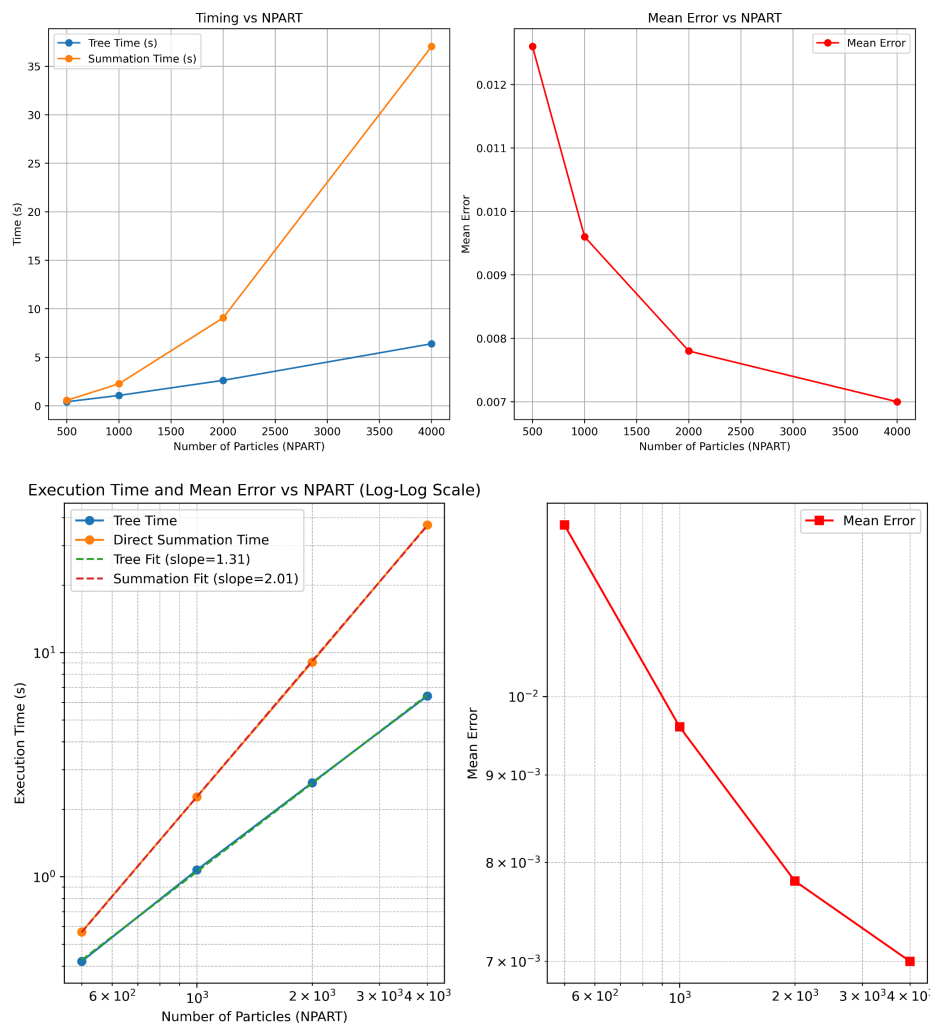


Week 5 homework

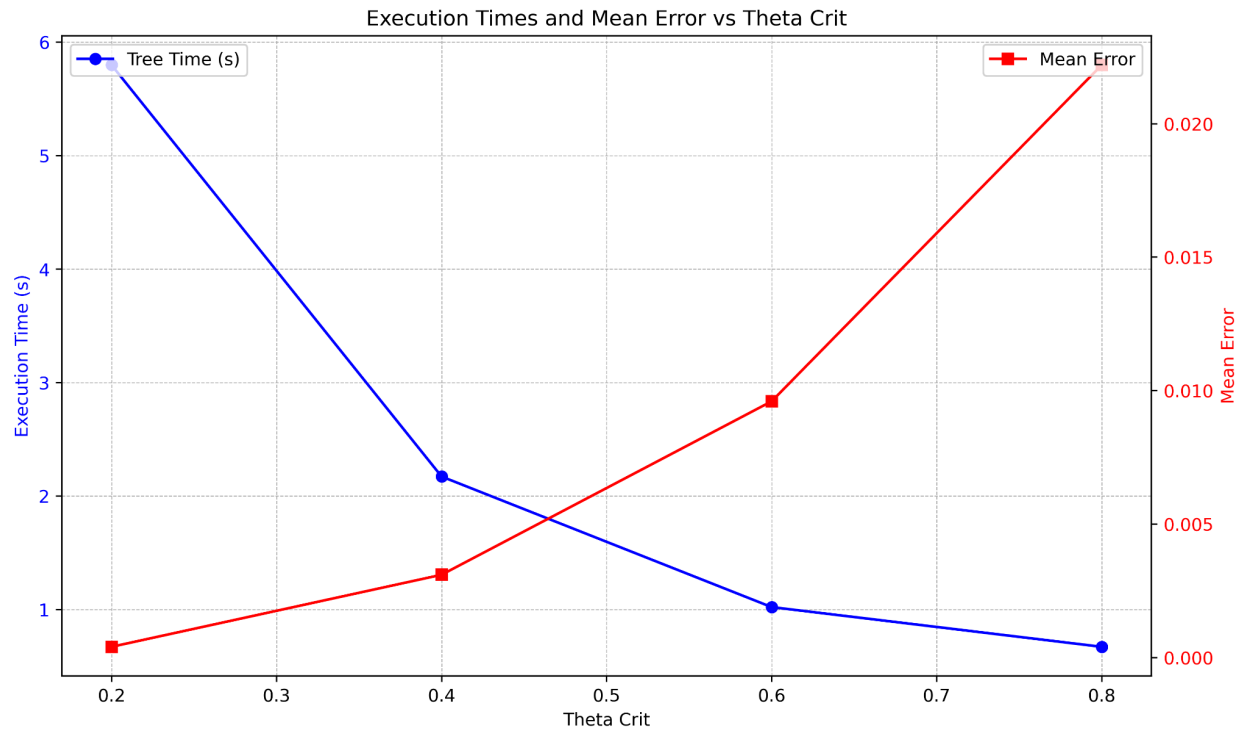
- (a) See code in file tree_marco.py
- (b) See code in file tree_marco.py. A series of diagnostic plots is attached in img/
- (c) See code in file tree_marco.py
- (d) ,(e): See tables and charts below:

NPART	Tree Time (s)	Summation Time (s)	Mean Error
500	0.42	0.57	0.0126
1000	1.07	2.27	0.0096
2000	2.63	9.07	0.0078
4000	6.40	37.04	0.0070



The mean error (η per particle) for the tree code decreases with the number of particles. Direct summation times increase quadratically (exponent of 2.01 fitted), and the tree code should scale as $O(n \log n)$. In the calculated range, the octo-tree code scales with $N^{1.3}$.

(f)



There is a tradeoff between computation time and mean acceleration error. The error decreases with smaller theta, and the computation time increases with smaller theta (for a fixed number of particles).