CompSci 18S
Recursion
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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

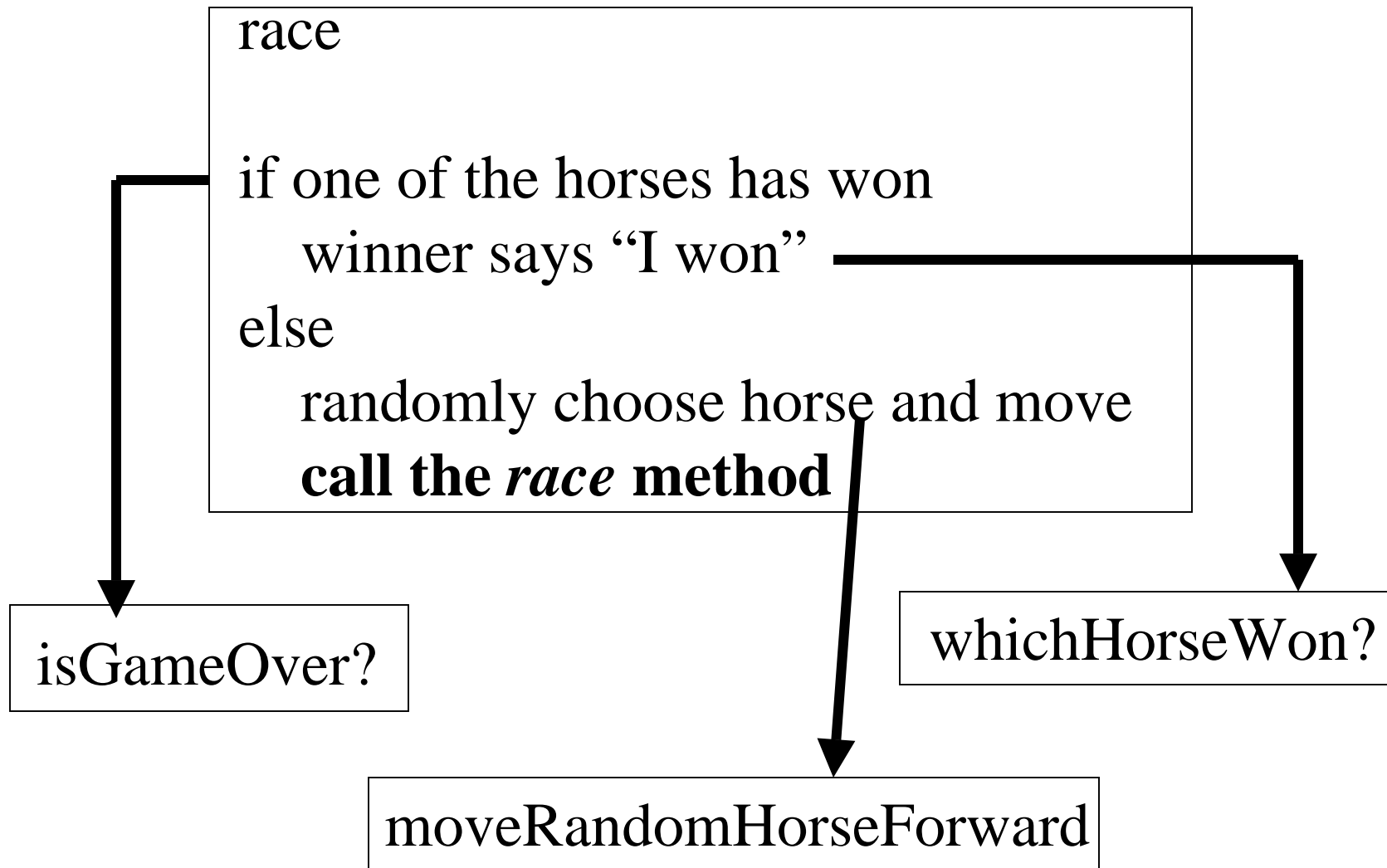# "Do everything again" - Call race method

```
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
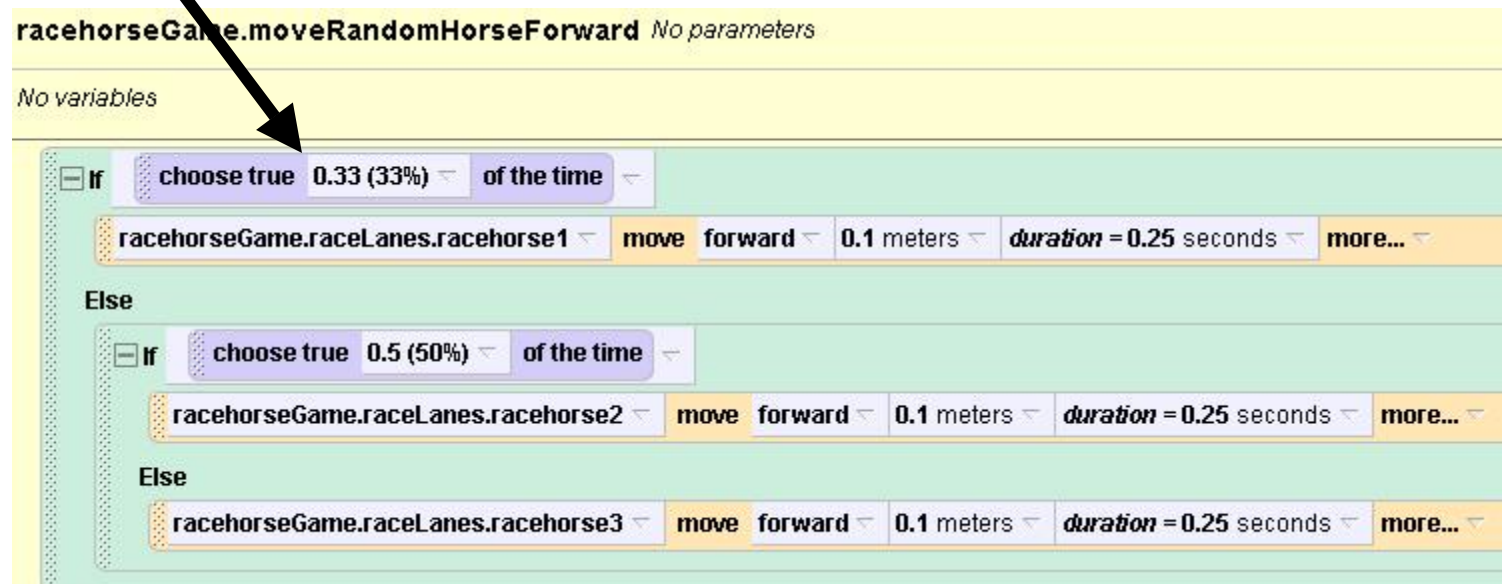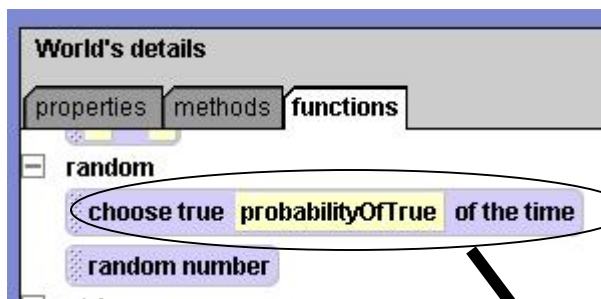
isGameOver?

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"?

racehorseGame.race *No parameters*

No variables

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

Classwork today

- Written: raceHorse move recursive statement

- Write recursive method BunnysMeet

- More info on Recursion: See Chap. 8, Sec 1