Iteration

# TODO

# Lesson Notes

## What is iteration?

* Repeating a process to reach a goal or result
* Each time we repeat our process, it’s called one “iteration”
* Example: Hiking to the top of a hill
  + Each iteration we might:
    - Turn so we are facing up the trail
    - Take one step up the hill
  + We might stop hiking
    - Because we reached the top
    - Because we are tired
    - Because it’s getting late
    - Because we have traveled 5 miles
    - All of the above!

## A hiking algorithm

* function hike()
* {
* faceUpTheTrail();
* takeOneStep();
* if (doneHiking()) {
* return;
* }
* faceUpTheTrail();
* takeOneStep();
* if (doneHiking()) {
* return;
* }
* // and so on!
* }
* function doneHiking() {
* return reachedTheTop() || tired() || gettingLate() || milesTraveled() > 5;
* }

## The for statement

* Show form of for statement

## Our hiking algorithm

* Show hiking loop with use of for(;;)

## Stopping our loop

* What if there are more things to do after the loop?
  + We have to send a picture of the view to our friend
* Introduce break statement
* Send a picture of the view to a friend, after we are done

## What happens if we don’t stop?

* Hiking example without the conditions
* Infinite loop
  + Worlds simplest case

## Using a variable to count

* Example: counting to 3
* Variable is called the “loop counter”

## Exercises:

* Use a variable to count to 3
  + Step it in the debugger
* Use a variable to count to 1000000000
  + Break into the debugger
  + Look at counter variable
* Use a variable to draw 3 squares
  + Each square has
    - X: counter \* 100
    - Y: 0
    - Width: 5
    - Height: 5

## Debugging loops

* It is tedious to step through a loop
* You can use the debugger statement to break into the debugger
* This is useful anytime there is a complex logic, not just loops

## The short form for a loop

* Putting the control variable in the for
* Show equivalent loop
* More clear, since control variable is clear
* Not required

## Exercises:

* Update your loops that have a control variable to use the short form
* Draw 10 squares where:
  + X: counter \* 100
  + Y: 0
  + Width: twice as wide as previous square, starting with 5
  + Height: 5
* Draw 10 squares where:
  + X: counter \* 100
  + Y: 0
  + Width: alternating 5 or 10, starting with 5
  + Height: alternating 5 or 10, starting with 5
* Draw 100 random squares within the canvas
  + X: random
  + Y: random
  + Width, Height: 10
  + Color: fixed
  + Add colors, randomly selected

## Sine wave

* Definition of sine, and period
  + <http://en.wikipedia.org/wiki/Sine>
  + <http://upload.wikimedia.org/wikipedia/commons/d/d2/Sine_one_period.svg>

## Exercise: Sine wave

* Start at 0, End at 2 \* PI, every PI/4 draw a point
* Point
  + Rectangle of width 1, height 1
* Math object
  + Math.sin
  + Math.PI
* Scale:
  + Y=0 is 1, Y=100 is 0, Y=200 is -1
  + X=0 is 0\*PI, X=1000 is 2\*PI
  + Understanding how to scale a number
* Now change it to be every PI/100
* Notice how many points can approximate a curve

## Nested loops

* We can use loops inside of loops
  + Each loop has its own set of statements
  + Terms “inner loop”, “outer loop”
* This might be in the same function, or different function
  + Functions can call functions that loop
* Example
  + Count from 1 to 3
  + Each iteration, count from 1 to N
* Show code
* Break leaves the enclosing loop
  + Example
* Show code

## Exercise

* Type in the above example and step it in debugger
  + How many times does the inner loop iterate (total)?
  + How many times does the outer loop iterate?
* Draw increasing number of squares
  + 4 rows
  + First row has 1 square
  + Next row has 2 squares
  + (etc)
* Draw checkerboard
  + 8 x 8
  + Each square is 100 x 100
  + Upper left is red
  + Color alternates each time (red, black)
    - Could use “mod” to see if it is even/odd given the row
    - Could use a Boolean value which is toggled back and forth

## Exercise

* Create some artwork using:
  + Canvas
  + Random numbers
  + Iteration
  + Give example of an next
* Display your artwork
  + Everyone does a “walk-around” after a period of time
  + Ask questions