Data Structures Review

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Lists

	`add(i,x)` `remove(i)`	`get(i)` `set(i)`
ArrayStack[1]	$O(1+n-i)$	$O(1)$
ArrayDeque[1]	$O(1+\min\{i,n-i\})$	$O(1)$
DualArrayDeque[1]	$O(1+\min\{i,n-i\})$	$O(1)$
RootishArrayStack	$O(1+n-i)$	$O(1)$
RootishArrayStack[2]	$O(\sqrt{n})$	$O(1)$
SLList	$O(1+i)$	$O(1+i)$
DLList	$O(1+\min\{i,n-i\})$	$O(1+\min\{i,n-i\})$
SkipList[3]	$O(\log n)$	$O(\log n)$

[1] amortized
[2] Assignment 3
[3] randomized

Sets and Maps

	`add(x)` `remove(x)`	`contains(x)` `get(x)/put(x)`
MultiplicativeHashTable[4]	$O(1)$	$O(1)$

[4] amortized and randomized

SortedSets

	all operations
Skiplist[1]	$O(\log n)$
Treap[1]	$O(\log n)$
ScapegoatTree[2]	$O(\log n)$
2-4 Tree	$O(\log n)$
Red-Black Tree	$O(\log n)$

[1] randomized

[2] amortized

Priority Queues

	`findMin()`	`deleteMin()`	`merge()`
		`add()`	
BinaryHeap[1]	$O(1)$	$O(\log n)$	N/A
MeldableHeap[2]	$O(1)$	$O(\log n)$	$O(\log n)$

[1] amortized — if using the Eytzinger Method

[2] randomized

Sorting Algorithms

	time	in-place	#comparisons
QuickSort[1]	$O(n \log n)$	yes	$2n \ln n \approx 1.38 n \log_2 n$
HeapSort	$O(n \log n)$	yes	$2n \log_2 n$
MergeSort	$O(n \log n)$	no	$n \log_2 n$

[1] randomized

Other Algorithms

- Graham's Scan: Compute the convex hull
  - $O(n)$ time (after sorting by x-coordinate)
  - Uses a Stack
- Bentley-Ottman Plane Sweep: Compute all intersecting pairs of line segments
  - $O((n+k)\log n)$ time (k is the number of intersecting pairs)
  - Uses a SortedSet and a PriorityQueue

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- Plus many other courses requiring the use of data structures (large scale-programming, computer games, computational geometry,. . .)

Final Exam Format

- Multiple-choice scantron
- 1/2 pre-midterm material (up to and including hash tables)
- 1/2 post-midterm material
- Not overly long (62 questions)
- Questions cover material in the same order as presented in the course
- Use review questions as study guide