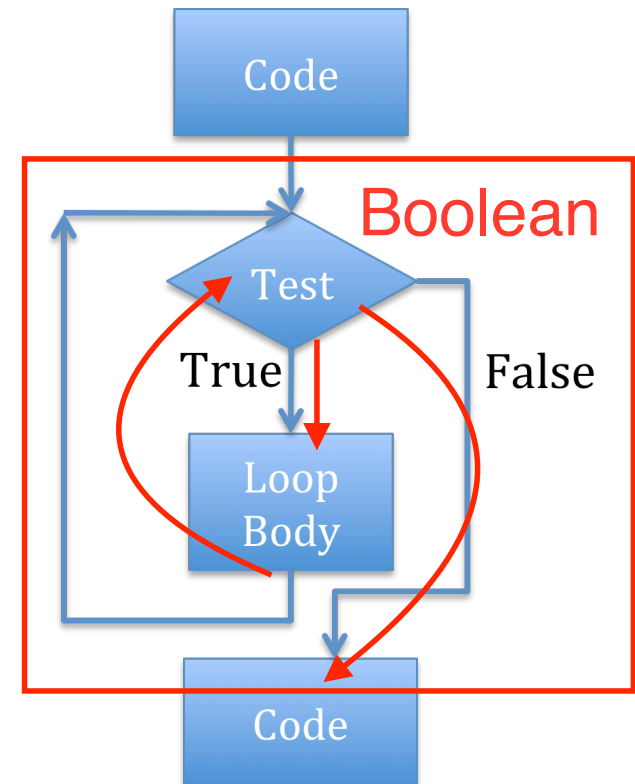# Iteration

- Need one more concept to be able to write programs of arbitrary complexity
  - Start with a test
  - If evaluates to `True`, then execute loop body once, and go back to reevaluate the test
  - Repeat until test evaluates to `False`, after which code following iteration statement is executed

An example

```
x = 3
ans = 0
itersLeft = x
while (itersLeft != 0):
    ans = ans + x
    itersLeft = itersLeft − 1
print(str(x) + '*' + str(x) + ' = ' + str(ans))
```

This code squares the value of x by repetitive addition.

Stepping through this code

```
x = 3
ans = 0
itersLeft = x
while (itersLeft != 0):
    ans = ans + x
    itersLeft = itersLeft − 1
print(str(x) + '*' + str(x) +
    ' = ' + str(ans))
```

x	ans	itersLeft
3	0	3
	3	2
	6	1
	9	0

Some properties of iteration loops:
• need to set an iteration variable outside the loop
• need to test that variable to determine when done
• need to change that variable within the loop, in addition to other work

Iterative code

- Branching structures (conditionals) let us jump to different pieces of code based on a test
  - Programs are **constant time**
- Looping structures (e.g., while) let us repeat pieces of code until a condition is satisfied
  - Programs now take time that depends on values of variables, as well as length of program