

Sabancı University
Faculty of Engineering and Natural Sciences

CS301 – Algorithms

Homework 1

Due: March 6, 2024 @ 23.55
(upload to SUCourse)

PLEASE NOTE:

- Provide only the requested information and nothing more. Unreadable, unintelligible, and irrelevant answers will not be considered.
- Submit only a PDF file. (-20 pts penalty for any other format)
- Not every question of this homework will be graded. We will announce the question(s) that will be graded after the submission.
- You can collaborate with your **TA/INSTRUCTOR ONLY** and discuss the solutions of the problems. However, you have to write down the solutions on your own.
- Plagiarism will not be tolerated.

Late Submission Policy:

- Your homework grade will be decided by multiplying what you normally get from your answers by a “submission time factor (STF)”.
 - If you submit on time (i.e. before the deadline), your STF is 1. So, you don’t lose anything.
 - If you submit late, you will lose 0.01 of your STF for every 5 mins of delay.
 - We will not accept any homework later than 500 mins after the deadline.
 - SUCourse’s timestamp will be used for STF computation.
 - If you submit multiple times, the last submission time will be used.
-

Question 1

The recurrence relation of a recursive divide and conquer algorithm is given. Explain this recurrence, verbally, in terms of the size of each sub-problem, the cost of dividing the problem, and combining solutions.

$$T(n) = 3T\left(\frac{n}{4}\right) + 2n + n^3$$

Answer:

Question 2

Find an asymptotically tight lower bound for the following recurrence by using the substitution method.

$$T(n) = T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + \Theta(n)$$

Answer:

Question 3

For the following recurrences, either solve it by using the master method or show that it cannot be solved with the master method.

(a) $T(n) = T(\frac{n}{2}) + \Theta(1)$

Answer:

(b) $T(n) = 3T(\frac{n}{4}) + n \lg n$

Answer: