Outlook

Re: SE3082 – Assignment Proposal

From Nuwan Kodagoda <nuwan.k@sliit.lk>
Date Sun 11/2/2025 10:05 AM
To SENADHEERA H.A.H it23162082 <it23162082@my.sliit.lk>

Accepted. Please proceed

Best Regards

Nuwan

From: it23162082 SENADHEERA H.A.H <it23162082@my.sliit.lk>
Date: Saturday, 1 November 2025 at 2:20 pm
To: Nuwan Kodagoda <nuwan.k@sliit.lk>
Subject: SE3082 – Assignment Proposal

Title of the Algorithm: N-body Simulation Problems

Problem Domain: Numerical Computation and Scientific Computing

Description:

The N-body simulation is an algorithm used to model the motion of multiple bodies that interact with each other through gravitational forces. It calculates how each body moves over time based on the forces applied by all the other bodies. This concept is commonly used in physics and astronomy to simulate systems such as planetary motion, star clusters, or particle systems.

In this algorithm, each body experiences a force from every other body according to Newton's law of gravitation. The algorithm repeatedly calculates these forces, updates the velocities, and then adjusts the positions of the bodies for each time step. Since every body interacts with all others, the number of force calculations increases rapidly with the number of bodies, making the algorithm computationally intensive.

Because each body's force calculations are independent of others (except for reading their

positions), this algorithm is very suitable for **parallel computing**. It allows multiple calculations to be carried out at the same time for example, one thread or process can handle one or more bodies. This property makes the N-body simulation an excellent choice to demonstrate how parallel programming improves performance and efficiency in numerical computation tasks.

Pseudocode

Initialize N bodies with random positions, velocities, and masses
Repeat for several time steps:
  For each body i:
    Fx = 0, Fy = 0
    For each body j ≠ i:
      Compute distance between i and j
      *Compute gravitational force F = G * m1 * m2 / r²*
      Add components of F to Fx and Fy
    Update velocity of body i using Fx, Fy, and its mass
  Update position of each body using its velocity
Display final positions of all bodies
End

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