Announcements

• Exam 1 Thursday, Oct 6
  – 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

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

• Let’s look at another example.
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 \( \frac{\text{distance}}{(\pi \times \text{diameter})} \)

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

• We want to return the value computed as
  \[ \text{Distance} / \pi \times \text{diameter} \]
  where \( \pi = 3.14 \ldots \)

• 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: 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?
- 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 =` (to `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
Another 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
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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?
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”)
Classwork today