

Exercise Sheet 8 for Advanced Data Structures (Summer 2026)

Hand In: Until 2026-06-19 18:00, on ILIAS.

Problem 1

30 points

Explain how to implement (i) treaps and (ii) splay trees with partial persistence, using the transformation described in the lecture. How does the runtime and space usage of these data structures change when adding persistence?

Problem 2

40 points

You are given a sequence x_1, \dots, x_n of n distinct integers. You must create a data structure which can answer *range selection queries* quickly. In a range selection query, we are given three values (i, j, k) , where $1 \leq i \leq j \leq n$ and $1 \leq k \leq j - i + 1$, and must answer the following question:

Suppose the numbers x_i, \dots, x_j were sorted, yielding the sequence y_1, \dots, y_{j-i+1} . Then what is the value of y_k ?

For full marks, your data structure should have $O(n \log n)$ construction time and $O(\log n)$ query time.