**Assignment 1 Particle Dynamics**

**Due date: Sun, April 11**

**Starter Code:** This assignment has starter code (see attached **zip**), primarily to support OpenGL rendering and a simple Windows programming. In this assignment, you will modify this package as needed.  
  
**Demo Video:** <http://caig.cs.nctu.edu.tw/users/alvin/demo.avi>

**Software Dependencies:**

**VC2008:** The starter code will compile and run using Microsoft Visual Studio 2008.

**OpenGL:** Although you can complete this assignment without writing any OpenGL, you can find more information on OpenGL or JOGL, some random introductory starting points are:

[OpenGL Programming Guide ("The Red Book"):](http://www.amazon.com/OpenGL-Programming-Guide-Official-Learning/dp/0321173481) [An online version](http://glprogramming.com/red/)

**Assignments Steps:** The starter code allows you to build particle systems, but you will quickly discover that some things are broken or just implemented poorly. All assignment code should be added to the PhysEnv class which contains function stubs marked with "TODO" to indicate where you should implement your assignment. Here are the steps you need to address:

1.      Implement Numerical Integrators (20%)

Forward Euler integration is provided, but Midpoint and RK4 integration methods should be available and working.

2.      Apply Gravity Force (10%)

3.      Apply Spring Forces (30%)

I.            Implement spring forces in CPhysEnv::ComputeForces

II.          Find good spring constants

4.      Wall-Particle Collision Detection & Response (30%)

The particles should be tested for collisions and contacts with the ground and with the object. If there is penetration, you should apply a stiff spring force on the particle out from the surface of the object.

**Using the code**

To use the code to simulate cloth, follow these steps. When you start out, they won't work very well. When you've finished, they'll work well.

1. Run the code.  You should see a box container in space.
2. From the File menu, click "Open" to load an object. We've included an obj loader to help you get started.
3. To add a spring, you must click the two end vertices and press the “enter”.
4. To start the simulation, press R.
5. To reset, press the T.

**Questions for you to answer (10%)**

What is the effect of the Ks and Kd parameters on the spring? What sets of values can be used to generate different types of object?  **Submission**

Prepare a README.txt file with your responses to the above question, as well as discussing the project and your solution to it, in the project directory. Discuss different things you tried with the simulation, and design decisions you made. If you ran into problems and were unable to complete the assignment, describe what works, what doesn't, and how I should explore your project in order to get the best idea of what you've accomplished. If we gave you special dispensation to change or add files, mention that as well. Also list all resources, whether books, webpages, or fellow students, that you used when doing the assignment.

Before submission, you MUST clean the solution and additionally delete the NCB file in the project directory. If you do not do this, you WILL lose points.  Submissions that do not compile will not be graded.

Make sure that your submission can be downloaded to any computer, built, and executed without any problems or other setup required.

Submit the completed assignment, zipped up and name as your student ID. If you encounter problems or aren't sure if your submission went through, additionally email the file to TA.

If you want to re-submit your assignment, please change the file name to indicate the version number. **Extra Credit**

If you feel like going beyond the scope of the assignment, you should consider the following extra credit assignments. Get the assignment working without them first.

1.    Apply User Forces by Mouse

2.    Apply Friction Force

3.    Implement Self-Collision Detection & Response

You can get a maximum of 20 points in extra credit. Simply implementing these things doesn't guarantee you a 20; you really need to go above and beyond to get the full amount.

Start early!