Announcements

• Test 2 is Thursday, November 18
• Note: We will NOT cover Chap 8, Sec 2
• After Test – Alice3
What we will do today

• Lecture on Chap 8 Section 1
  – Recursion
• Classwork on recursion
• More practice with arrays next time
Repetition

• Sometimes don’t know exactly how many times a block of instructions should be repeated
  – Repeat until some condition is true
  – Repetition gets closer to condition being true

• Example – Chess, don’t know when in advance how many moves til game ends
Indefinite Repetition

• When number of repetitions is indefinite
  – While statement – previously
  – Recursion - today
Recursion

• Many times a structure is identified by a special word
  – Do in order
  – Do Together
  – If/Else
  – Loop

• Recursion
  – Is NOT a program statement with a special word
  – Recursion means a method (or function) calls a clone of itself
Example – horse race

- Horse race
- One horse randomly selected to move forward, repeatedly
- First horse to finish line is winner
Storyboard

race

if one of the horses has won
    winner says “I won”
else
    randomly choose horse and move
    do everything again

• “do everything again” means the entire method should be repeated – this is recursion
“Do everything again” - Call race method

race

if one of the horses has won
    winner says “I won”
else
    randomly choose horse and move
call the race method

• Recursion means that a method calls a “clone of itself”
Stepwise Refinement

race

if one of the horses has won
  winner says “I won”
else
  randomly choose horse and move
call the race method

isGameOver?

whichHorseWon?

moveRandomHorseForward
isGameOver and WhichHorseWon

• isGameOver
  – Is the finish line < 0.5 meters in front of any horse? If so, game is over
  – Returns true if game is over

• WhichHorseWon
  – Which horse is within 0.5 meters of finish line?
  – Returns the horse that won
moveRandomHorseForward

- To choose horse to move forward, use built-in random selection function
race method

- Uses recursion
- Where is the “way out”? 

```plaintext
racehorseGame.race  No parameters
No variables

If racehorseGame.isGameOver
  racehorseGame.whichHorseWon say I won!!!
Else
  racehorseGame.moveRandomHorseForward
  racehorseGame.race
```
Classwork today

- **Written:** raceHorse move recursive statement
- **Write recursive method BunnysMeet**
  - Two bunnys repeatedly hop towards each other at the same time, as long as they are > 3 meters apart.
  - When bunnys are close (≤ 3 meters apart but still at least 2 meters apart, 1 bunny hops once.
  - When bunnys are too close to jump any more, they bow to each other once at the same time.
  - Download file: BunnysInGarden
- **Problem 3 – Mystery recursive function**