Prof. Susan Rodger
Announcements

• Next time Review for Test
• Test 2 is Tuesday, March 31
• Note: We will NOT cover Chap 8, Sec 2
• After Test – Java
What we will do today

• Lecture on Chap 8 Section 1
  – Recursion

• Classwork on recursion and more practice with arrays.
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

```python
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”? 
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
• More Array practice … see next page
More Array Practice – Array of frogs

- Double size of all frogs
- Randomly color some frogs
- Move frogs of new color all to left in array by swapping