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Summer Term 2015

Assignment on Geometric Data Structures for Computer Graphics - Sheet 1

Due Date 22. 04. 2015

Exercise 1 (Quadtree Construction, *5 Credits*)

Show that the bound $O((d + 1)n)$ for the construction time of quadtree is "tight", ie, there exist instances where the construction time is really necessary.

Exercise 2 (Balanced Quadtrees, *3 Credits*)

What happens if we change the balancing criterium for balanced quadtrees? Assume the size of adjacent rectangles must be equal for all rectangles (instead of a factor of two that was presented in the lecture). Is the number of nodes still linear? If this is the case, please give a reason. If this is not the case: Can you provide another bound?

Exercise 3 (Range Queries, *8+4 Credits*)

Quadtrees are perfectly suited for so-called *range queries*.

a) Describe an algorithm in pseudo-code that returns all points that are located inside an axis-aligned rectangle $R = [x_r, x'_R] \times [y_r, y'_r]$ (Such a query is called *range query*.).

b) Determine the worst-case running time for such a range query as a function of the number of points.