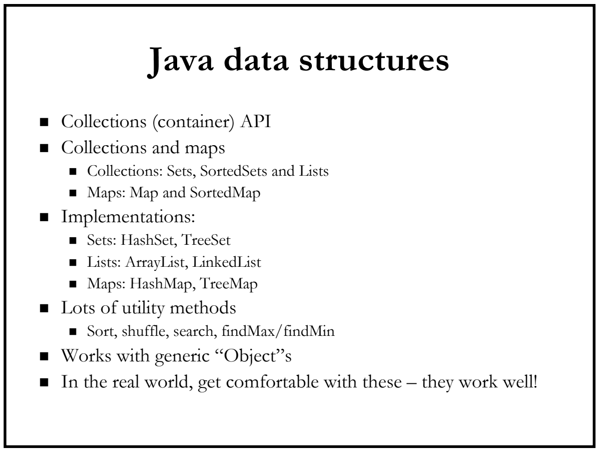
Agenda

- End class
- Start final review



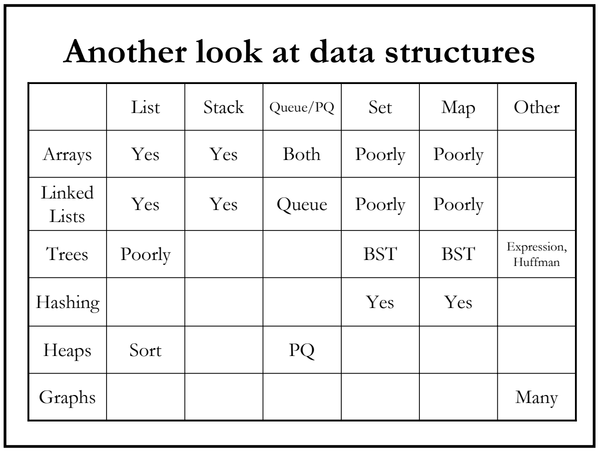
Intractable problems

- There are graph (and other!) problems that can't be done in any reasonable time (linear, logarithmic, polynomial) – they're often exponential time, e.g., x^n – and grow way too quickly
- Considered NP-complete (Non-deterministic Polynomial)
- Insta-Ph.D.: prove P==NP (or vice-versa)
- Example: traveling salesman problem -- visit all cities exactly once, and return to starting point, taking minimum-cost path
  - Hamiltonian cycle problem
  - N! time!



Java data structures

- Collections (container) API
- Collections and maps
  - Collections: Sets, SortedSets and Lists
  - Maps: Map and SortedMap
- Implementations:
  - Sets: HashSet, TreeSet
  - Lists: ArrayList, LinkedList
  - Maps: HashMap, TreeMap
- Lots of utility methods
  - Sort, shuffle, search, findMax/findMin
- Works with generic "Object"s
- In the real world, get comfortable with these – they work well!



Another look at data structures

	List	Stack	Queue/PQ	Set	Map	Other
Arrays	Yes	Yes	Both	Poorly	Poorly	
Linked Lists	Yes	Yes	Queue	Poorly	Poorly	
Trees	Poorly			BST	BST	Expression, Huffman
Hashing				Yes	Yes	
Heaps	Sort		PQ			
Graphs						Many

Selected algorithms

- Sorts
  - Comparison-based sort
    - Bubble, selection, insertion: O(n^2)
    - Merge, heap: O(n lg n)
    - Quick: Approximately O(n lg n)
  - Other
    - Radix: Approximately O(n log n)
    - Topological: O(V+E) { list }; O(V^2) { matrix }

Selected graph algorithms

- Unweighted, undirected graphs
  - Search/traversal: BFS, DFS
  - Spanning tree: BFS or DFS and store edges
- Directed graphs
  - Topological sort
  - Connectivity: Warshall
- Weighted graphs
  - Spanning tree: Prim
  - Shortest path: Dijkstra (single-source), Floyd (all-source)

The Exam

- Similar to midterm, but about 50-75% longer
- What you don't need to know
  - Shellsort
  - Red-black trees
  - 2-3-4 trees/external storage
  - Floyd's algorithm (too hard to do on the exam)
- What you do need to know
  - Pretty much everything else
  - Remember, stuff in class – use my slides
- Chapter 15 is a useful overview

What’s next?

- That’s pretty much it slideswise.
- What other topics do you want to review?
- Another session next week?