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/ [Week 10: Strings, Radix Sort, and Quicksort](#)

Started on	Wednesday, 5 April 2023, 09:05
State	Finished
Completed on	Wednesday, 5 April 2023, 09:59
Time taken	53 mins 51 secs
Marks	5.33/7.00
Grade	7.62 out of 10.00 (76%)

Question 1

Partially correct

Mark 0.83 out of 1.00

Complete the trace for LSD string sort (the array is depicted as a column, time advances from left to right)

shell	shell	✗	speak	✓	snail	✓	shell	✓	grill
sport	speak	✗	snail	✓	speak	✓	snail	✓	shell
spell	spell	✓	shell	✓	shell	✓	speak	✓	snail
grill	grill	✓	spell	✓	spell	✓	spell	✓	speak
snail	snail	✓	grill	✓	grill	✓	grill	✗	spell
speak	sport	✓	sport	✓	sport	✓	sport	✗	sport

shell

sport

spell

grill

snail

speak

Your answer is partially correct.

You have correctly selected 20.

The correct answer is:

Complete the trace for LSD string sort (the array is depicted as a column, time advances from left to right)

shell	[speak]	[speak]	[snail]	[shell]	grill
sport	[shell]	[snail]	[speak]	[snail]	shell
spell	[spell]	[shell]	[shell]	[speak]	snail
grill	[grill]	[spell]	[spell]	[spell]	speak
snail	[snail]	[grill]	[grill]	[sport]	spell
speak	[sport]	[sport]	[sport]	[grill]	sport

Question 2

Correct

Mark 1.00 out of 1.00

Your colleague bold_algorithmicist proposes to use the following string sorting algorithm:

For each position, from most significant to least significant, perform key indexed counting.
(Just like LSD-string-sort, only considering the 'digits' in the opposite order).

Which of the following statements are correct?

- ☒ a. There are sequences of strings that this algorithm does not sort correctly ✓
- ☐ b. The algorithm is correct on all sequences of strings
- ☒ c. The algorithm is correct for all sequences of strings of length 1 ✓
- ☒ d. There are sequences of strings that this algorithm sorts correctly ✓

Your answer is correct.

The correct answers are: There are sequences of strings that this algorithm sorts correctly, There are sequences of strings that this algorithm does not sort correctly, The algorithm is correct for all sequences of strings of length 1

Question 3

Incorrect

Mark 0.00 out of 1.00

Consider the partitioning algorithm [SW p 291]. How many comparisons are performed if 'partition' is called on the sub-array $a[l], \dots, a[h]$?

- ☐ a. $\sim (h - l)$
- ☐ b. $\sim (h - l)/4$
- ☐ c. $\sim n \log n$
- ☒ d. $\sim 2 * (h - l)$ ✗
- ☐ e. $\sim (h - l)/2$
- ☐ f. $\sim n$

Your answer is incorrect.

The correct answer is: $\sim (h - l)$

Question 4

Correct

Mark 1.00 out of 1.00

Assume the partitioning algorithm [SW p 291] returned the value j after a call on the complete array ($lo = 0, hi = n - 1$).

What statements are true about the array?

- ☐ a. the sub-array $a[lo] \dots a[j]$ is sorted
- ☒ b. for any $i < j$ and $j < k$, $a[i] \leq a[k]$ ✓
- ☒ c. the element at position j is at its final position in sorted order ✓
- ☐ d. the array is sorted

Your answer is correct.

The correct answers are: for any $i < j$ and $j < k$, $a[i] \leq a[k]$, the element at position j is at its final position in sorted order

Question 5

Partially correct

Mark 0.50 out of 1.00

Consider Quicksort as explained in [SW, p289], including the initial random shuffle.

Which of the following statements are correct?

- ☐ a. the expected running time is $O(n \log n)$, independent of the input sequence
- ☐ b. the best-case running time is $O(n)$
- ☐ c. there are input sequences for which the expected running time is $O(n^2)$
- ☒ d. the worst-case running time is $O(n^2)$ ✓

Your answer is partially correct.

You have correctly selected 1.

The correct answers are: the expected running time is $O(n \log n)$, independent of the input sequence, the worst-case running time is $O(n^2)$

Question 6

Correct

Mark 1.00 out of 1.00

Consider the following algorithm: You perform Quicksort (including the initial random shuffle) and stop the recursion (return immediately, without any further actions) when the length of the sub-array in the recursive call is less than the parameter k with $1 < k < n$.

Which of the following statements are correct?

- ☐ a. the rank k element is at position k in the final array
- ☐ b. no element has been moved by more than k positions, i.e., its position in the final array is at most k away from the position in the original array
- ☒ c. in the resulting array all elements are within a distance of k to their position in sorted order ✓
- ☒ d. the expected running time of the algorithm is $O(n \log n)$ ✓

Your answer is correct.

The correct answers are: in the resulting array all elements are within a distance of k to their position in sorted order, the expected running time of the algorithm is $O(n \log n)$

Question 7

Correct

Mark 1.00 out of 1.00

Consider the following algorithm: You perform Quicksort (including the initial random shuffle) and stop the recursion (return immediately, without any further actions) when the sub-array in the recursive call does not contain position k with $1 \leq k \leq n$.

Which of the following statements are correct?

- ☐ a. in the resulting array all elements are within a distance of k to their position in sorted order
- ☐ b. no element has been moved by more than k positions, i.e., its position in the final array is at most k away from the position in the original array
- ☒ c. the rank k element is at position k in the final array ✓
- ☒ d. the expected running time of the algorithm is $O(n \log n)$ ✓

Your answer is correct.

The correct answers are: the rank k element is at position k in the final array, the expected running time of the algorithm is $O(n \log n)$