

Discussion 03

Recursion

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Slides available at `teaching.aditbala.com`

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Recursion



An Exciting Activity

- The Problem
 - Late Sunday Evening
 - Have 10 murky dishes to wash



Recursion

- What is a recursive function?
 - A function that calls itself
 - Returns a function call of itself, not the object (different than HOF)
- Recursive Leap of Faith
 - The idea that the recursive function will work no matter what/how many test cases are passed in

Solution in Formal Terms of Recursion

- Base Case
 - smallest problem with guaranteed answer, or smallest input
 - **One dish left**
- Recursive Call
 - A method of reducing the current problem into a smaller problem
 - **Making a clone to wash dishes**

Recursion vs Iteration

- Recursion
 - Make problem smaller
 - Variables get reset
 - Many frames will open
 - Lot of memory taken up
 - Better for some problems
 - Recursive Data Structures (Trees, Linked Lists)
- Iteration
 - Loops happen in one frame
 - Easy to visualize
 - No additional function calls

Q2: Recursion Environment Diagram

Draw an environment diagram for the following code:

```
def rec(x, y):  
    if y > 0:  
        return x * rec(x, y - 1)  
    return 1  
  
rec(3, 2)
```


Q1: Recursive Multiplication

Write a function that takes two numbers m and n (only positive) and returns their product. Use recursion, not `mul` or `*`

```
def multiply(m, n):  
    """ Takes two positive integers and returns  
    their product using recursion.  
    >>> multiply(5, 3)  
    15  
    """"  
    """ * * * YOUR CODE HERE * * * """
```

Q3: Find the Bug

Find the bug with this recursive function.

```
def skip_mul(n):  
    """Return the product of n * (n - 2) * (n - 4) * ...  
    >>> skip_mul(5) # 5 * 3 * 1  
    15  
    >>> skip_mul(8) # 8 * 6 * 4 * 2  
    384  
    """  
    if n == 2:  
        return 2  
    else:  
        return n * skip_mul(n - 2)
```

Choose your own adventure !!!

Q3 , Q4 , Q5

Thank you!

Anon Feedback -> <https://tinyurl.com/adit-anon>