CENG 218 Spring 2024 Homework 2
Due date: 03th of June 2024, 17:00

Note: Submit photos or scans of your solutions via MS-Teams, as well as bring hard copies to course assistants. Homeworks submitted after the due date will not be evaluated. Write all your explanations and comments in English! Text in Turkish will not be evaluated. Submit a single pdf file. The file should be named as CENG218_HW2_<student_number>.pdf (Omit the angle brackets). Cheating or collaborative work will not be tolerated and will be considered as zero grade.

Q1 (20 points).

Let $G=(V,E)$ be a connected, undirected graph with real number edge weights. Also assume that all edge weights are distinct.

a. (5 pts) Does the min-weight edge of G have to be on Minimum Spanning Tree (MST) of G?

b. (5 pts) Can the max-weight edge of G belong to MST?

c. (5 pts) Adding the same positive value to every edge of G can change MST or not?

d. (5 pts) Adding the same positive value to every edge of G can change shortest path between two vertices or not?

For all question above, do not leave your answer as YES or NO. Discuss the situation with examples (by drawing simple graphs). If you can, prove your answer by contradiction or counter-examples. For some questions, answer may change at different conditions. If so, please discuss the answer separately for all different cases.

Q2 (30 points).

Remember the rod cutting problem, the following is an instance of it:

length *i*	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
price p_i	1	4	8	9	10	17	18	22	22	30

a. (15 pts) Define the ***density*** of a rod of length i to be p_i/i, that is, value per inch. A greedy strategy for cutting a rod of length n cuts first the piece with the highest density.

b. (15 pts) Show by a counterexample (at least for one n) that this greedy strategy does not always determine an optimal way to cut rods.

Q3 (50 points).

a) (35 pts) Build an AVL tree after successively inserting the keys: 91, 33, 64, 75, 27, 13, 73, 60, 89, 87, 20, 9, 12, 25, 26, 79, 74, 5. Show and explain every iteration.

b) (15 pts) Traverse the tree you build in-order, pre-order, and post-order.