Introduction

In this experiment you will conduct a quantitative analysis of a ball that falls under the influence of gravity and then bounces several times. In particular you will measure quantities such as the acceleration, the time between bounces and the height of each bounce.

Procedure

The main instrument we will use for studying the motion of the ball is a motion detector connected to a Logger Pro. This instrument detects the position of an object as a function of time using sonar and can be used to obtain graphs of position vs. time, velocity vs. time and acceleration vs. time. Typically the acceleration vs. time graph is hard to interpret, so the slope of the velocity time graph is the best way to determine the acceleration due to gravity. Tape the motion detector to the ceiling and release the ball at a distance of about 0.5 m below the motion detector (it cannot reliable detect motion at a distance closer than 0.5 m.)

Graphical Analysis

Your assignment is to complete the following tasks and answer all the questions carefully and in a quantitative way. Answer the questions on a separate piece of paper. Include this paper and printouts of your graphs with your assignment. In interpreting your graphs it will be helpful to consider what direction the motion detector takes as the positive direction and what location corresponds to the zero position?

1. Drop a ball below the motion detector and obtain position, velocity and acceleration vs. time graphs which are reasonably clean of anomalous spikes and which show several bounces of the ball. Describe the form of each graph. (eg parabolic, linear etc), On each graph indicate when the bounces occur and when the ball reaches its maximum height.

2. From the slope of the velocity vs. time graph obtain the value of the acceleration of the ball. Compare this value to the accepted value for the acceleration due to gravity (9.81 m/s^2). What is the percent error?

3. From the position vs. time graph make a list of the maximum heights of each bounce. Include the initial height of the ball in your list. Does this sequence of numbers form a recognisable type of pattern? (i.e. is it approximately an arithmetic or a geometric sequence?). Explain your answer.

4. From the position vs. time graph make a list of times between each successive bounce. Does this sequence form a recognisable type of pattern? (i.e. is it approximately an arithmetic or a geometric sequence?). Explain your answer.

This lab assignment is due on Wednesday, January 18th at 9:30 am.

Equipment:

Measuring Tape
Masking Tape
6-8 inch bouncing balls
Motion Detectors and Logger-Pro