Physically Based Animation
Assignment 1

Zou Zijun   Student ID: 48-186101

The assignment is accomplished using OpenGL.
This project includes:

result_videos folder:

task1.mpeg : result for Task 1

task2.mpeg : result for Task 2

task3.mpeg : result for Task 3

task4_1.mpeg : result for Task 4

task4_2.mpeg : result for Task 4 (rerunning)

task5_1.mpeg : result for Task 5

task5_2.mpeg : result for Task 5 (rerunning)

hp_1.mpeg : result for Task 5, lifting one ball initially

hp_2.mpeg : result for Hacker Point 2, lifting two balls initially

src folder:

particle.h : the header file for particle.cpp

particle.cpp : all the functions being used for all assignments(e.g. randomized particle   initialization, Verlet position update, particle collision and so on)

Other .cpp files : source code of corresponding task, all of them call functions from   particle.cpp

compile.sh : compiling script

Followings are some brief introduction on each task.

Task 1 :

It is implemented using Verlet integration.

Task 2:

Basing on Task 1, a position-based boundary constraint at the bottom is applied additionally.

Task 3:

A position-based method is applied which takes the projection of the ball on a line segment to constrain the ball on the line segment.

Task 4:

It is based on Task 2.

The collision between particles is calculated according to elastic collision. The velocity after collision after collision is the result from solving simultaneous equations which keep the conservation of momentum and kinetic energy. In addition, the positions after collision is being driven away from each other regarding to the mass of balls.

Randomized initial position and velocity is generated. The mass of the ball is proportional to its radius.

Task 5:

It is based on Task 4. Calculating gravitational force according to updated position and updating the external force using the accumulation of gravitational force.

Hacker Point 1:

I didn't do it.

Hacker Point 2:

It is based on Task 3 and Task 4.

A combination of force-based and position based method is used: constraining the updated position off the circle to the closest point on the circle and calculating the external force using the gravitational force as well as the supporting force from the string.

Reference:
Verlet Integration : https://en.wikipedia.org/wiki/Verlet_integration
Elastic collision : https://en.wikipedia.org/wiki/Elastic_collision