

# Discussion 04

## Tree Recursion, Python Lists

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# Announcements

- Homework 3 & the optional Busy Beaver contest are due Thursday 9/22
- Project 2: Cats due on Friday 9/30
  - Checkpoint due Tuesday 9/28
    - Bonus point for submitting by Thursday 9/29.
  - Try out the finished project on [cats.cs61a.org](https://cats.cs61a.org).

# 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

# Recursive Fibonacci

```
def fib(n):  
    if n == 0:  
        return 0  
    elif n == 1:  
        return 1  
    else:  
        return fib(n - 1) + fib(n - 2)
```

- Need to look at `fib(n - 1)` and `fib(n-1)`
- All steps of recursion present
  - Base Case
  - Recursive Calls
  - Applying to solve problem

Q1 , Q2

# Lists



# Lists

- An indexed collection of any data type
- Examples of valid lists:
  - `list_of_ints = [1, 2, 3, 4]`
  - `list_of_bools = [True, True, False, False]`
  - `nested_lists = [1, [2, 3], [4, [5]]]`



# 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
```

# Q3: WWPD (Lists)

# 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[:2:-1] # go backwards until STOP index  
[['cat']]
```

# 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 <filter>]]`
- `if` condition is optional

# List Comprehension Examples

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

```
>>> a  
[1, 4, 9, 16]
```

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

**Q3 , Q4 , Q5**

# Dictionaries

- Maps `keys` to `values`
- `keys` must be immutable, `values` can be mutable
- Doesn't really have an order
- Access elements using `keys` rather than indices
- Defined with curly braces ( `{}` )
  - `{key: value}`

Demo:

```
pokemon = {'pikachu': 25, 'dragonair': 148, 25: 'hello'}  
pokemon['pikachu'] = pokemon['pikachu'] + 1 # 25  
pokemon['mew'] = 2500  
pokemon # {'pikachu': 25, 'dragonair': 148, 25: 'hello', 'mew': 2500}
```



# Q6: WWPD (Dictionaries)

# Thank you

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