# Recursion

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# Opening Discussion

- Minute essay comments:
  - Don't use XML for …
    - Human-only stuff
    - Simple things
    - Big data sets of numbers
    - Binary data, like images
    - Low-level
  - Is XML used in video games?
  - Comments on in-class code.
  - Making computer remember who created whom.
  - Am I a Ke$ha fan? Do I prefer Animal or Cannibal?

# More

- Other operations for XML nodes.
- Commercially available 3-D chocolate printer.
- IcP solutions

# The Power of Recursion

- Previously we used recursion to create iteration. This is done with a recursive method that calls itself once and can often be done better with loops.
- The real power of recursion comes in when the method calls itself two or more times.
- The call stack provides memory so recursion can do one thing, then come back and do another.

# Fibonacci Numbers

- The simplest example of a recursive function that calls itself more than once is the Fibonacci numbers.
  - 1, 1, 2, 3, 5, 8, 13, 21, ...
- Each number is the sum of the two before it.
  - f(n)=if(n>2) f(n-1)+f(n-2) else 1
- Simple, but not great.

# Towers of Hanoi

- A classic example of recursion is solving the Towers of Hanoi.
- This game is generally made with disks and three pegs.
- You need to move the disks from one peg to another.
  - Can only move one disk at a time.
  - Can't place a disk on one smaller than it.
- Solution to N disks: move N-1 disks, move 1 disk, move N-1 disks.

# Mazes

- My favorite example is mazes.
- Consider a maze as a 2-D grid with each square either filled or not.
- Now the challenge is to find the length of the shortest path through the maze.
- How do you do that?

# Minute Essay

- What questions do you have about stuff?