Announcements

• Exam 1 Thursday, Oct 3
  – Closed book, closed notes, closed neighbor
  – Chaps 1-2, Chaps 4, 6, html
  – On Thursday, will give you an old exam to work on, then review it next Tuesday

• 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

  – “return value” – means “value” is the answer, you leave the function (don’t execute any more code in the function) and return the output
  – You should use the output 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

• Last time used one of Alice’s built-in functions
  – `skateAround` method for the `cleverSkater` uses the `distance to` built-in function

• Let’s look at other examples.
Example of a function

• Write a function to calculate the perimeter of the bounding box of the function.

• I want to walk all the way around the chair, how far is that?

• Know width and depth of chair
Example of a function

• Write a function to calculate the perimeter of the bounding box of the function.
• I want to walk all the way around the chair, how far is that?
• Know width and depth of chair
How do we write this function?

• Name of function?
• Parameters and types?
• What type is returned?

• How do we call/use this function?
• Is this a class function or world function?
  – Would we use this function with other objects?
Built-in String functions

- String functions are under “world”, “functions tab”
  - “a joined with b” - join two strings together into a longer string
  - “what as a string” – converts a number into a string (6 into “6”)
Exercise: Write a function called `phraseHowTall`

- Given an object, this function should return a string “I am this tall: num” where `num` is the actual height of the object
- Then have objects say the result of calling this function
phraseHowTall

• Return value? Parameters and types?
Longer Story Example

• Move ball to within 1 meter of net, then bounce ball over the net.
  – Bounce - Ball should move up and forward, then down and forward
Move Ball to 1 meter from Net

• Use “distance to” function and math
Height

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

Demo – what happens?
Rolling the ball

• How do we roll the ball along the ground?
• Want a realistic motion rather than a slide
• The ball must simultaneously move and roll.
• The ball must roll “as seen by” ground
• The ball and ground must face the same direction
Demo: A first attempt

```
toyBall1.test  No parameters

No variables

- toyBall1 ▼ turn to face tennisNet ▼ more... ▼
- ground ▼ turn to face tennisNet ▼ more... ▼

- Do together
  - toyBall1 ▼ move forward ▼ 2 meters ▼ asSeenBy = ground ▼ more... ▼
  - toyBall1 ▼ turn forward ▼ 2 revolutions ▼ more... ▼
```
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 \( \text{distance} / (\pi \times \text{diameter}) \)

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

• We want to return the value computed as
  \[
  \text{Distance} / \text{Pi} \times \text{diameter}
  \]
  where Pi = 3.14…

• Obviously, what is needed
  – The ball’s diameter
    • The ball object has a built-in width function
  – The distance the ball is to travel
    • Can be sent as a parameter to the function
`numberOfRevolutions` function
Demo: Write method \texttt{realisticRoll} to Call 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?
- Add a parameter for distance
Now Ball roll to net?

• Difficult….
• ToyBall turn to face TennisNet and roll, what happens?
Tricky – Orient To

- toyBall1 `orient to` ground `more...`
- toyBall1 `turn to face` tennisNet `more...`
- ground `turn to face` tennisNet `more...`
- toyBall1.realisticRoll `distance` = `{ toyBall1 `distance to` tennisNet - 1 }`

- toyBall1 `orient to` world `more...`
- toyBall1 `turn to face` tennisNet `more...`

**Do together**

- toyBall1 `move` forward `2` meters `more...`

**Do in order**

- toyBall1 `move up` `{ subject = tennisNet 's height * 1.5 }`
- toyBall1 `move down` `{ subject = tennisNet 's height * 1.5 }`
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
Calling Perimeter Function

• Code in myFirstMethod
Perimeter Function

world.perimeter (width, depth)

No variables

(Do Nothing)

Return (2 * width) + (2 * depth)
phraseHowTallFunction

Calling the function:

bunny say world.phraseHowTall creature = bunny duration = 2 seconds

camel say world.phraseHowTall creature = camel duration = 2 seconds