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Red-Black Trees in Sweepping Algorithms [BSc Vertiefung]

Sweeping algorithms [1] related to the temporal dimension use a vertical sweepline to pass through the lifespan of all tuples in the input relations, i.e. they pass through all starting and ending points of input tuples in a smaller-to-larger fashion. During their execution, they manage a *sweepline status*, including information on the tuples with which the sweepline intersects, and an *event-point schedule*, indicating the next starting/ending points that will be encountered. The goal of this project is to compare the *insert*, *delete* and *lookup* processes of Red-Black and AVL trees when they are performed over large datasets.

Tasks

1. Study and implement red-black trees [1].
2. Explain the complexity of the insert/delete/search processes for red-black trees.
3. Using large datasets with different characteristics, experimentally evaluate the runtime of the above processes.
4. Explain use of red-black trees in sweeping algorithms [1].
5. Report (approximately 5 pages)
6. Oral Exam

Optional Implementation of the sweeping algorithm whose *event-point schedule* develops dynamically as the algorithm progresses and whose *sweepline status* the most appropriate of the above trees. The output of the algorithm should include the lineage expressions of the tuples valid over each interval.

References

[1] Thomas H. Cormen, Clifford Stein, Ronald L. Rivest, and Charles E. Leiserson. *Introduction to Algorithms*. McGraw-Hill Higher Education, 2001.

Supervisor: Katerina Papaioannou
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