

## CSE 5311 Homework Assignment 3 (Fall 2019)

Due date: 9/18 (Wednesday) (type, print, and hand-in in class)

[Submit source codes of your four programs required in the assignment via Canvas.]

1. [20 points] Problem 4-2 on Page 107
2. [40 points] Problem 7-2 (a) (b) and (c) on Page 186

And (d) write two quicksort programs, one for `RANDOMIZED_QUICKSORT(A, p, r)` (see Page 179) and one for `RANDOMIZED_QUICKSORT'(A, p, r)`. Run the programs on the array of numbers [5 6 8 10 11 13 8 8 3 5 2 11 8] and report number of recursive calls to `RANDOMIZED_QUICKSORT()` or `RANDOMIZED_QUICKSORT'()`.

3. [40 points] Problem 7-4 on Page 188

(Hint: For subproblem (c) you can choose the smaller subarray to apply recursion so that the  $O(\lg n)$  worst-case stack depth can be achieved. You don't have to explain how to "Maintain the  $O(\lg n)$  expected running time of the algorithm.".

And (d) write two quicksort programs, one for `TAIL-RECURSIVE-QUICKSORT (A, p, r)` and one for `Optimized_TAIL-RECURSIVE-QUICKSORT (A, p, r)` designed in subproblem (c). Assume each function call increases the stack depth by one. And each exiting of a function decreases the stack depth by one. Record the stack depth each time it changes. Run the programs on the array of numbers [5 6 8 10 11 13 8 8 3 5 2 11 8] and plot the changing stack depths for each program's run as a curve. And draw the two curves in one figure.