Note: thanks to Wanda Dann and Steve Cooper for slide ideas
Announcements

• Midterm exam next Thursday
  – Closed book, closed notes, closed neighbor
  – Chaps 1-2, Chaps 4, 6, html

• Assignment 4 storyboard due today
  – Alice world due Thursday
What we will do today

• Lecture on Chap 6, Sec 1 - Functions
• Classwork
Functionality

- A function
  - Receives value(s)
  - Performs computation on value(s)
  - Returns (sends back) a value
Types of functions

• The type of a function depends on the type of value it returns
  – a calculated value (a number)
  – a specific object
  – a color
  – etc.
Built-in functions

- Used one of Alice’s built-in functions
  - *skateAround* method for the *cleverSkater*

- Let’s look at another example.
Example

• How do we bounce a ball? Let’s bounce a ball over a net
  – Ball is 1 meter from the net to start
  – Ball should move up and forward, then down and forward

  – Note: Looks easy – but do not be deceived!
Design Storyboard

• Design for a world-level method

  World.ballOverNet:
  Do in order
  toyball turn to face the net
  Do together
  toyball move up
  toyball move forward
  Do together
  toyball move down
  toyball move forward

• To reach the top of the net
  – Ball should move forward 1 meter (we positioned it 1 meter in front of the net)
  – How far upward should the ball move to clear the net?
Height

• Can use the built-in height function to determine the height of the net and move the ball up that distance

Demo – ballOverNetWork – what happens?
Problem

- The ball does not bounce over the net
- The problem – cannot tell “which way is up” from the perspective of the ball
Solution

- We think “up” and “down” relative to the ground – so can orient the ball (and net) with the ground
- Now, ball will bounce over the net
Rolling the ball

• How do we roll a ball along the ground?
• Want a realistic motion rather than a slide
• The ball must simultaneously move and roll.
Demo: A first attempt
Revising the Approach

• The ball is made to roll 1 revolution.
• What if we want the ball to roll a certain distance?
• How can we make the ball roll the correct number of revolutions to cover a given distance along the ground?
Number of Revolutions

• The number of revolutions depends on the size of the ball
  – The number of revolutions is distance / (Pi * diameter)

• There is no built-in function to return the number of revolutions
  – Must write it!
Parameters

- We want to return the value computed as
  Distance / Pi * diameter

- Obviously, what is needed
  - The ball’s diameter
    - The ball object has a built-in width question
  - The distance the ball is to travel
    - Can be sent as a parameter to the question
**numberOfRevolutions** function

**Code snippet:**

```plaintext
toyball.numberOfRevolutions 123 distance

No variables

Do Nothing

Return: 

(distance / 3.14 * subject = toyball 's width)
```
Demo: Calling the function

This is a test value

- Run the animation with several test values
- Make sure it works as expected
- What happens if you use a negative value?
Levels of functions

• As with methods, you can write functions as either class-level or world-level. (what was the function we just wrote?)
• Guidelines for class-level methods apply to class-level functions:
  – No references to other objects
  – No references to world-level functions
  – Built-in world-level functions are ok
Classwork today