Python

for-loops
Repetition

• Python allows the same block of statements to be repeatedly executed.

• Python iterates over a list such as the range of integers from 0 to $n-1$.

• For loop prototype is

```python
for i in range(n):
    Block of Statements
```
Repetition

for i in range(n):

• Keywords for, in, :

• `range(n)` is a short cut for a list $0, 1, 2, \ldots, n-1$

• `i` is a variable

  • First time through block, `i` is 0, then `i` is 1, ...

• Indented block of statements
Example

```python
for i in range(10):
    print(i)
```
Range

- Range allows you to specify a start in addition to the stop value.
- `range(1, 10)`: start value 1, stop value 10

``` python
for i in range(1, 10):
    print(i)
```
Range

- You can also specify the stride
  - `range(10, -1, -1)`
    - start with 10
    - stop before -1 (i.e. with 0)
    - change by going down by one
  - `range(0, 10, 2)`
    - start with 0
    - go up in twos: 0, 2, 4, 6, 8
    - stop when stepping on or over 10
Example

```python
for i in range(10,-1,-1):
    print(i)
```

```bash
>>> == RESTART: /Users/thomasschwarz/Google Drive/AATeaching/Ahmedabad/for1.py ==
10
9
8
7
6
5
4
3
2
1
0
```
Other iterations

- If you use `for` on a string, you walk through all of the letters of the string:

```python
for letter in "hello world":
    print(letter*2)
```
Calculating Sums

• For loops are handy to calculate mathematical sums

• Geometric series:

  \[ \frac{1}{2^0} + \frac{1}{2^1} + \frac{1}{2^2} + \frac{1}{2^3} + \frac{1}{2^4} + \ldots + \frac{1}{2^{10}} \]

  • Determine iterator needs to run from 0 to 10 (inclusive)

    • `for i in range(11):`

• Need to accumulate fractions in a sum

  • Just don’t call it “sum”, because “sum” has another meaning
Calculating Sums

```python
accu = 0
for i in range(11):
    accu += 1/2**i
print(accu)
```
Calculating Sums

• Admittedly, we could have used Mathematics instead
  • The sum is 1.1111111111 in binary.
  • Add $1/2^{10}$ or 0.0000000001 in binary and we get 2.
  • Thus, the sum is $2 - 1/2^{10}$
Drawing Pictures

- We can use the index in a for loop in order to draw contours
- The trick is to use string repetition instead of drawing each line separately.
Drawing Pictures