Mandatory Exercise: Persistent Data Structures

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1 Use of persistence Use **persistent** data structures to describe an efficient and simple solution to each of the following problems.

1.1 Given a set I of n intervals $\{[x_1, y_1], [x_2, y_2], ..., [x_n, y_n]\}$ on the real line, build a data structure that efficiently supports the following query:

- *contains*(p): return all intervals in X that contain the point p.

1.2 Given a set L of n line segments in the plane all parallel to the x-axis, build a data structure that supports the following query:

- *intersect*(s): Return all segments in L that intersect s, where s is a line segment parallel to the y-axis.

The segment s is given on the form (x, y_1, y_2) and the line segments in L are given on the form (x_1, x_2, y).

Analyze the space, preprocessing time, and query time of your solutions.