THREE DIMENSIONAL SIMULATION OF SPACE.

State is defined as-

- The current position in terms of x, y, z coordinates.
- The current velocity in x, y, z axis
- Radius of the object
- Mass of the object

The solar system consists of stars, planets and asteroids as space objects. Consider a hypothetical situation where the only forces influencing the space objects is the gravitational force between them.

You are given a dataset representing the current state of the solar system and time is denoted by 't'.

Your objective is to simulate and arrive at the state of all space objects when t = 1e+6 (unless otherwise specified for the test case).

Constraints:

- **General:**
  - ➢ Smallest unit of time for simulation is 1-unit time, i.e. time can only be an integer
  - ➢ 1e+14 < Mass of stars <= 1e+15 units
  - ➢ 1e+4 < Mass of planets <= 1e+7 units
  - ➢ 0 < Mass of asteroid <= 0.01 units
  - ➢ Consider Acceleration to be constant during each time interval dt = 1-unit time.
  - ➢ Consider G = 7*1e+4 units
- **Collision Mechanism:**
  - ➢ Collisions between Planet-Planet and Planet-Star are not taken into consideration and hence, do not exist in the dataset.
  - ➢ Collisions between asteroid-planet and asteroid-star leads to destruction of the asteroid.
  - ➢ Collisions between asteroid-asteroid leads to the destruction of both the asteroids.

Objective:

- ➢ You are to note the time at which the collision takes place.
- ➢ You are to note the time at which the asteroid goes too far away from the sun, i.e. beyond 6*1e+10 unit of distance.

Note that, any activity of the space system taking place at a distance beyond 6*1e10 is not taken into consideration.

You are given basic modules to read/save data into an excel file. All you need to do is to build the logical module for the question above.

Evaluation will be done on the basis of:

- Primary Evaluation is done in such a way as to check accuracy of time of collision of asteroid.
- Secondary Evaluation is done in such a way as to check accuracy of state of space objects.
- Efficiency of your program may also be tested in case of a draw.

Sample Test Cases:

Orbit: 1M units of time, 2 objects
The answer for Orbit is the excel sheet named **"Orbit Final".**

Sample 1: 0.1M units of time, 4 objects
The answer for Sample 1 is the excel sheet named **"Final 1".**

Sample 2: 0.1M units of time, 4 objects
The answer for Sample 2 is the excel sheet named **"Final 2".**

Test Cases:

Test2: 0.7M units of time, 7 objects.
Test 3: 1M units of time, 7 objects.
Test 4: 1M units of time, 10 objects.
Test 5: 0.8M units of time, 10 objects.

Sample Dataset:

A sample Dataset before and after simulation is given below

				INITIAL					
X	Y	Z	Mass	Vx	Vy	Vz	Radius	Time	
0	0	0	1E+15	0	0	0	902459008	0	Star
8660253696	0	5000000000	16601	-10000	83666	0	9590019	0	Planet
-8983886848	4844712960	-6152848384	1.65708E-05	641627.75	-652300.875	282781.9688	3636463872	0	Asteroid
542658560	17131463680	18648141824	7.84948E-05	-611290.9375	-313876.3125	-910742.8125	3021560320	0	Asteroid2
				FINAL					
0.117384665	0.047907121	0.071075819	1E+15	2.04372E-06	1.52959E-06	1.28545E-06	902459008	0	Star
589247168	5480968192	718610112	16601	-133109.7813	-8470.391602	-77430.125	9590019	0	Planet
-2693427200	-1474988800	-3341987584	0	671103.6875	-654073.875	310193.4375	3636463872	9646	Collided Asteroid
-40788799488	-4863726080	-43733868544	0	-601281	-324381.5	-912329.875	3021560320	68288	Far Away Asteroid