Discussion 04

Tree Recursion and Python Lists

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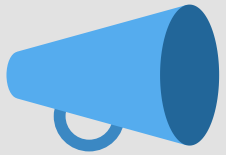
Announcements 

Tree Recursion 

Tree Recursion

- What is Tree Recursion?
  - Recursion, but with more recursive calls
  - Can break down the problem in more than one way
  - With all of the options drawn out, looks like a tree of recursive calls
- When and Why?
  - Useful when the original problem can be broken down in multiple ways
  - Accumulate all sub-problems with multiple recursive calls

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Lists

Lists

- An indexed collection of any data type
- Examples of valid lists:
  - `[1, 2, 3]`
  - `[True, False, 'boo']`
  - `[[4], [3, 6, 7], [8]]`

Creation and Usage

- In order to access the values in our list, we have to use the index
- Python lists are zero indexed, so the first element is at index 0
- `n` element is at `n-1` index
- Can also access elements in reverse order through negative index
  - Last element is accessed through index `-1` or `len(list) - 1`

```
>>> a = [1, 2, [3, 4]]
>>> a[0]
1

>>> a[2]
[3, 4]

>>> a[2][0]
3
```

WWPD

List Slicing

- How do you access a subset of the list?
- List slicing: creating a copy of part of the list
  - Syntax: `list[<start index>: <non inclusive end index>: <step size>]`
  - step size by default is 1
  - negative step size means list is reversed

List Slicing Examples

```
>>> a = [7, 89, True, ['cat']]

>>> a[1:3]
[89, True]

>>> a[:3:2]
[7, True]

>>> a[::-1]
[['cat'], True, 89, 7]

>>> a[:3:-1]
[]
```

List Comprehension

- How do you create a list that fits some criteria?
  e.g. How would you create a list with numbers 1 - 4, but squared
  `[1, 4, 9, 16]`
- List Comprehension: creating a list based on expressions filtering other lists
- Syntax: `[<expression> for <value> in <sequence> if <fitler>]`
- `if` condition is optional

List Comprehension Examples

```
>>> a = [x**2 for x in range(1, 5)]

>>> a
[1, 2, 9, 16]

>>> [x/2 for x in [x for x in a if x % 2 == 0]]
[1, 8]
```