

Names: _____

Acceleration/Deceleration

Recall that acceleration/deceleration involves changing speed, so the basic pattern involves animation variables for both position and speed.

- $\text{position} = \text{position} + \text{speed}$
- $\text{speed} = \text{speed} + \text{acceleration}$

Physically-Based Motion

Gravity and Air Resistance

Gravity is acceleration downwards.

- $\text{yspeed} = \text{yspeed} + g$ ($g > 0$)

Air resistance slows the speed proportional to the speed as the object moves through space; replace k by some very small (but positive) value.

- $\text{speed} = \text{speed} - k * \text{speed}$ ($k > 0, k \ll 1$)

Note: if both gravity and air resistance are being used, combine them into a single update for the y speed.

- $\text{yspeed} = \text{yspeed} + g - k * \text{speed}$

Bouncing and Damping

Bouncing is changing direction to go the other way when a surface is hit.

- $\text{speed} = -1 * \text{speed}$

Note: bouncing off a vertical surface affects the x speed, bouncing off a horizontal surface affects the y speed.

Damping slows the speed proportional to the speed when the object bounces, to model the effects of friction; instead of simply flipping the sign of the speed (multiplying by -1), multiply by $-k$, where k is a value close to (but smaller than) 1.

- $\text{speed} = -k * \text{speed}$ ($k \gg 0, k < 1$)

At the End of Class

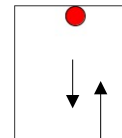
Hand in this worksheet.

Also hand in any sketches you have worked on during class, even if a sketch is incomplete.

- Make sure each sketch is named as directed and has a comment with the names of your group. Also be sure to save your sketches! (This should be in your sketchbook `~/cs120/sketchbook`)
- Copy the entire directory for each sketch (not only the `.pde` file) into your handin directory (`/classes/cs120/handin/username`). You only need to hand in one copy for the group.

Exercises

1. Consider the scenario where a circle is moving downwards and bounces when it reaches the bottom of the window.



what changes?	position (y) speed (y)
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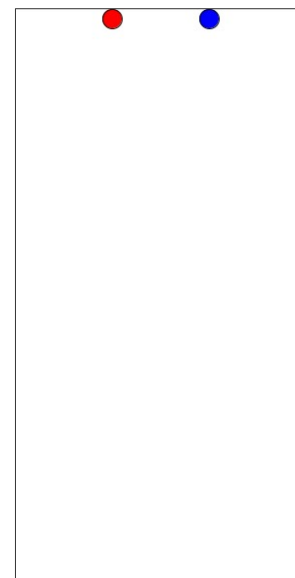
is this a situation that calls for making choices, repetition, or neither of this?	making choices
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Finish this question on the next page

before moving on to #2 below.

For all sketches, be sure to **include a comment with the names of your group at the beginning of the sketch.**

2. Create a sketch named **sketch_251029a** which contains two circles that start in the position shown and move as described below. Make the drawing window taller than it is wide.
 - The red circle should start from rest (speed 0), accelerate due to gravity, and bounce when it hits the bottom of the window.
 - The blue circle should start from rest (speed 0), accelerate due to gravity, bounce when it hits the bottom of the window, and also be subject to air resistance and damping. Choose k values for air resistance and damping so that the effects are visible but not too drastic.



what happens differently, or only sometimes?	the circle only bounces sometimes
what are the alternatives?	bounce, or don't bounce
how do we decide between them?	based on the position of the bottom of the circle
on the spot or prior happenings?	on the spot

on-the-spot	is "do nothing" an option?	yes
	when does each alternative occur?	bounce when the bottom of the circle is at or past the bottom of the window do nothing the rest of the time

prior happenings	what is the decision about?	
	how many alternatives are there?	
	is "do nothing" an option?	
	which alternative do we start with?	
	For each alternative, when do we change to that alternative?	