# Summer Coding School 2023

Aug 19, 2023

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# Data type

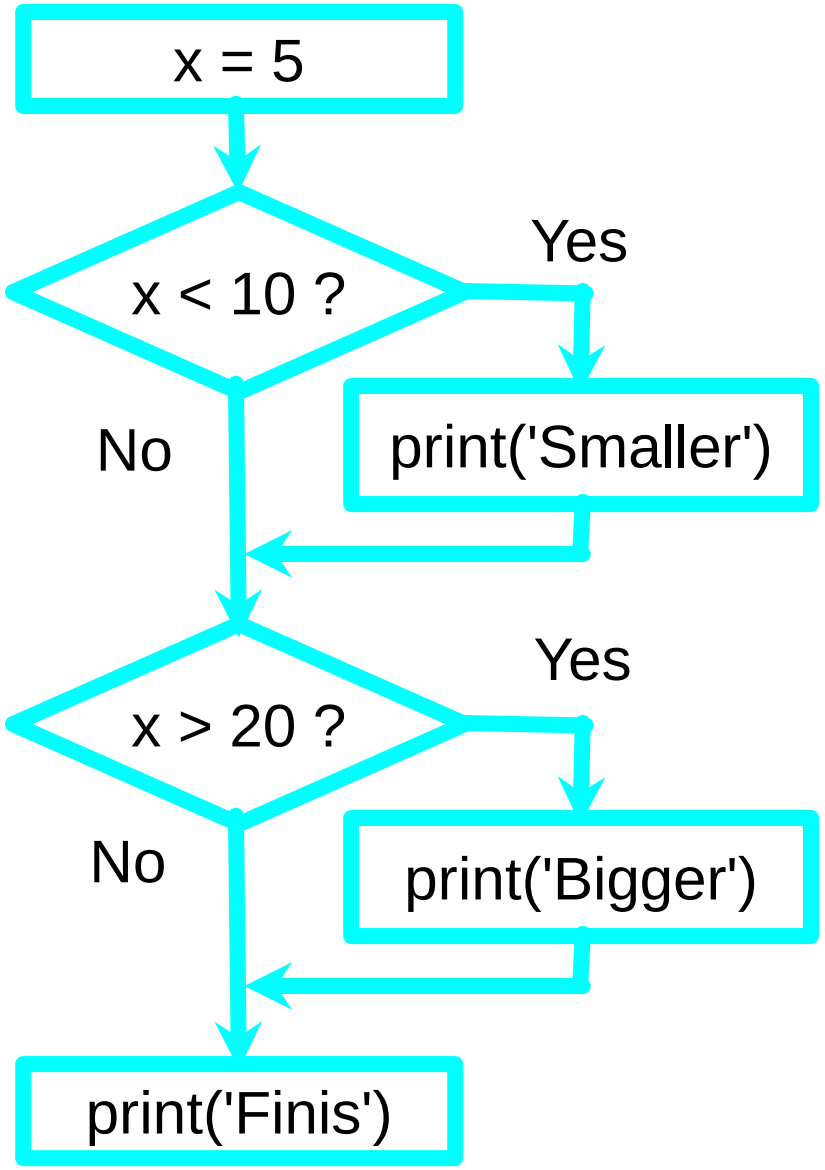
- Integer
- Floating point
- String
- Boolean

# Data structure

- List
- Set
- Tuples
- Dictionary

# Today’s Agenda

- Conditional and Control flows
- While Loop
- For Loop




# Conditional Steps

Program:

```
x = 5
if x < 10:
    print('Smaller')
if x > 20:
    print('Bigger')

print('Finis')
```

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Comparison Operators

- Boolean expressions ask a question and produce a Yes or No result which we use to control program flow
- Boolean expressions using comparison operators evaluate to True / False or Yes / No
- Comparison operators look at variables but do not change the variables

| Python | Meaning |
|---|---|
| < | Less than |
| <= | Less than or Equal to |
| == | Equal to |
| >= | Greater than or Equal to |
| > | Greater than |
| != | Not equal |

Remember: "=" is used for assignment.

http://en.wikipedia.org/wiki/George_Boole

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Comparison Operators

```
x = 5
if x == 5 :
    print('Equals 5')
if x > 4 :
   print('Greater than 4')
if  x >= 5 :
    print('Greater than or Equals 5')
if x < 6 : print('Less than 6')
if x <= 5 :
    print('Less than or Equals 5')
if x != 6 :
    print('Not equal 6')
```

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Indentation

- Increase indent indent after an if statement or for statement (after : )
- Maintain indent to indicate the scope of the block (which lines are affected by the if/for)
- Reduce indent back to the level of the if statement or for statement to indicate the end of the block
- Blank lines are ignored - they do not affect indentation
- Comments on a line by themselves are ignored with regard to indentation

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

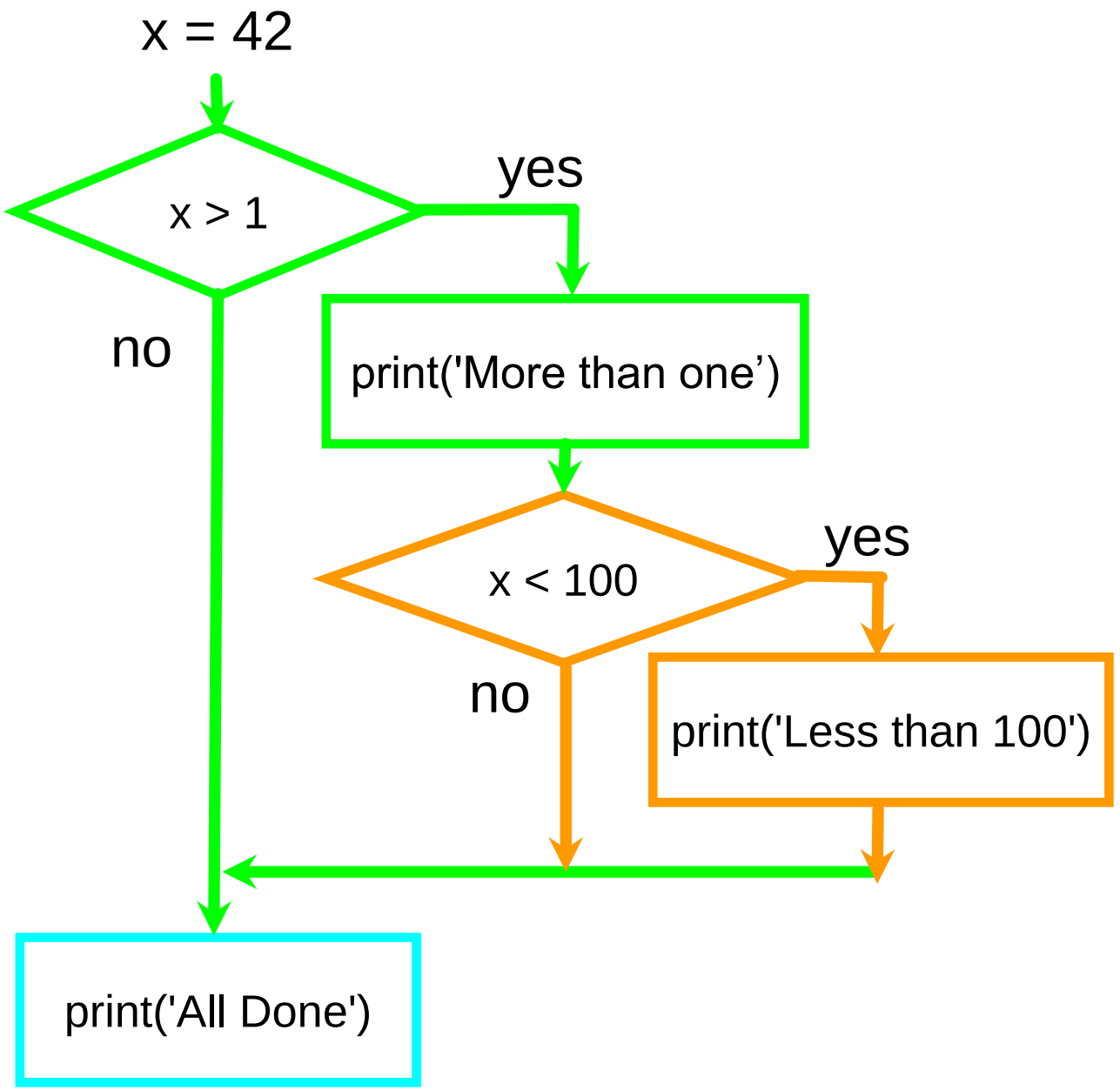
# begin/end Blocks

```
x = 5
if x > 2 :
    print('Bigger than 2')
    print('Still bigger')
print('Done with 2')
```

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Nested Decisions

```
x = 42
if x > 1 :
    print('More than one')
    if x < 100 :
        print('Less than 100')
print('All done')
```

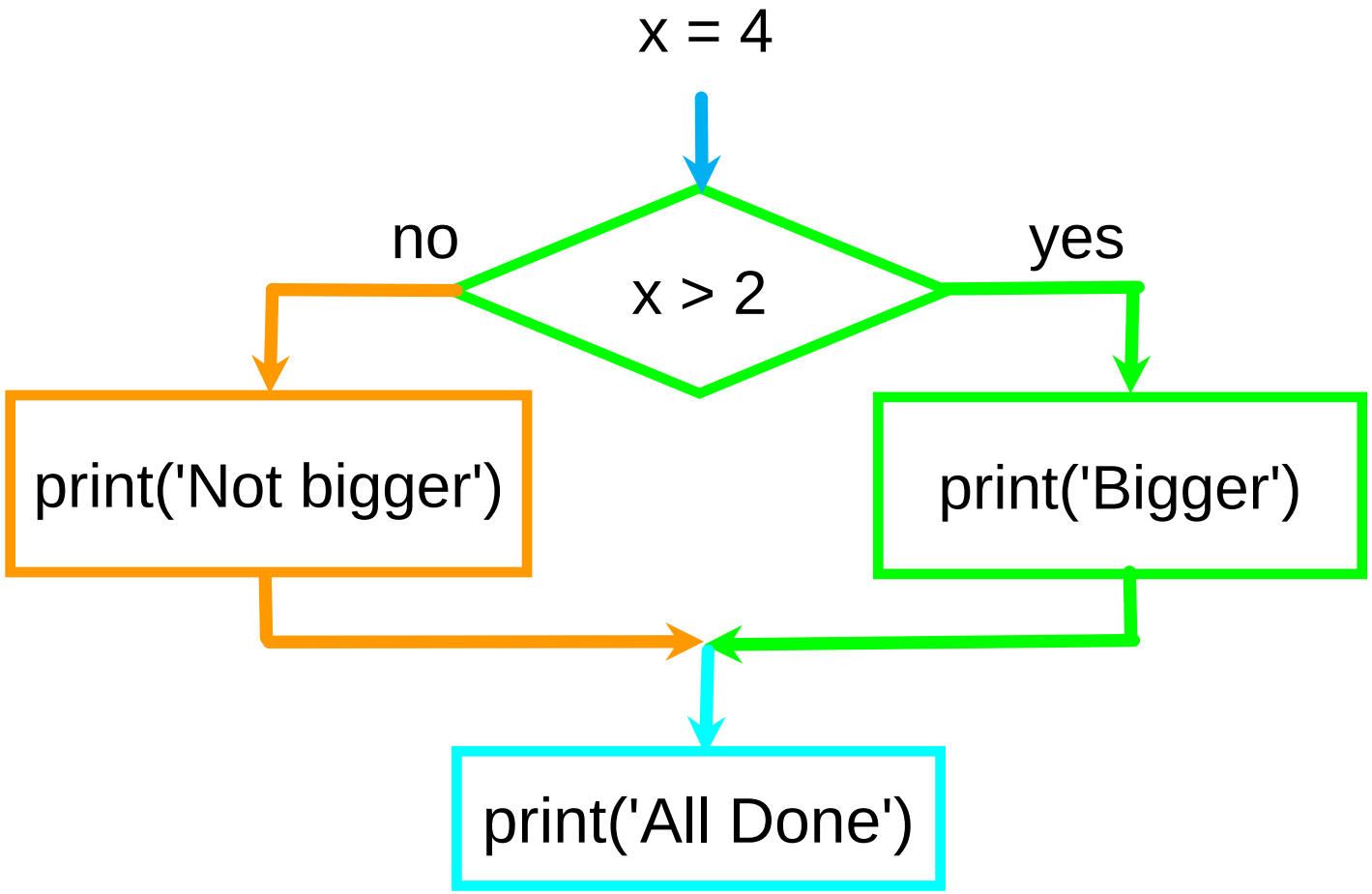



Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Two-way Decisions

Sometimes we want to do one thing if a logical expression is true and something else if the expression is false

It is like a fork in the road - we must choose one or the other path but not both

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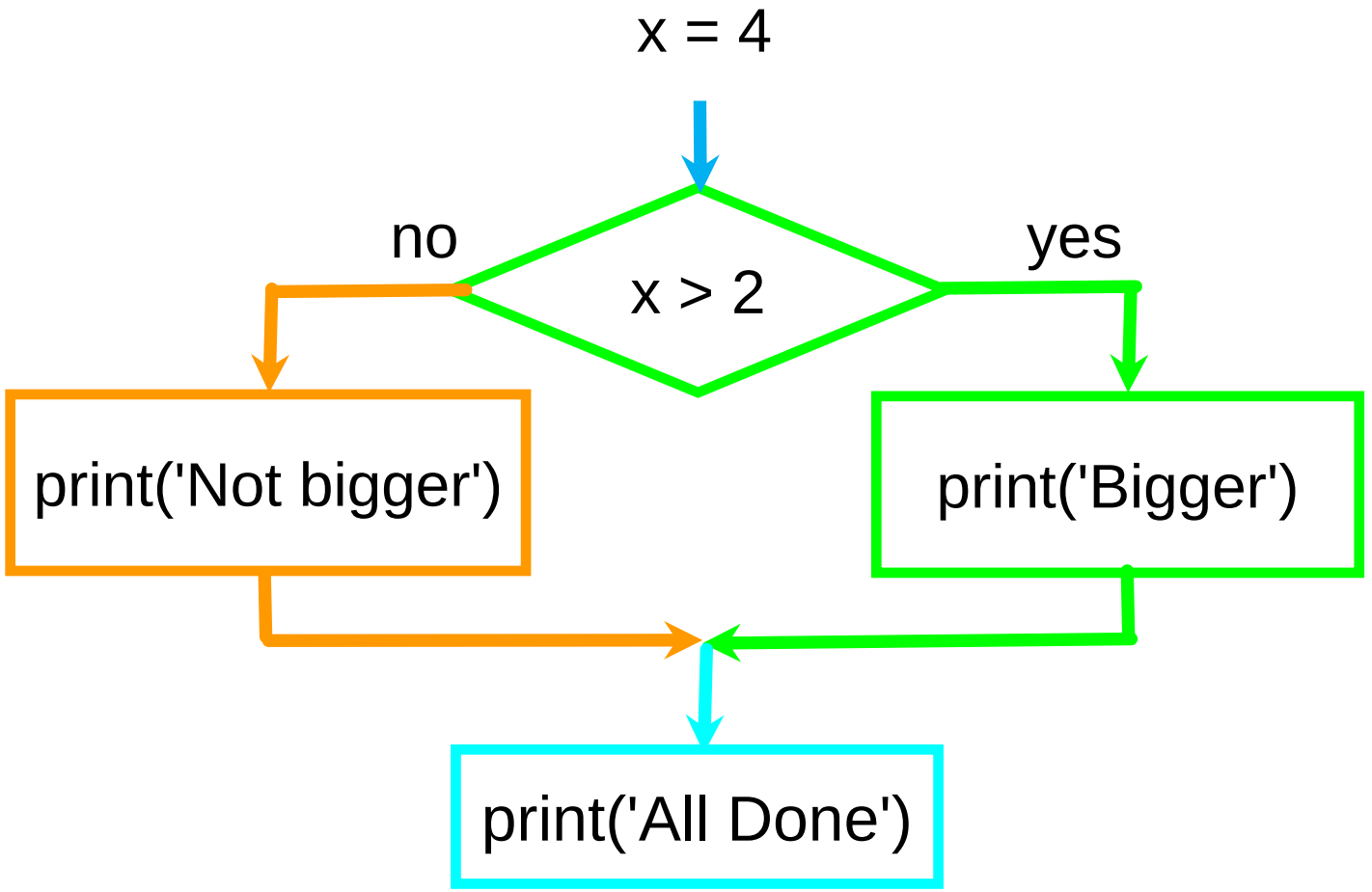
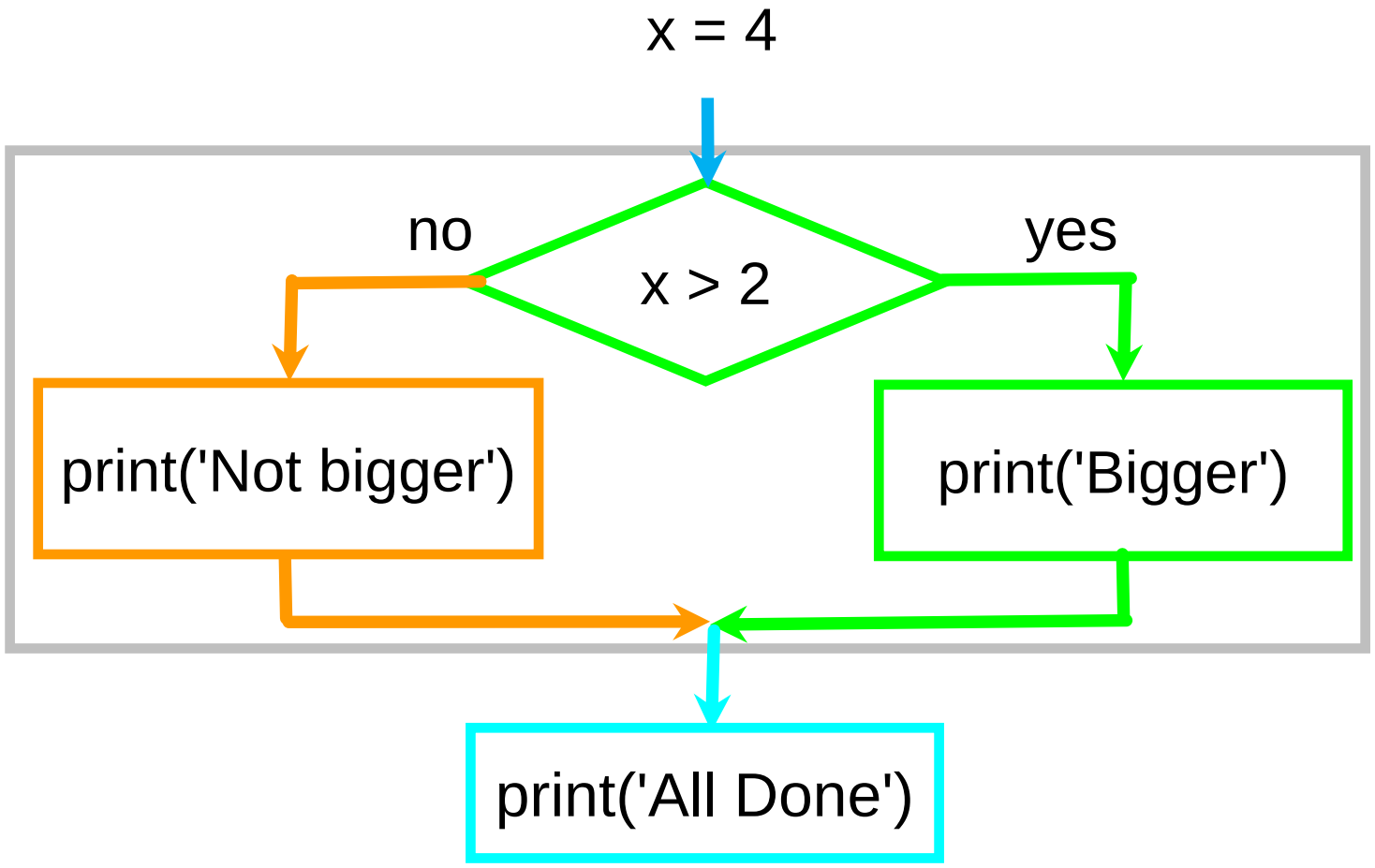
# Two-way Decisions with else:

```
x = 4

if x > 2 :
    print('Bigger')
else :
    print('Smaller')

print('All done')
```



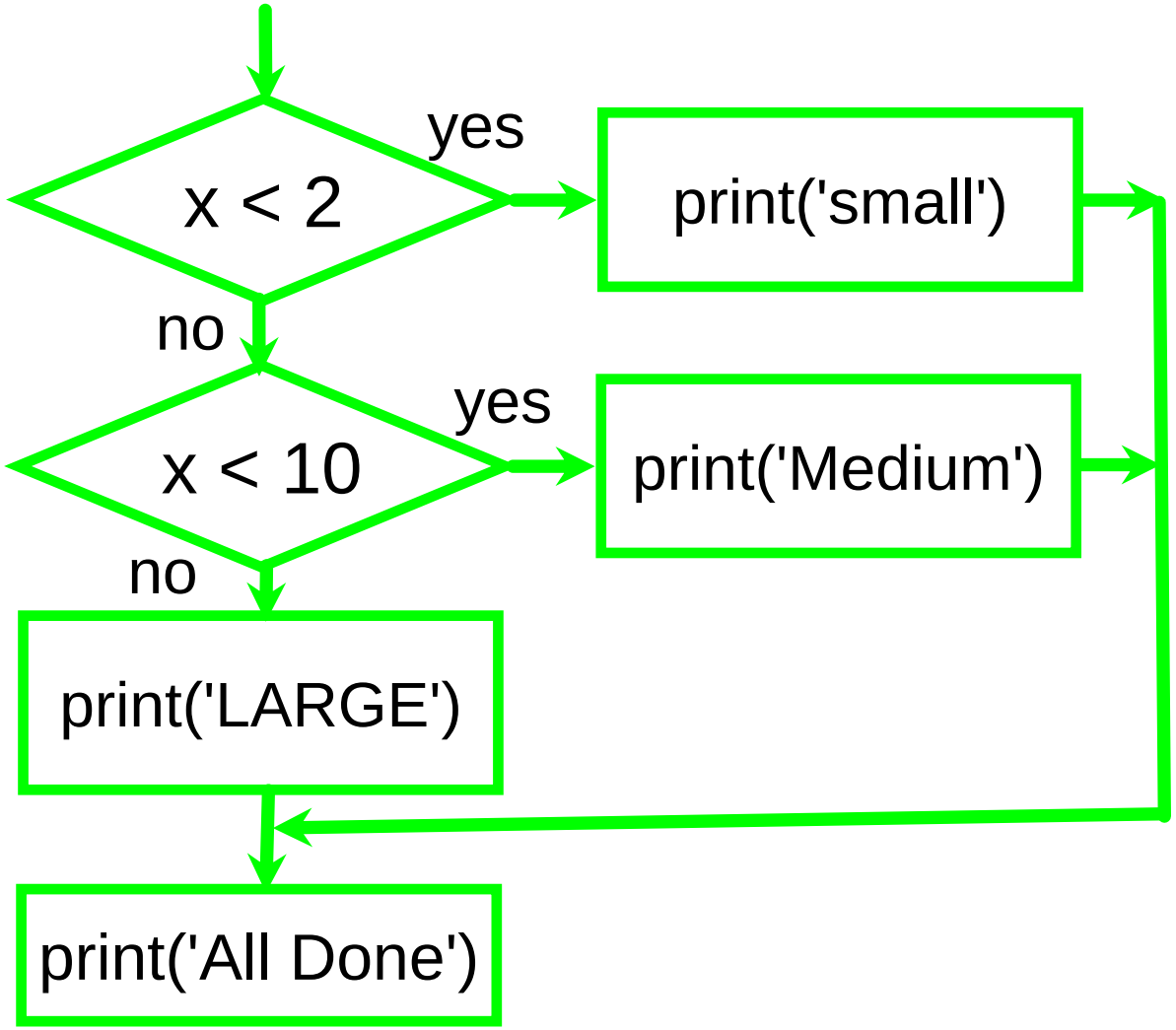
# Visualize Blocks

```
x = 4

if x > 2 :
    print('Bigger')
else :
    print('Smaller')

print('All done')
```



# Multi-way

```
if x < 2 :
    print('small')
elif x < 10 :
    print('Medium')
else :
    print('LARGE')
print('All done')
```

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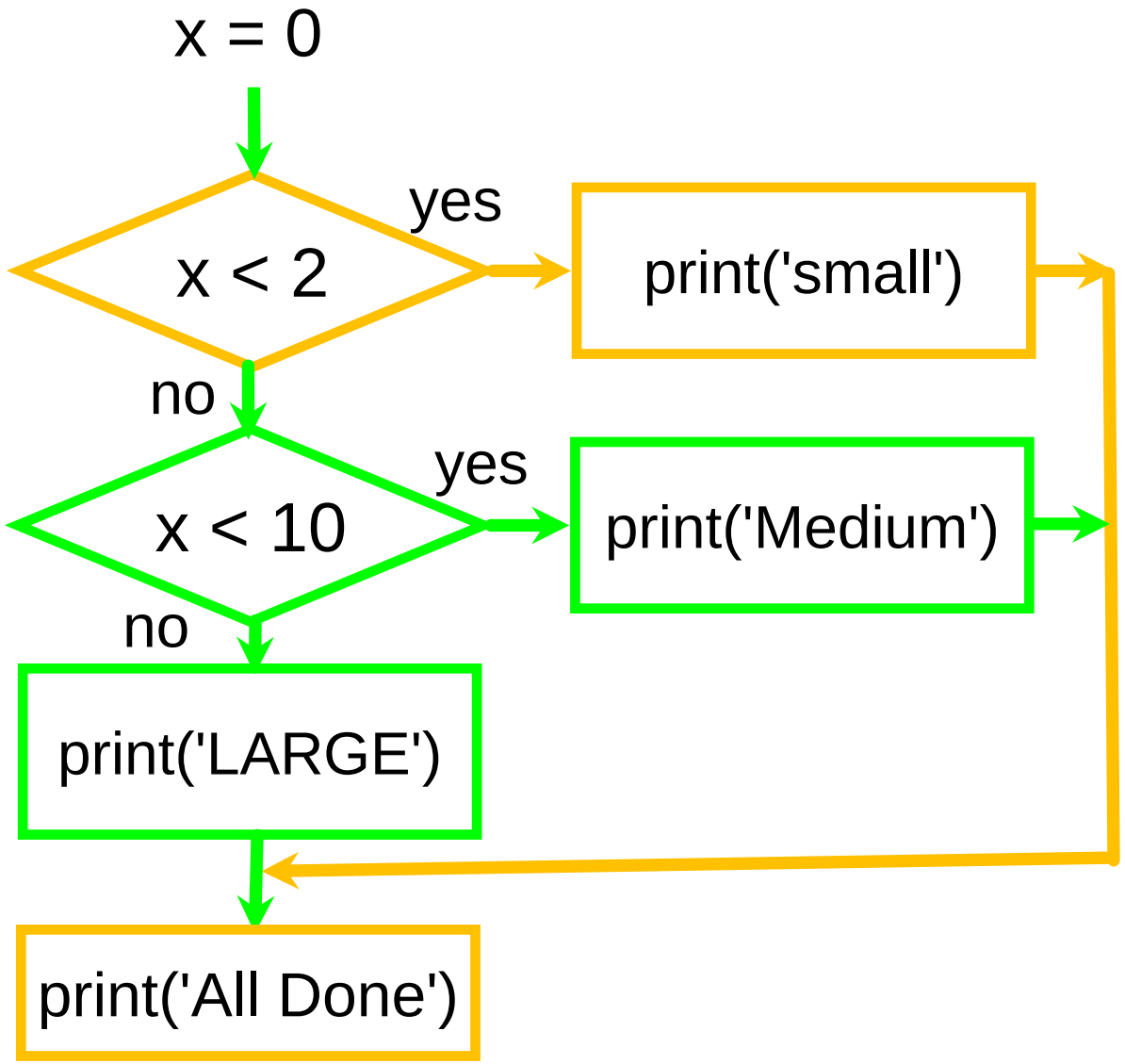
# Multi-way

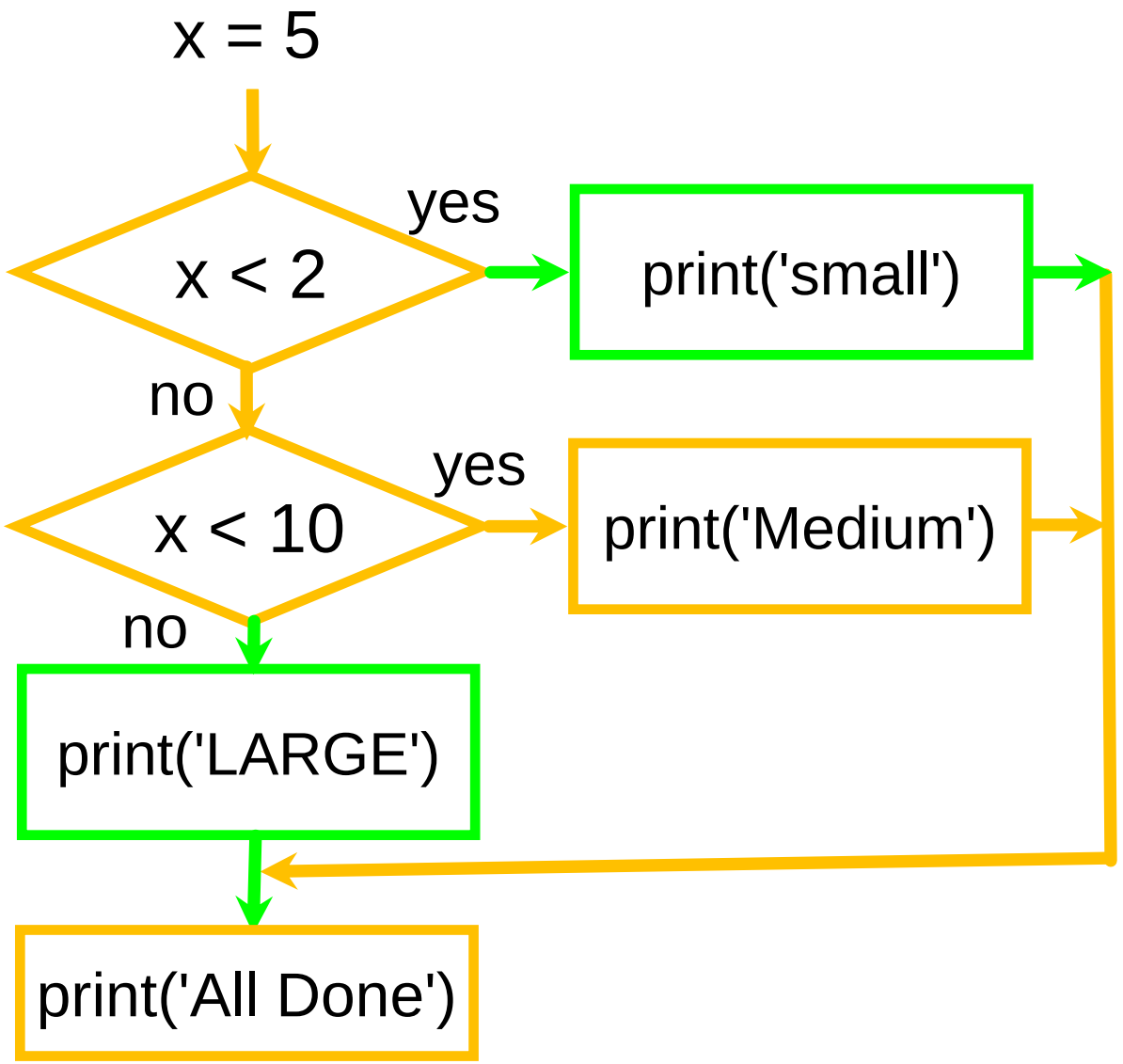
```
x = 0
if x < 2 :
    print('small')
elif x < 10 :
    print('Medium')
else :
    print('LARGE')
print('All done')
```




Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Multi-way

```
x = 5
if x < 2 :
    print('small')
elif x < 10 :
    print('Medium')
else :
    print('LARGE')
print('All done')
```

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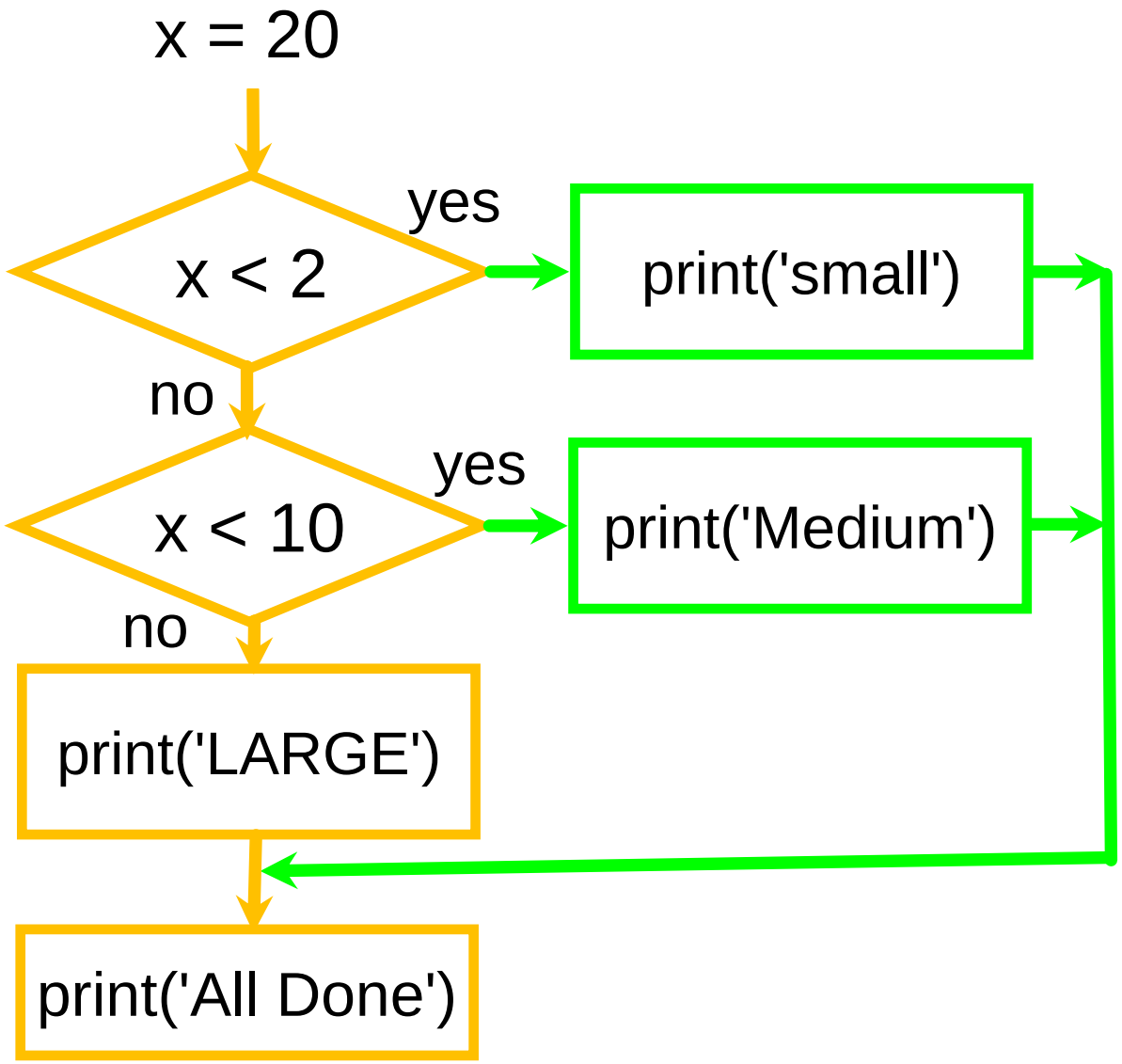
# Multi-way

```
x = 20
if x < 2 :
    print('small')
elif x < 10 :
    print('Medium')
else :
    print('LARGE')
print('All done')
```

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# Multi-way

```
# No Else
x = 5
if x < 2 :
    print('Small')
elif x < 10 :
    print('Medium')

print('All done')
```

```
if x < 2 :
    print('Small')
elif x < 10 :
    print('Medium')
elif x < 20 :
    print('Big')
elif x < 40 :
    print('Large')
elif x < 100:
    print('Huge')
else :
    print('Ginormous')
```

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Multi-way Puzzles

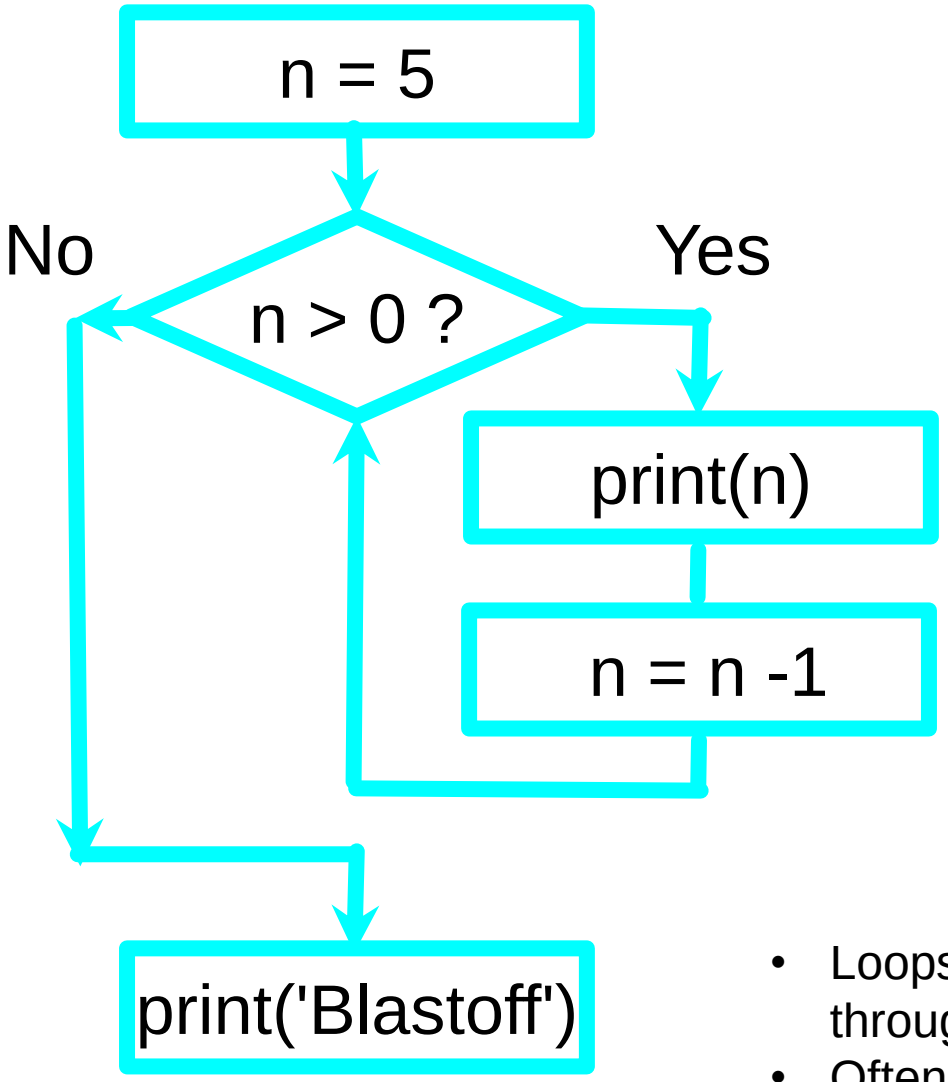
Which will never print regardless of the value for x?

```
if x < 2 :
    print('Below 2')
elif x > 2 :
    print('More than Two')
else :
    print('Something else')
```

```
if x < 2 :
    print('Below 2')
elif x < 20 :
    print('Below 20')
elif x < 10 :
    print('Below 10')
else :
    print('Something else')
```

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Repeated Steps




Program:

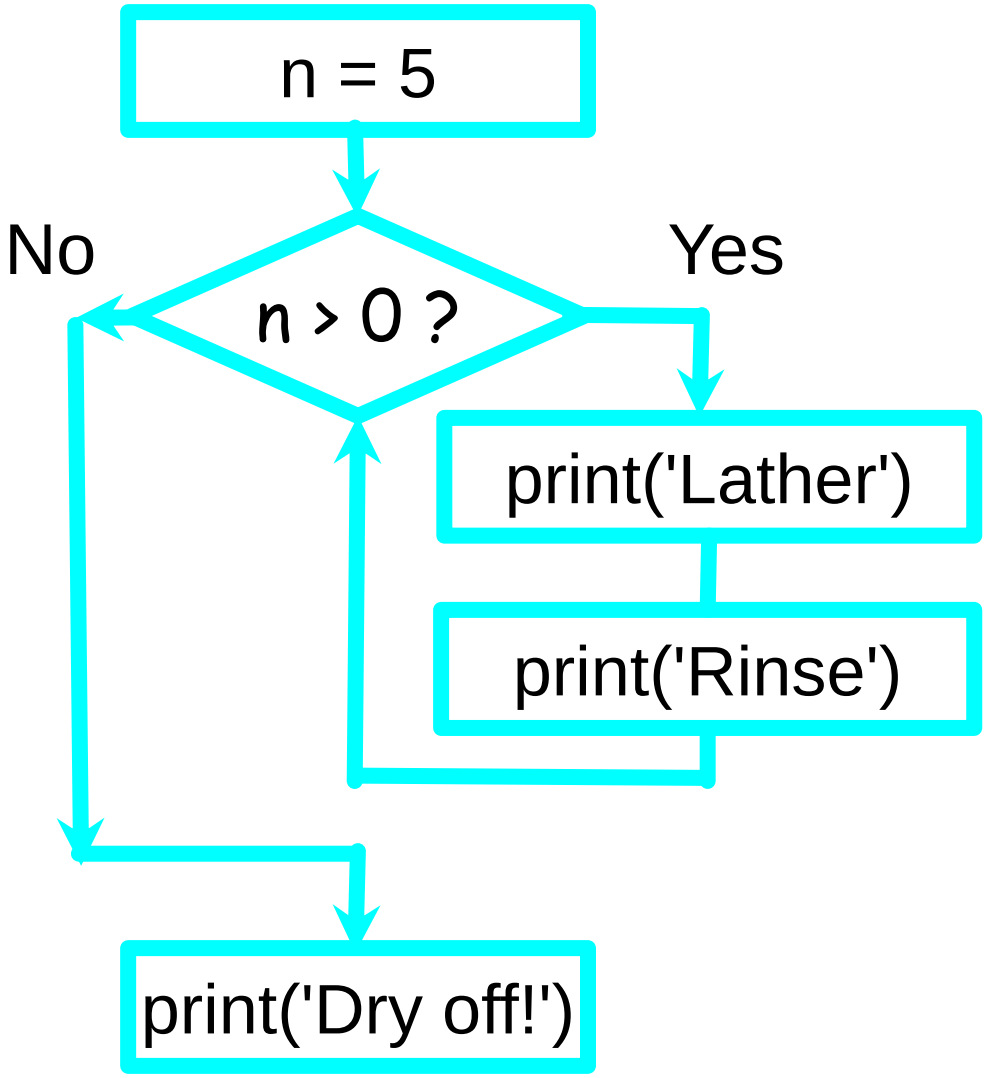
```
n = 5
while n > 0 :
    print(n)
    n = n - 1
print('Blastoff!')
print(n)
```

Output:

5
4
3
2
1
Blastoff!
0

- Loops (repeated steps) have iteration variables that change each time through a loop.
- Often these iteration variables go through a sequence of numbers.

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

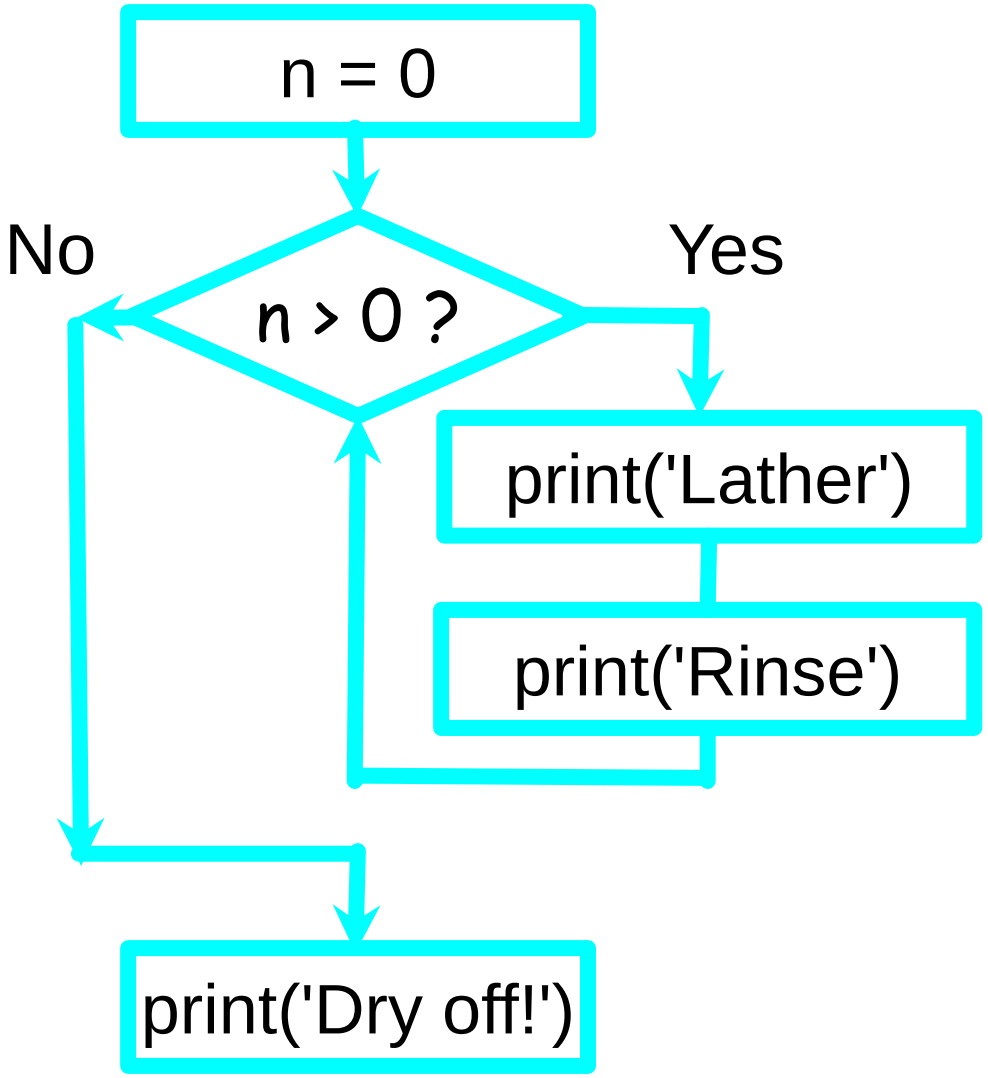



# An Infinite Loop

```
n = 5
while n > 0 :
    print('Lather')
    print('Rinse')
print('Dry off!')
```

What is wrong with this loop?

Source: Python for Everybody, Charles Severance, University of Michigan School of Information




# Another Loop

```
n = 0
while n > 0 :
    print('Lather')
    print('Rinse')
print('Dry off!')
```

What is this loop doing?

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Breaking Out of a Loop

The break statement ends the current loop and jumps to the statement immediately following the loop

It is like a loop test that can happen anywhere in the body of the loop

```
while True:
    line = input('> ')
    if line == 'done' :
        break
    print(line)
print('Done!')
```

# Finishing an Iteration with continue

The continue statement ends the current iteration and jumps to the top of the loop and starts the next iteration

```
while True:
    line = input('> ')
    if line[0] == '#' :
        continue
    if line == 'done' :
        break
    print(line)
print('Done!')
```

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Indefinite Loops

While loops are called “indefinite loops” because they keep going until  a logical condition becomes False

The loops we have seen so far are pretty easy to examine to see if they will terminate or if they will be “infinite loops”

Sometimes it is a little harder to be sure if a loop will terminate

# Definite Loops

Quite often we have a list of items of the lines in a file - effectively a finite set of things

We can write a loop to run the loop once for each of the items in a set using the Python for construct

These loops are called “definite loops” because they execute an exact number of times

We say that “definite loops iterate through the members of a set”

# A Simple Definite Loop

```
for i in [5, 4, 3, 2, 1] :
    print(i)
print('Blastoff!')
```

5
4
3
2
1
Blastoff!

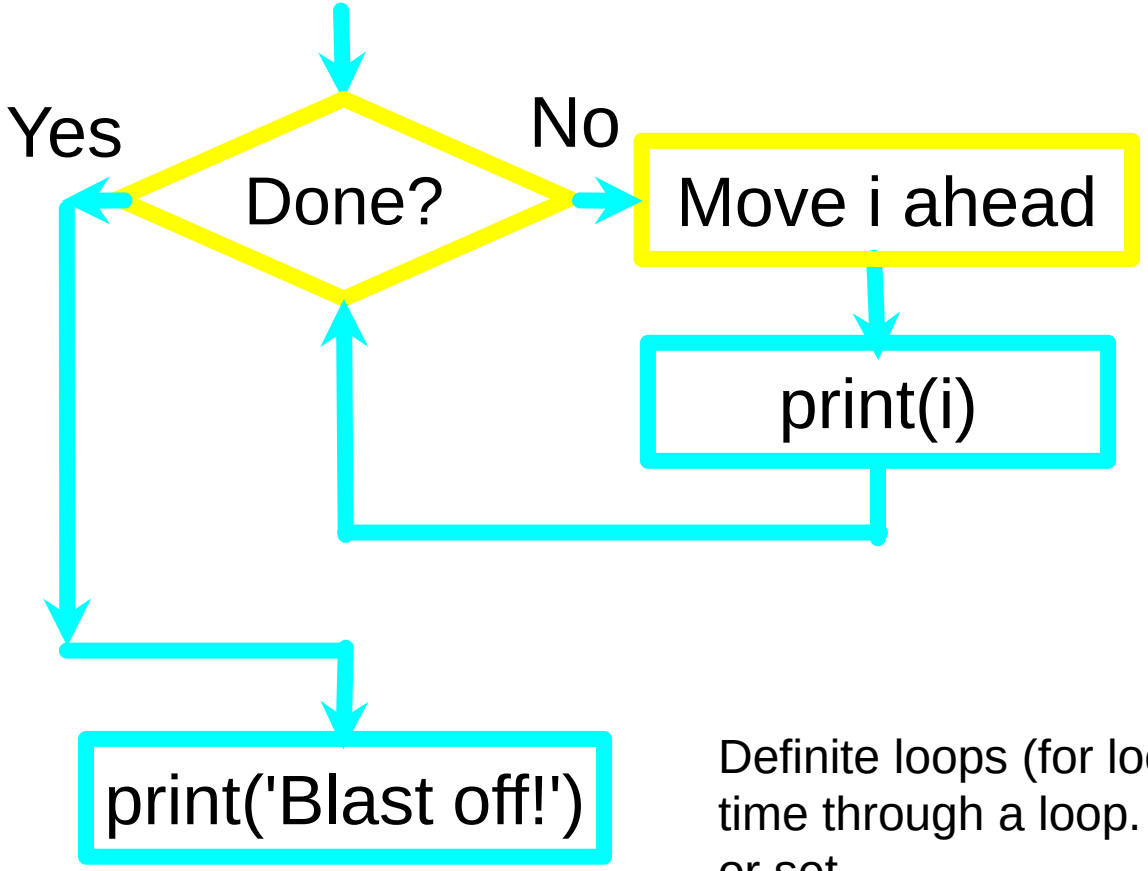
# A Definite Loop with Strings

```
friends = ['Joseph', 'Glenn', 'Sally']
for friend in friends :
   print('Happy New Year:', friend)
print('Done!')
```

Happy New Year: Joseph
Happy New Year: Glenn
Happy New Year: Sally

Done!

# A Simple Definite Loop




```
for i in [5, 4, 3, 2, 1] :
    print(i)
print('Blastoff!')
```

```
5
4
3
2
1
Blastoff!
```

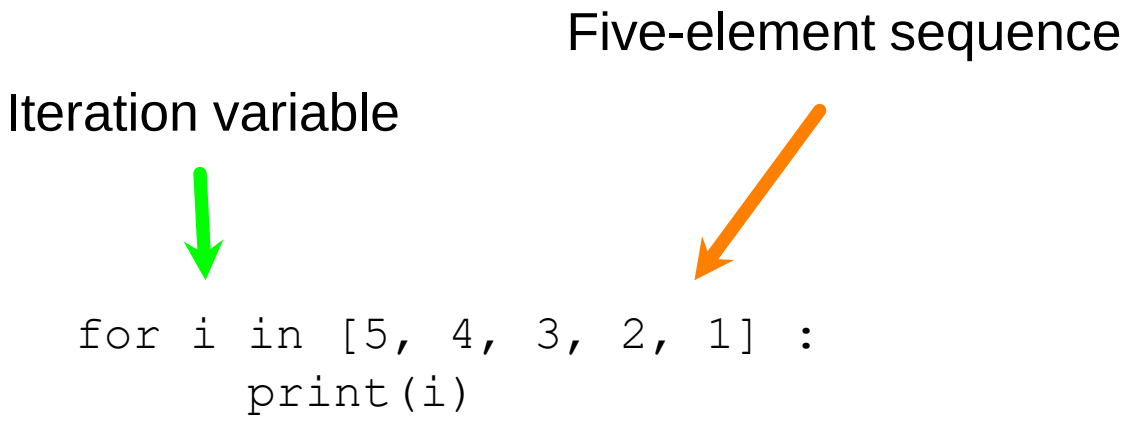
Definite loops (for loops) have explicit iteration variables that change each time through a loop. These iteration variables move through the sequence or set.

# Looking at in...

The iteration variable “iterates” through the sequence (ordered set)

The block (body) of code is executed once for each value in the sequence

The iteration variable moves through all of the values in the sequence

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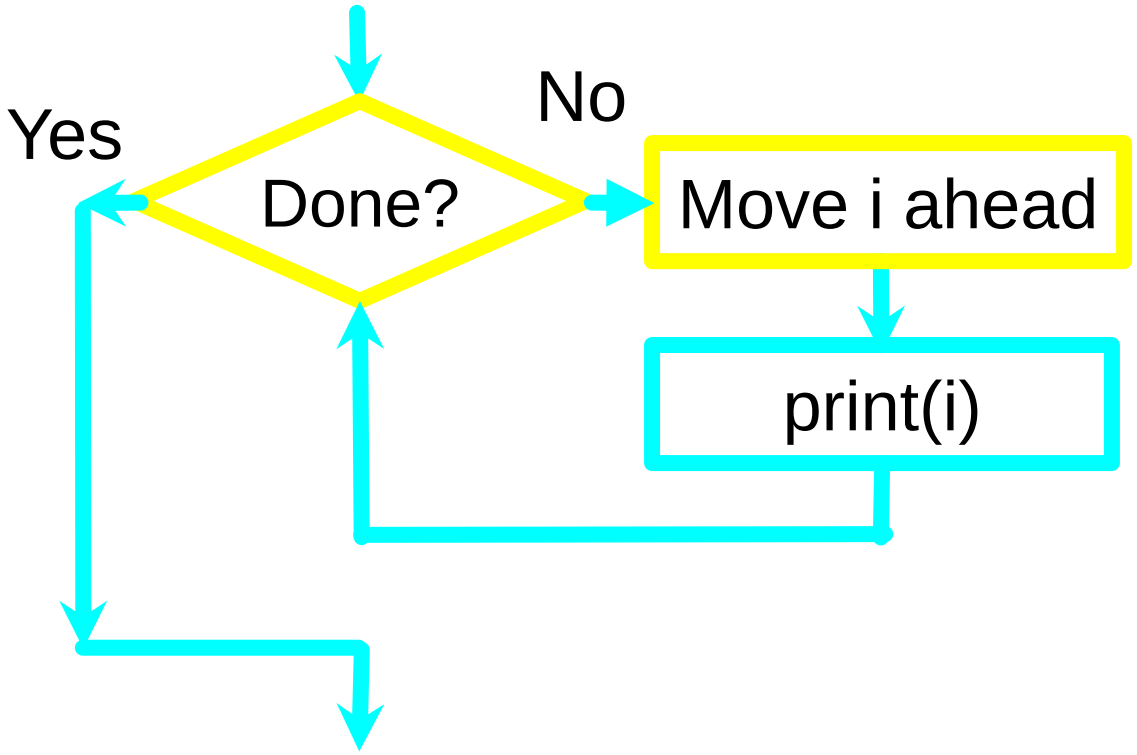


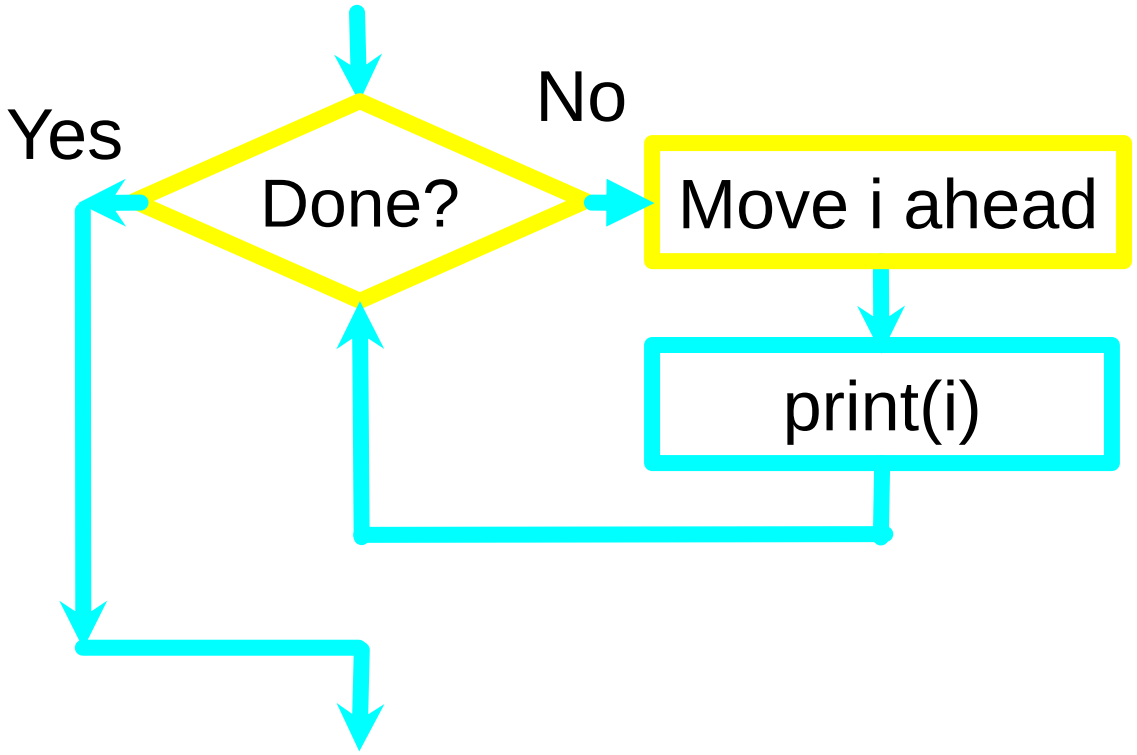

```
for i in [5, 4, 3, 2, 1] :
   print(i)
```

The iteration variable “iterates” through the sequence (ordered set)

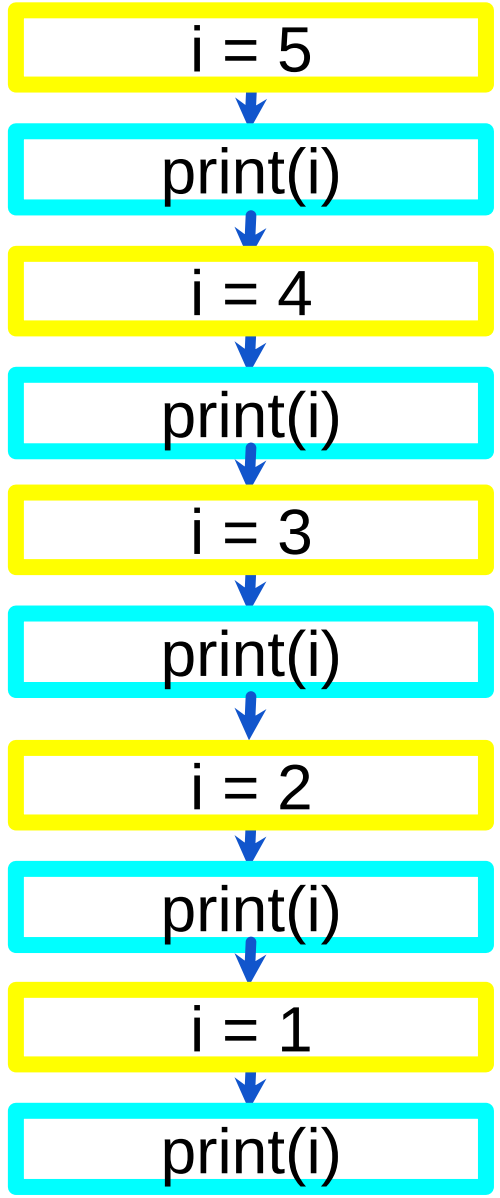
The block (body) of code is executed once for each value in the sequence

The iteration variable moves through all of the values in the sequence

Source: Python for Everybody, Charles Severance, University of Michigan School of Information




```
for i in [5, 4, 3, 2, 1] :
    print(i)
```




Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Making “smart” loops

The trick is “knowing” something about the whole loop when you are stuck writing code that only sees one entry at a time

Set some variables to initial values

for thing in data:

Look for something or do something to each entry separately, updating a variable

Look at the variables

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# Looping Through a Set

```
print('Before')
for thing in [9, 41, 12, 3, 74, 15] :
     print(thing)
print('After')
```

```
Before
9
41
12
3
74
15
After
```

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# begin/end Blocks

```
for i in range(5) :
    print(i)
    if i > 2 :
        print('Bigger than 2')
    print('Done with i', i)
print('All Done')
```

Source: Python for Everybody, Charles Severance, University of Michigan School of Information

# Finding the Largest value

```
largest_so_far = -1
print('Before', largest_so_far)
for the_num in [9, 41, 12, 3, 74, 15] :
    if the_num > largest_so_far :
        largest_so_far = the_num
    print(largest_so_far, the_num)

print('After', largest_so_far)
```

```
Before -1
9  9
41  41
41 12
41  3
74  74
74  15
After 74
```

We make a variable that contains the largest value we have seen so far.
If the current number we are looking at is larger,
it is the new largest value we have seen so far.

# Finding the smallest value?

How would we change this to make it find the smallest value in the list?

```
largest_so_far = -1
print('Before', largest_so_far)
for the_num in [9, 41, 12, 3, 74, 15] :
    if the_num > largest_so_far :
        largest_so_far = the_num
    print(largest_so_far, the_num)

print('After', largest_so_far)
```

# Finding the smallest value

```
smallest_so_far = ?
print('Before', smallest_so_far)
for the_num in [9, 41, 12, 3, 74, 15] :
    if the_num < smallest_so_far :
        smallest_so_far = the_num
    print(smallest_so_far, the_num)

print('After', smallest_so_far)
```

# Counting in a Loop

```
zork = 0
print('Before', zork)
for thing in [9, 41, 12, 3, 74, 15] :
    zork = zork + 1
    print(zork, thing)
print('After', zork)
```

```
Before 0
1 9
2 41
3 12
4 3
5 74
6 15
After 6
```

To count how many times we execute a loop,
we introduce a counter variable that starts at 0
and we add one to it each time through the loop.

# Summing in a Loop

```
zork = 0
print('Before', zork)
for thing in [9, 41, 12, 3, 74, 15] :
    zork = zork + thing
    print(zork, thing)
print('After', zork)
```

```
Before 0
9 9
50 41
62 12
65 3
139 74
154 15
After 154
```

To add up a value we encounter in a loop,
we introduce a sum variable that starts at 0
and we add the value to the sum each time through the loop.

# Finding the Average in a Loop

```
count = 0
sum = 0
print('Before', count, sum)
for value in [9, 41, 12, 3, 74, 15] :
    count = count + 1
    sum = sum + value
    print(count, sum, value)
print('After', count, sum, sum / count)
```

```
Before 0 0
1 9 9
2 50 41
3 62 12
4 65 3
5 139 74
6 154 15
After 6 154 25.666
```

An average just combines the counting and sum patterns and divides when the loop is done.

# Acknowledgements / Contributions

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