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Algorithms of Scientific Computing II

Exercise 4 - Methods for Long-Range Potentials

1) Error estimation

In this exercise we want to analyse the error in the calculation of long-range potentials with the tree methods from the lecture. Assume, that the kernel G of the potential Φ behaves like a $\frac{1}{r}$-potential.

In the lecture it was stated, that the relative local approximation error in the calculation of Φ is $O(\theta^{p+1})$. Prove that!

Use the θ-criterion from the lecture:

$$\frac{diam}{\|x - y_0^\nu\|} \leq \theta$$

2) Complexity of the Barnes-Hut-Method

In the lecture the costs for the d-dimensional Barnes-Hut-Method were given as $O(\theta^{-d} N log N)$. First derive the costs for the twodimensional Barnes-Hut-Method. Then explain descriptively (without proof), why the formula is also correct for 3d.