16:332:573

Homework #3 (100pt), Due. 03-21-2017

Q1. [30pt] **Sorting:** Let's take a look at the following dataset. The left-most column is the original input strings to be sorted. The right-most column has strings in sorted order. Middle columns (from 2nd to 7th cols.) are the contents at some intermediate step during one of the 6 algorithms listed as follows – a) insertion sort, b) selection sort, c) shellsort, d) mergesort (top-down), e) mergesort (bottom-up), and f) quicksort. Match up each algorithm under the corresponding column.

lifo	find	data	data	data	data	hash	data
fifo	fifo	fifo	fifo	exch	fifo	fifo	exch
data	data	find	find	fifo	lifo	data	fifo
type	exch	hash	hash	find	type	link	find
hash	hash	heap	heap	hash	hash	leaf	hash
heap	heap	lifo	lifo	heap	heap	heap	heap
sort	less	link	link	leaf	link	exch	leaf
link	left	list	list	left	sort	node	left
list	leaf	push	push	less	find	lifo	less
push	lifo	root	root	lifo	list	left	lifo
find	push	sort	sort	link	push	find	link
root	root	type	type	list	root	path	list
leaf	list	leaf	leaf	sort	leaf	list	next
tree	tree	left	tree	tree	null	next	node
null	null	node	null	null	path	less	null
path	path	null	path	path	tree	root	path
node	node	path	node	node	exch	sink	push
left	link	tree	left	type	left	swim	root
less	sort	exch	less	root	less	null	sink
exch	type	less	exch	push	node	sort	sort
sink	sink	next	sink	sink	next	type	swap
swim	swim	sink	swim	swim	sink	tree	swim
next	next	swap	next	next	swap	push	tree
swap	swap	swim	swap	swap	swim	swap	type

Q2. [40pt] **Quicksort vs. Mergesort**: Implement Quicksort using median-of-three to determine the partition element. Compare the performance of Quicksort with the top-down version of Mergesort from HW2. After that, change the codes so that they use insertion sort when the input size is 10. Evaluate whether there exists a performance enhancement due to the "cut-off to insertion" scheme.

Q3. [30pt] **BST ordered operation**: Implement BST and its rank()/select() ordered operations. Let's take the attached dataset (hw3-q3-data.txt*) as inputs to construct BST. Then,

i) What is the value of select(9) for the dataset?

ii) What is the value of rank(15) for the dataset?

***Note**: since there is one value per row, assume key is equal to its value.