A Naive solution to the N-Body problem would require

1 points

- O(N) steps
- O(NlogN) steps
- O(N^2) steps ✓
- O(Nlog^2N) steps

Feedback for correct answers

Naive computation requires pairwise interaction between every pair of elements. There are N(N-1) pairs. So, O(N^2).

Feedback for incorrect answers

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Say true or false: 1) In a metric tree, the leaf node always contains 1 particle. 2) The cost of constructing a Quad tree for N particles when the particles' coordinates are unique (no collision) is typically O(NlogN).

1 points

1. 1)True 2)True ✓
2. 1)True 2)False
3. 1)False 2)True
4. 1)False 2)False

Feedback for correct answers

In a metric tree, the leaf node always contains O(1) particles and not necessarily 1 particle. The cost of constructing a QuadTree is typically O(NlogN)

Feedback for incorrect answers

In a metric tree, the leaf node always contains O(1) particles and not necessarily 1 particle. The cost of constructing a QuadTree is typically O(NlogN)

The PP, PM, FMM, and BH algorithms/methods of N-body simulation are arranged by their time complexities (from the one that takes max time to least time) . Select the statement(s) that are correct (multiple answers apply).

1 points

- [x] PP, BH, FMM=PM ✓
- [x] PP, BH=FMM, PM ✓
- [x] PP=BH, FMM=PM ✓
- [x] PP=BH, FMM, PM ✓

Feedback for correct answers

PP (particle-particle) method is naive computation. So takes O(N^2) time. BH method's complexity depends on theta. If theta value is large (>1), then a particle ends up traversing the whole tree making it as good/worse as PP method. However, for practical values of theta BH is O(NlogN). PM (particle-mesh) has complexity of O(N). However, accuracy is not good. FMM, for a given accuracy, can yield O(N) time performance. However, it can go up to O(NlogN) depending upon tree construction time. So, all options are correct.

Feedback for incorrect answers

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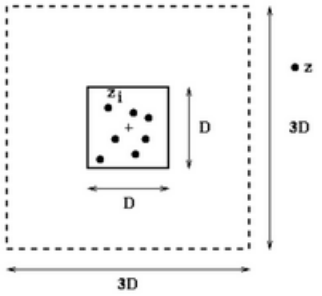
How many multipole expansion terms do I need to store to get an accuracy of up to 16 decimal digits (assume that the outer box is 2D instead of 3D)?

1 points



1. 16 ✓
2. 8
3. 32
4. 4

Feedback for correct answers

For an outer box length of 2D, using the formula p=log_2 1/e where e=2^-16, we get p=16. The formula becomes different if the outer box length is 3D.

Feedback for incorrect answers

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