Lab 3 Assignment

Particle – Particle Interactions

Dead line 8 – 12 – 2015

In this problem, we calculate the motion of n particles interacting with each other in time interval time step dt , at each dt seconds, each particle effect on all other particles by gravity force.

Each particle has the following properties:

- Cartesian position (rx , ry)
- velocity components (vx , vy)
- force components (fx , fy)
- mass (m)

A particle interact with another particle as following:

Ex: having two particles P1 (rx, ry, vx, vy, fx, fy, m)

And P2 (rx, ry, vx, vy, fx, fy, m)

Particle P2 act with gravity force on article P1 , consequently making particle P1 change its position and velocity.

- the distance between P1 and P2

  dx = P1.rx – P2.rx
  dy = P1.ry – P2.ry
  distance = $\sqrt{dx^2 + dy^2}$

- force that effect on P1 by P2 and then we update the new P1 force

  dx = P1.rx – P2.rx
  dy = P1.ry – P2.ry
  distance = $\sqrt{dx^2 + dy^2}$
  F = (G * P1.m * P2.m) / (distance*distance + E)
  P1.fx = F * dx / dist
  P1.fy = F * dy / dist

  G = 6.673 * 10^-11

  E = 1.98892

  NOTE: (G ,E) are constants that can't be changed ever.

- update the velocity and position using a time step dt = 1^11 Giga second

  vx = (dt * fx / mass) + vx
  vy = (dt * fy / mass) + vy
  rx = (dt * vx) + rx
  ry = (dt * vy) + ry

- reset force

  fx = 0
  fy = 0

- showInfo
  - show new position and velocity to screen

So, the program works like this:

1- Create N particles
2- Initialize all these particles with random positions, velocity, and masses. {initial force is zero for all particles}
3- Calculate the force that acts on each particle by all other particles {two for loops, NxN, where N is the number of particles}, this will be the sum of all forces act on one particle by all other particles.

    Ex: P1 is effected by P2, P3, ….Pn
    So, force affected on P1 by all other particles, is the sum of forces from P2 on P1, P3 on P1, ….. Pn on P1.

4- Update the position and velocity of all particles according to the new force calculated in step 3.
5- Print the new positions and velocity of all particles to the screen.

- **Create a Class called Particle with the previously mentioned methods and data members,**
- **Use the methods in file MainApp.java to help you initialize the Particles array.**

Do not forget to comment your code with description of what you are doing.