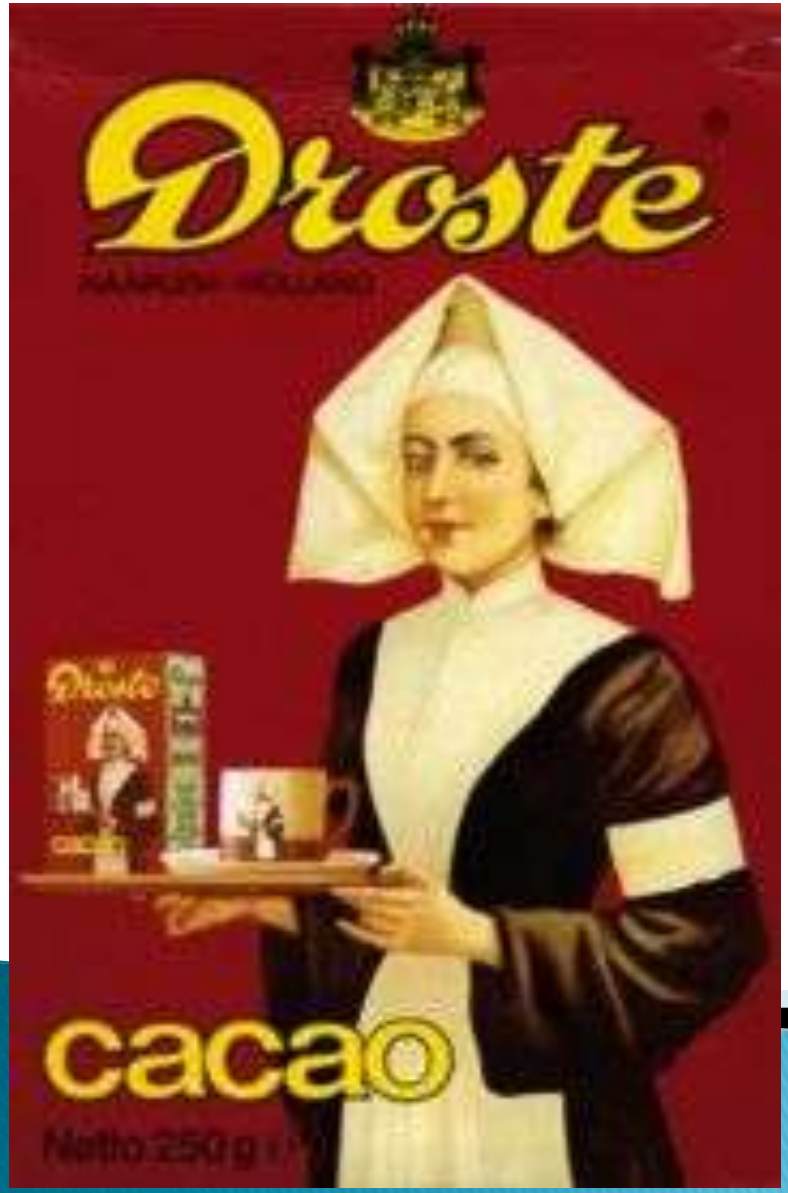


CSSE 220 Day 19

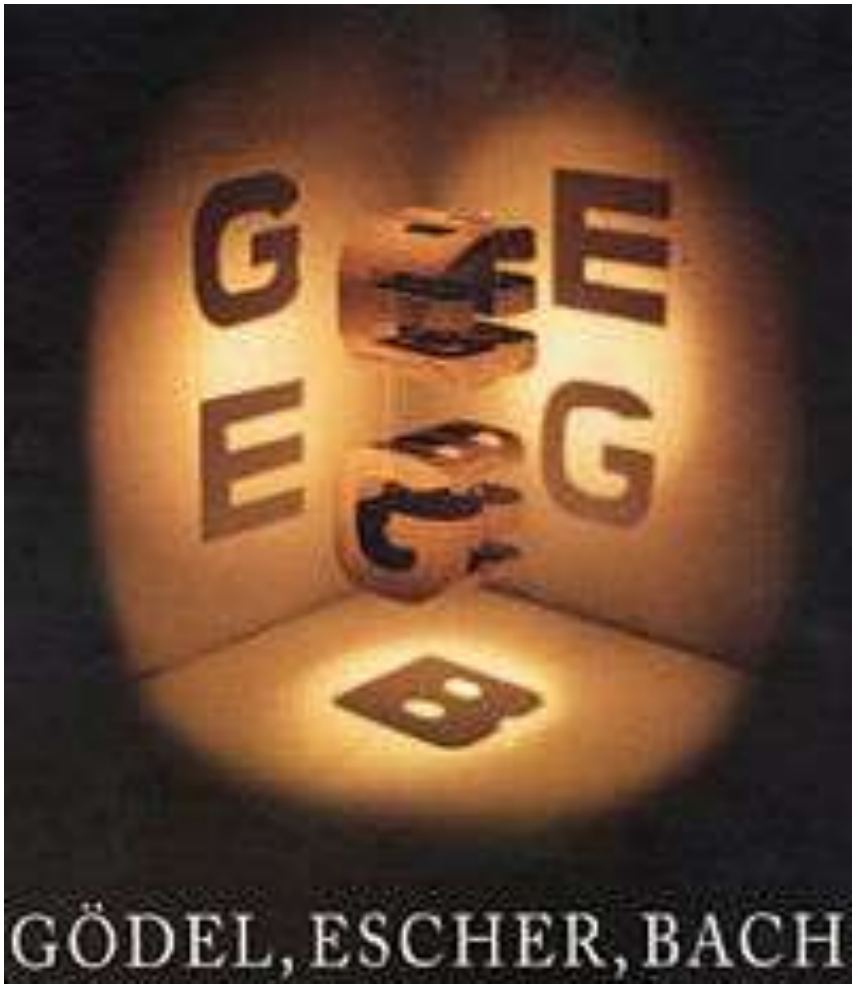
Recursion

Checkout *Recursion* project from SVN

Questions?

Gödel, Escher, Bach

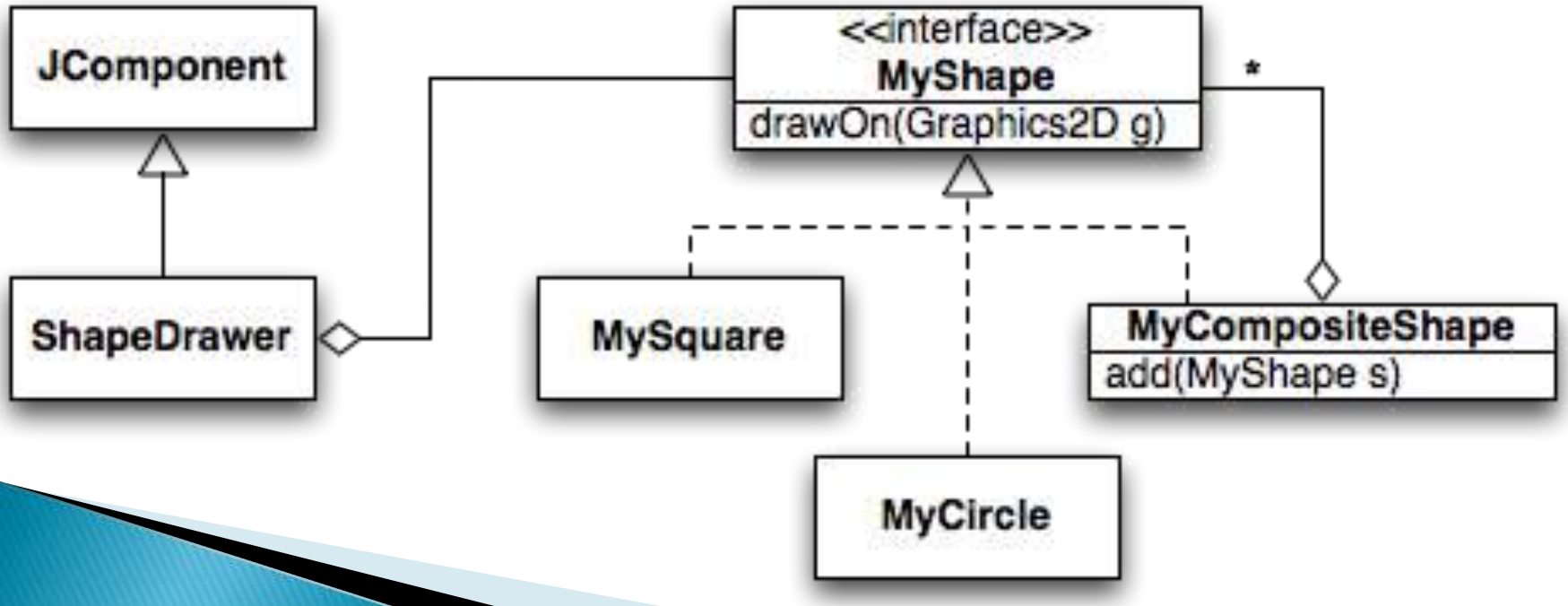
- By Douglas Hofstadter
- Argues that intelligence arises (in part) because of **our ability to think about thinking**



Recursion

- A solution technique where the same computation **occurs repeatedly** as the problem is solved

recurs

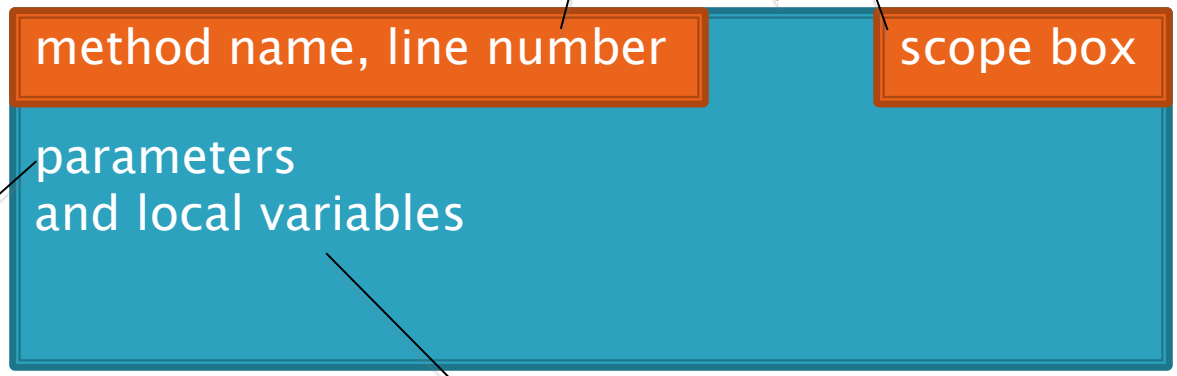


Frames for Tracing Recursive Code

1. Draw box when method starts

2. Fill in name and first line no.

3. Write class name (for static method) or draw reference to object (for non-static method)



4. List every parameter and its argument value.

5. List every local variable declared in the method, **but no values yet**

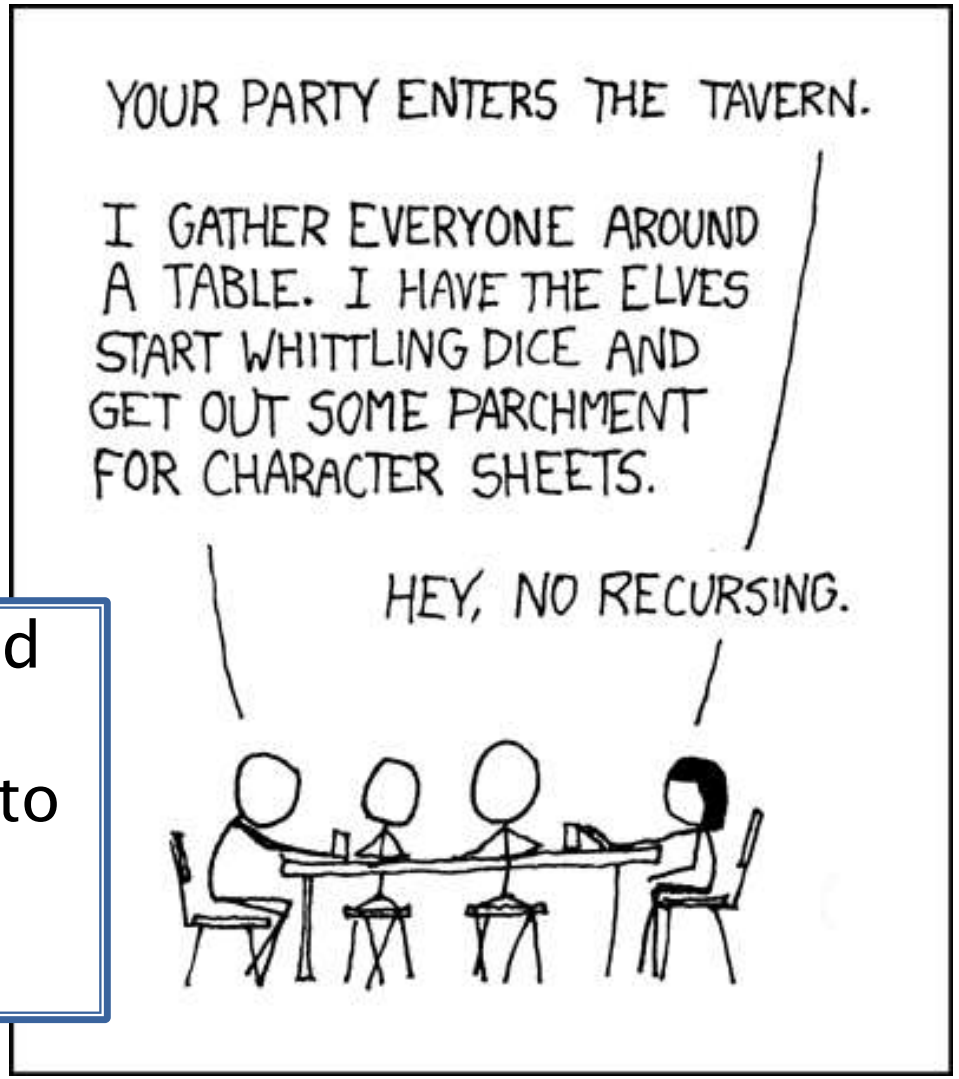
6. Step through the method, update the line number and variable values, draw new frame for new calls

7. "Erase" the frame when the method is done.

Thanks for David Gries for this technique

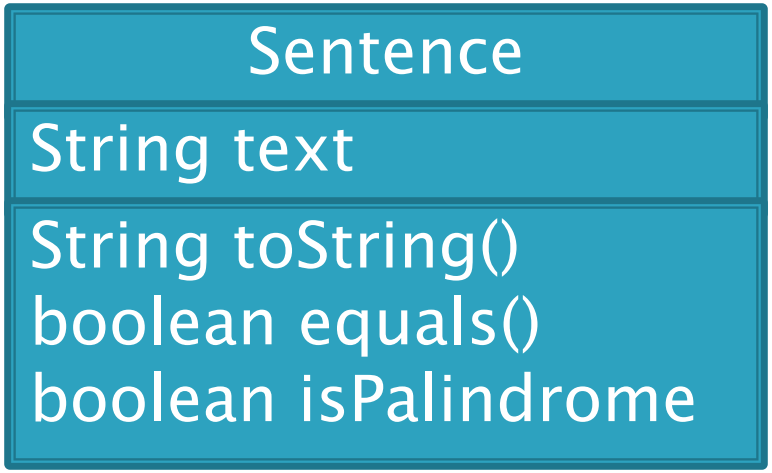
Tabletop Roleplaying

I may have also tossed one of a pair of teleportation rings into the ocean with interesting results.



Programming Problem

- Add a recursive method to Sentence for computing whether Sentence is a palindrome



Recursive Functions

- Factorial:

$$n! = \begin{cases} 1 & \text{if } n \leq 1 \\ n * (n-1)! & \text{otherwise} \end{cases}$$

Base Case

Recursive step

- Ackermann function:

$$A(m,n) = \begin{cases} n+1 & \text{if } m = 0 \\ A(m-1,1) & \text{if } m > 0 \text{ and } n = 0 \\ A(m-1, A(m,n-1)) & \text{otherwise} \end{cases}$$

Recursive Helpers

- Our isPalindrome() makes lots of new Sentence objects

- We can make it better with a “recursive helper method”

- ```
  public boolean isPalindrome() {
      return isPalindrome(0, this.text.length() - 1);
  }
  ```
  ```

Key Rules to Using Recursion

- Always have a **base case** that **doesn't recurse**
- Make sure recursive case always makes **progress**, by **solving a smaller problem**
- **You gotta believe**
  - Trust in the recursive solution
  - Just consider one step at a time

Another Definition of Recursion

- “If you already know what recursion is, just remember the answer. Otherwise, find someone who is standing closer to Douglas Hofstadter than you are; then ask him or her what recursion is.”

  —Andrew Plotkin

Work Time

- Finish **BallWorlds** with partner
  Start **Sierpinski**, due Friday