SuperSpheres:

SuperSpheres is a 3-dimensional n-body simulation that attempts to model the way that gravity affects celestial bodies' movement in space. The goal of this application is to provide an appealing and informative visualization of newtonian physics (we might use general relativity instead) in the context of gravity. In addition, we want to provide the user the ability to be in "sandbox" mode, where they can create any complex system of celestial bodies and observe their interactions. This project puts into application what we have learned in our mechanics class since it incorporates the following concepts: gravity, forces, momentum.

Features:

- Celestial bodies (asteroid(if possible), planet, star, etc) that have the ability to move around based on the gravitational force from other bodies.
    - There should be a window on the side that displays its properties (mass, velocity, etc)
    - Its movement can be traced by a trail.
    - Collisions with other celestial bodies can be done(if possible)
- Camera movement: the camera can either move around freely or is locked onto a particular planet
- Sandbox mode: the user is starts off in any given system (can be empty or can be our current solar system too or just a system with a stars) and is able to spawn in any celestial bodies
    - There can be a pause/play setting in order to stabilize any position.
- Preset environments: there can be builtin systems such as the solar system that is saved on the disk that the user is able to load in.
- Saving environment: allow the user to save whichever state that their environment is in.

Software to be used:
- JavaFX
- JavaFX3D

Usage scenarios:
-Users will be able to:
- Simulate and see how different celestial bodies interact with one another.
- Simulate our solar system using the preset environments
- Create different environments using the Sandbox mode and simulate them.

Relevance:
This project is highly relevant to any STEM student studying mechanics or astrophysics since it allows the user to visually see how the different laws of physics apply to celestial objects.
The different features like sandbox and preset environments will allow users to acquire a deeper understanding of our solar system and of how different celestial systems function in our universe.

Feasibility:

This project should be feasible as planetary motion simulations are fairly common and well documented. However, difficulties may arise as our attempt is set to be in a 3-dimensional space. Due to this our team must learn the features and limits of JavaFX 3D Graphics and cannot fully rely on our previous knowledge of JavaFX. Planetary motion in 3D space is also much more complex than in 2D as we must consider a third plane of motion. The learning of how an n-body simulation is created will likely be difficult as despite learning of gravity, forces and momentum in mechanics, we were never taught how planetary motion is calculated in our science courses and we will have to rely purely on self-teaching.