CECS 528, Learning Outcome Assessment 8a, April 7th, Spring 2023, Dr. Ebert

NO NOTES, BOOKS, ELECTRONIC DEVICES, OR INTERPERSONAL COMMUNICATION ALLOWED. Submit solutions to at most 2 LO problems on separate sheets of paper.

Problems

LO4. Use the Subsitution method to prove that $T(n) = T(n/3) + T(2n/3) + n$ implies that $T(n) = \Omega(n \log n)$.

LO5. At the top level of recursion for the Median-of-Five Find Statistic algorithm, with

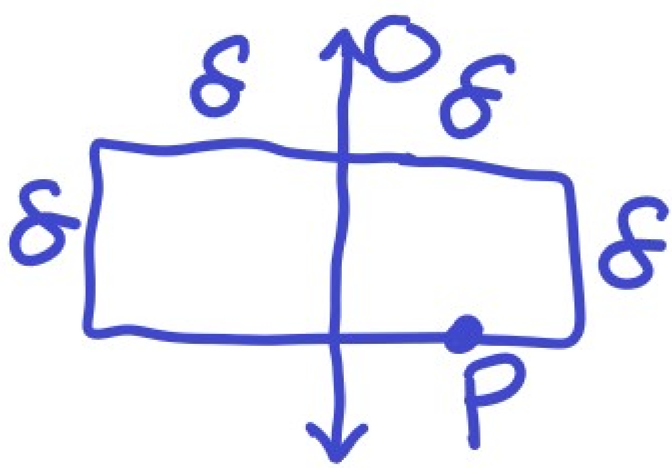
$$a = 83, 63, 38, 65, 4, 60, 7, 69, 32, 67, 36, 91, 82, 21, 24, 33, 72, 2, 62, 47, 52, 71$$

and $k = 11$ as inputs,

(a) What number will be chosen as the pivot for the partitioning step? Show work.

(b) At the next level (1) of recursion, which array will be examined: a_{left} or a_{right}? Explain.

LO6. Recall the combine step of the `Minimum Distance Pair (MDP)` algorithm where, for each point P in the δ-strip, there is a $2\delta \times \delta$ rectangle whose base contains P and is bisected by the dividing line O (see below).



(a) Explain why there can be at most 7 other points (from the problem instance) in this rectangle.

(b) Why are those 7 points the only ones for which P's distance must be computed?

LO7. Answer/Solve the following questions/problems.

(a) The dynamic-programming algorithm that solves the `Edit Distance` optimization problem defines a recurrence for the function $d(i, j)$. In words, what does $d(i, j)$ equal? Hint: do *not* write the recurrence (see Part b).

(b) Provide the dynamic-programming recurrence for $d(i, j)$.

(c) Apply the recurrence from Part b to the words $u =$ aabbab and $v =$ bababa. Show the matrix of subproblem solutions and use it to provide an optimal sequence of edits.

LO8. Answer/Solve the following questions/problems.

(a) The dynamic-programming algorithm that solves the `Matrix-Chain Multiplication` optimization problem defines a recurrence for the function $mc(i, j)$. In words, what does $mc(i, j)$ equal? Hint: do *not* write the recurrence (see Part b).

(b) Provide the dynamic-programming recurrence for $mc(i, j)$.

(c) Apply the recurrence from Part b to the dimension sequence 2,5,5,1,4. Show the matrix of subproblem solutions and use it to provide an optimal parenthesization.