

## CSE 5311 Homework Assignment 3 (Fall 2022)

Due date: 11:59pm 9/20 (Tuesday) (upload one pdf file in 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 function exit 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.