

CECS 528, Homework Assignment 1, Spring 2025, Dr. Ebert

Directions: Please review the Homework section on page 6 of the syllabus including a list of all rules and guidelines for writing and submitting solutions.

Due Date: Monday, February 3rd as a PDF-file upload to the HW1 Canvas dropbox.

Problems

1. Let $T(n)$ be a positive and increasing integer function that satisfies the recurrence

$$T(n) = 3T(n/2) + 4T(n/3) + 5T(n/4) + n.$$

- (a) Use the Master Theorem and the fact that $T(n)$ is increasing to obtain an upper bound for the growth of $T(n)$. Justify your reasoning. Hint: $T(n)$ increasing means that $T(x) < T(y)$ whenever $x < y$. (15 pts)
 - (b) Use the substitution method and a calculator to determine an approximation of the least k (accurate to within one decimal place) for which $T(n) = O(n^k)$. Show work and justify your answer. (20 pts)
2. Use the substitution method to show that, if $T(n)$ satisfies the recurrence

$$T(n) = T(n/2) + T(n/4) + \frac{2n}{\log n},$$

Then $T(n) = O(\frac{n}{\log n})$. (20 pts)