Data Types and `if` Structure

Lecture 2

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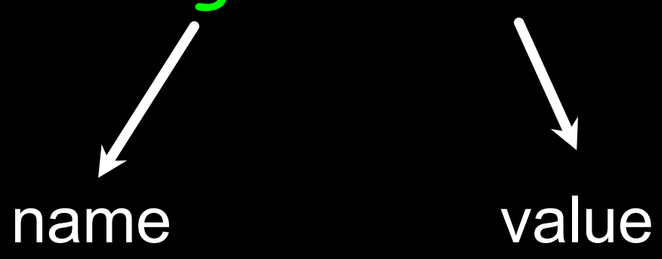
Variables & Assignment

A variable is a memory location used to store a value (20)



Python Variable Name Rules

- Must start with a letter or underscore _
- Must consist of letters, numbers, and underscores
- Case Sensitive

```
Good:     age     age_anne    age23
Bad:      #age    age anne    age.23
```

Assignment

```
x = 2
y = 3*x+(1-x)
z = input()
```

⟵ Constant

⟵ Expression

⟵ Function

? Type of `x,y,z`?

What Does “Type” Mean?

- In Python variables, literals, and constants have a “type”
- Python knows the difference between an integer number and a string
- For example “+” means “addition” if something is a number and “concatenate” if something is a string

```
>>> ddd = 1 + 4
>>> print(ddd)
5
>>> eee = 'hello ' + ‘Lucy'
>>> print(eee)
hello Lucy
```

concatenate = put together

Type Matters

- Python knows what “type” everything is
- You cannot “add 1” to a string
- We can ask Python what type something is by using the type() function

```
>>> eee = 'hello ' + ‘Lucy'
>>> eee = eee + 1
Traceback (most recent call last):
File "<stdin>", line 1, in
<module>TypeError: Can't convert
'int' object to str implicitly
>>> type(eee)
<class'str'>
>>> type('hello')
<class'str'>
>>> type(1)
<class'int'>
>>>
```

1. Numbers

- Numbers have two main types
  - Integers are whole numbers:
    -14, -2, 0, 1, 100, 401233
  - Floating Point Numbers have
    decimal parts: -2.5 , 0.0, 98.6, 14.0

```
>>> xx = 1
>>> type (xx)
<class 'int'>
>>> temp = 98.6
>>> type(temp)
<class'float'>
>>> type(1)
<class 'int'>
>>> type(1.0)
<class'float'>
>>>
```

Type Conversions

Built-in functions

- int( ) and float( )

```
>>> i = 42
>>> type(i)
<class'int'>
>>> f = float(i)
>>> print(f)
42.0
>>> type(f)
<class'float'>
>>> type(int(f))
<class'int'>
```

String Conversions

- You can also use int() and float() to convert between strings and integers
- You will get an error if the string does not contain numeric characters

```
>>> strVal = '123'
>>> type(strVal)
<class 'str'>
>>> intVal = int(strVal)
>>> type(intVal)

>>> sv = 'hello bob'
>>> niv = int(sv)
Traceback (most recent call last):
File "<stdin>", line 1, in <module>
ValueError: invalid literal for int()
with base 10: 'x'
```

2. Booleans

- Only 2 basic members
  - True
  - False

  Logical expressions with logical operators : `and` ,`or` and `not`

```
>>> True and False
False
>>> not (True and False)
True
>>> (not True) and False
False
>>> x = True
>>> y = False
>>> x and y
False
>>> y or (not y)
True
```

Comparison Operators

Python	Meaning
==	equality
!=	inequality
<	Less than
<=	Less than or Equal
>=	Greater than or Equal
>	Greater than

Remember: “=” is used for assignment.

```
>>> 3 == 2 + 2
False
>>> 3 != 2 + 2
True
>>> x = “cat”
>>> y = “hat”
>>> x == y
False
>>> print(x)
‘cat’
>>> len(x) > 7 and
y.count(“a”) < 3
False
```

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

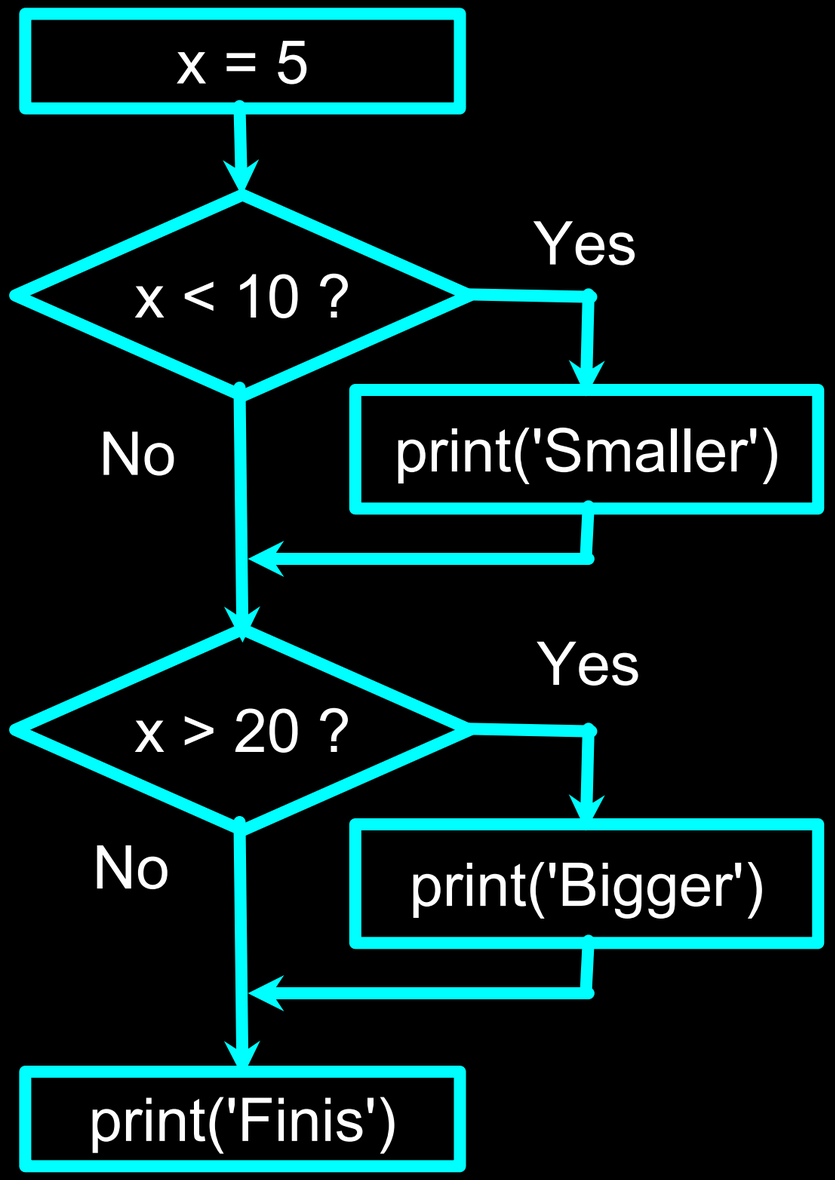
Type

Boolean version of type()

- isinstance( )

```
>>> i = 42
>>> type(i)
<class'int'>
>>> isinstance(i,int)
True
>>> isinstance(str(i),int)
False
>>> isinstance(“hat”,str)
True
>>> isinstance(3==4,str)
False
```

Conditional Execution



Conditional Steps

Program:

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

print('Finis')
```

Output:

```
Smaller
Finis
```

Indentation

```
 x = 5
if x < 10:
    print('Smaller’)
    x = x + 1
if x > 20:
    print('Bigger’)

print(x)
```

- increase after if statement
- maintain to indicate the scope
- reduce to indicate end of block

Tab key


Esc
F1
F2
F3
F4
F5
F6
F7
F8
F9
F10
F11
F12
Backspace
Insert
Print Screen
Home
Scroll Lock
PgUp
Pause Break
Num Lock
Tab
Q
W
E
R
T
Y
U
I
O
P
Delete
End
PgDn
7 Home
8
9 PgUp
Caps Lock
S
D
F
G
H
J
K
L
Enter
4
5
6
Shift
Z
C
V
B
N
M
1 End
2
3 PgDn
Ctrl
Fn
Alt
0 Insert
Delete

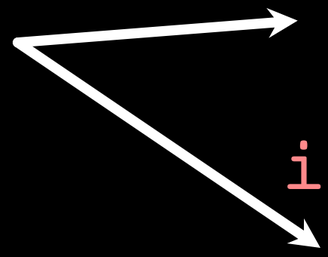
Indentation

Program:

```
x = 5
if x < 10:
    print('Smaller’)
    x = x + 1
if x > 20:
    print('Bigger’)

print(x)
```

Must be spaced
tabbed



Output:

```
Smaller
6
```

Indentation errors

Program:

```
x = 5
if x < 10:
print('Smaller’)
```

Output:

```
File "<stdin>", line 3
    print('Smaller’)
    ^
IndentationError: expected
an indented block
```

Indentation errors

Program:

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

Output:

```
File "<stdin>", line 4
      print("Bigger")
IndentationError: unexpected
indent
```

Indentation errors

- Python cares a *lot* about how far a line is indented. If you mix tabs and spaces, you may get “indentation errors” even if everything looks fine

Program:

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

Output:

```
File "<stdin>", line 3
      print("Bigger")
IndentationError: unexpected
indent
```

A difference?

Program1:

```
# 2-statement block
if 1 + 1 == 3:
    print('that shouldn't happen')
    print('what?')
```

Output:

Program2:

```
# 1-statement block
if 1 + 1 == 3:
    print('that shouldn't happen')
print('what?')
```

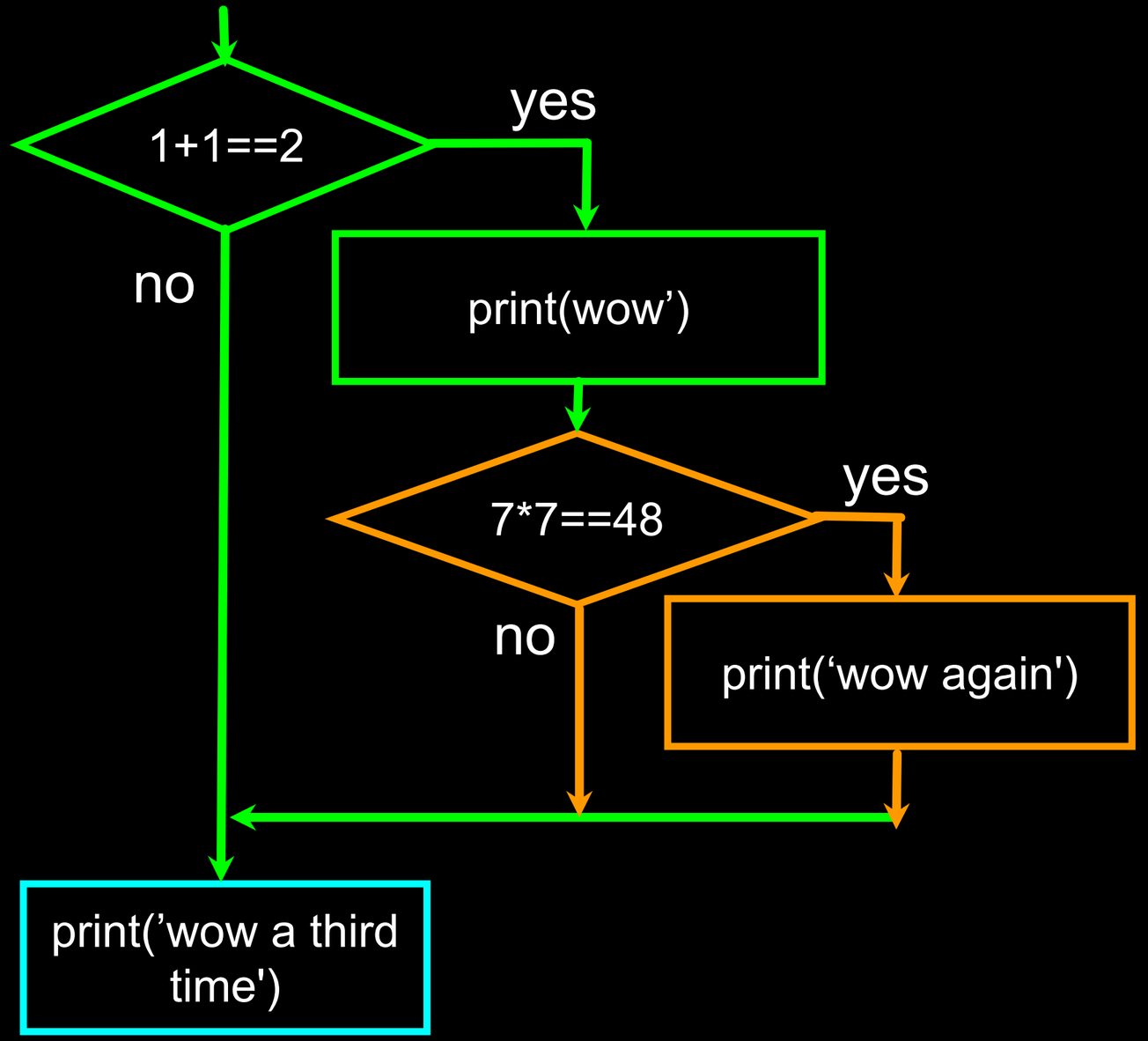
Output:

```
"what?"
```

Nested Decisions

Program:

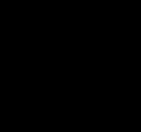
```
if 1 + 1 == 2:
    print(‘wow’)
    if 7*7 == 48:
        print(‘wow again’)
print(’wow a third time’)
```



Nested Decisions

Program:

```
if 1 + 1 == 2:
    print('wow')
    if 7*7 == 48:
        print('wow again')
print('wow a third time')
```

Output: 

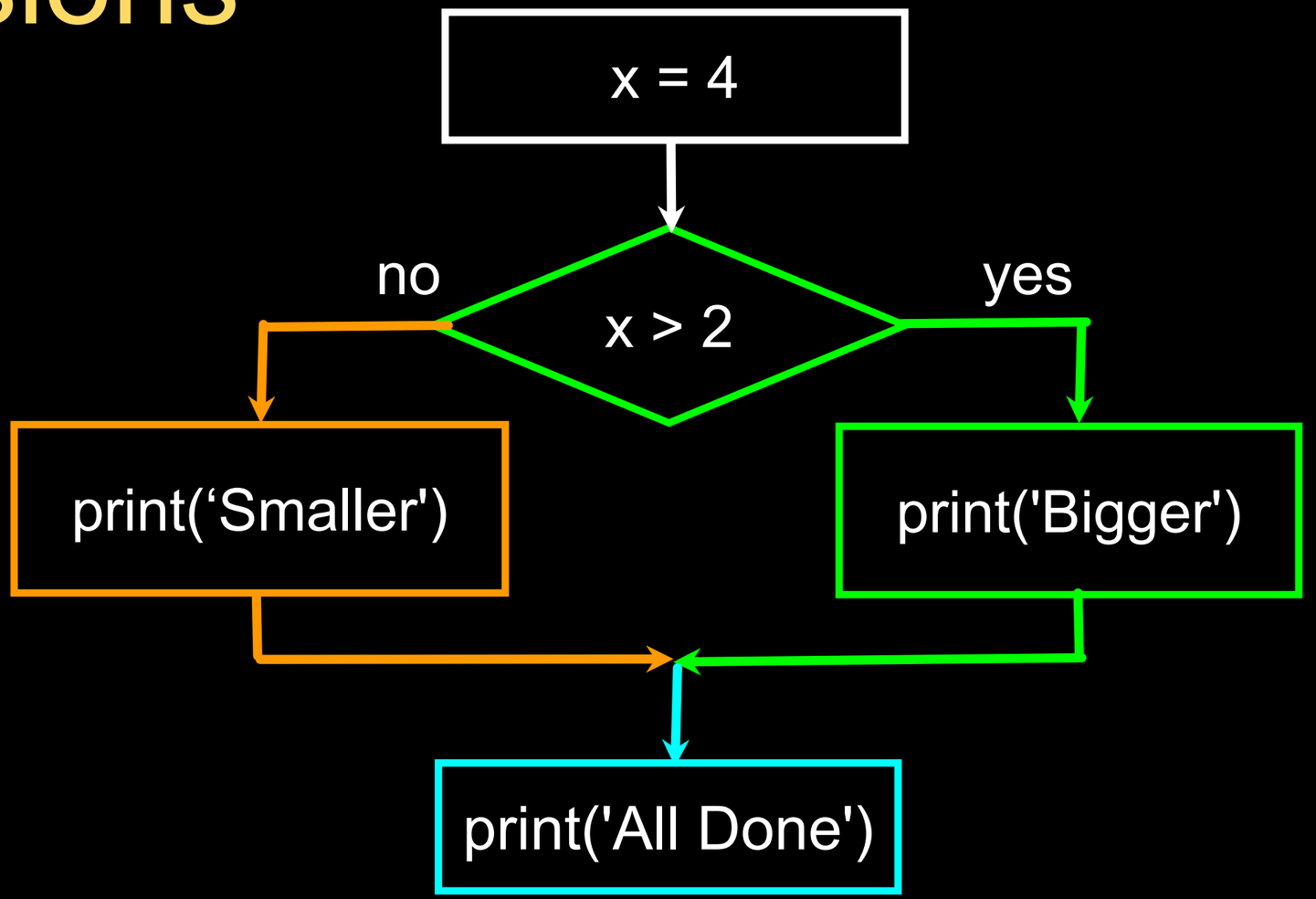
'wow'
'wow a third time'

Two-way Decisions with `else`:

```
x = 4

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

print('All done')
```

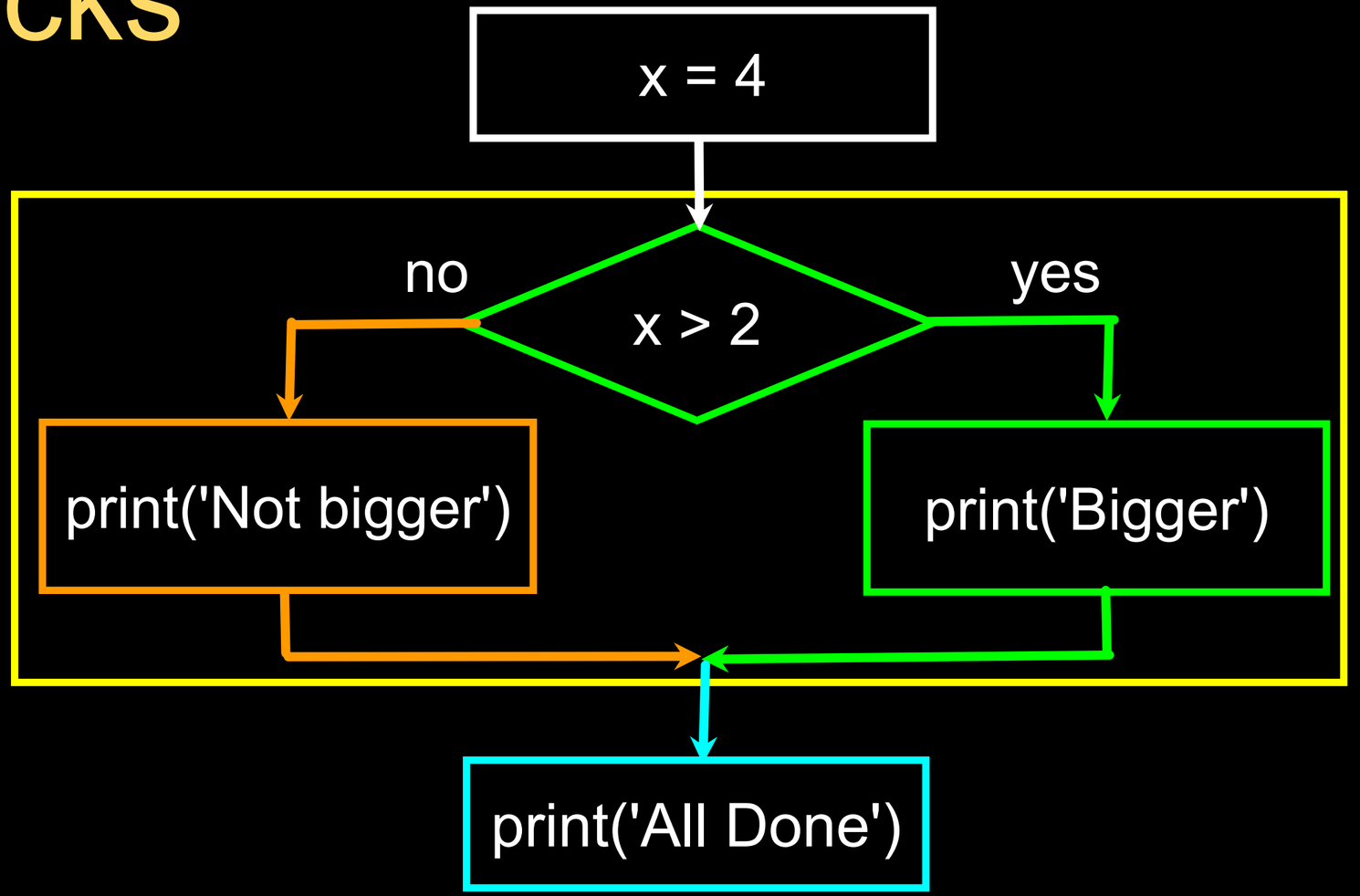


Visualize Blocks

```
x = 4

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

print('All done')
```



if … else

If the `if` clause evaluates to true, the else block will not execute:

```
if 2+2==4:
    print('this will print')
else:
    print("but this won't")
    print('...and neither will this')
```

output: ‘this will print’

if … else

If the `if` clause evaluates to true, the else block will not execute:

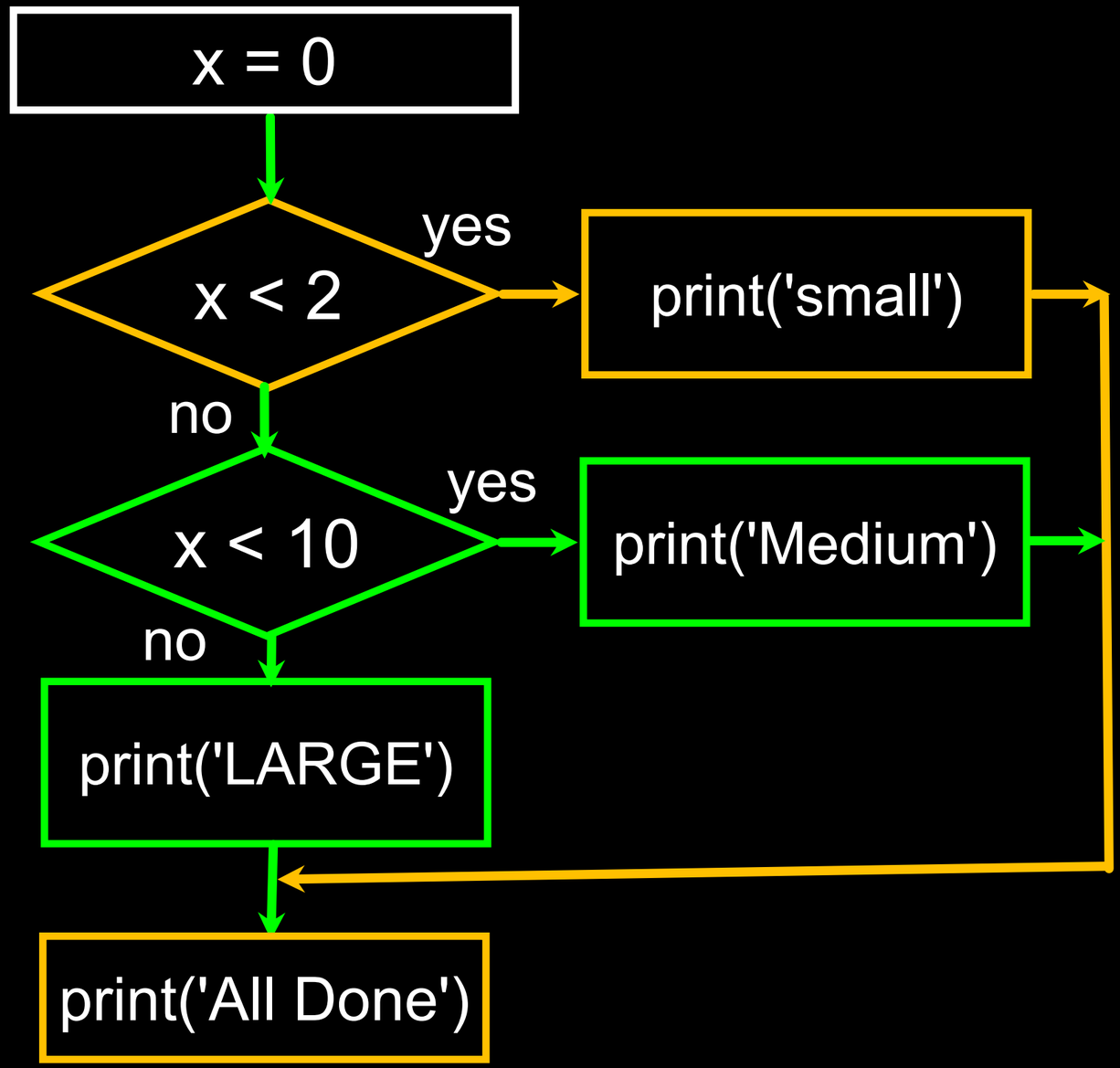
```
if 2+2==10:
    print('this will print')
else:
    print("but this won't")
    print('...and neither will this')
```

output: “but this won’t”
“...and neither will this”

Multi-way

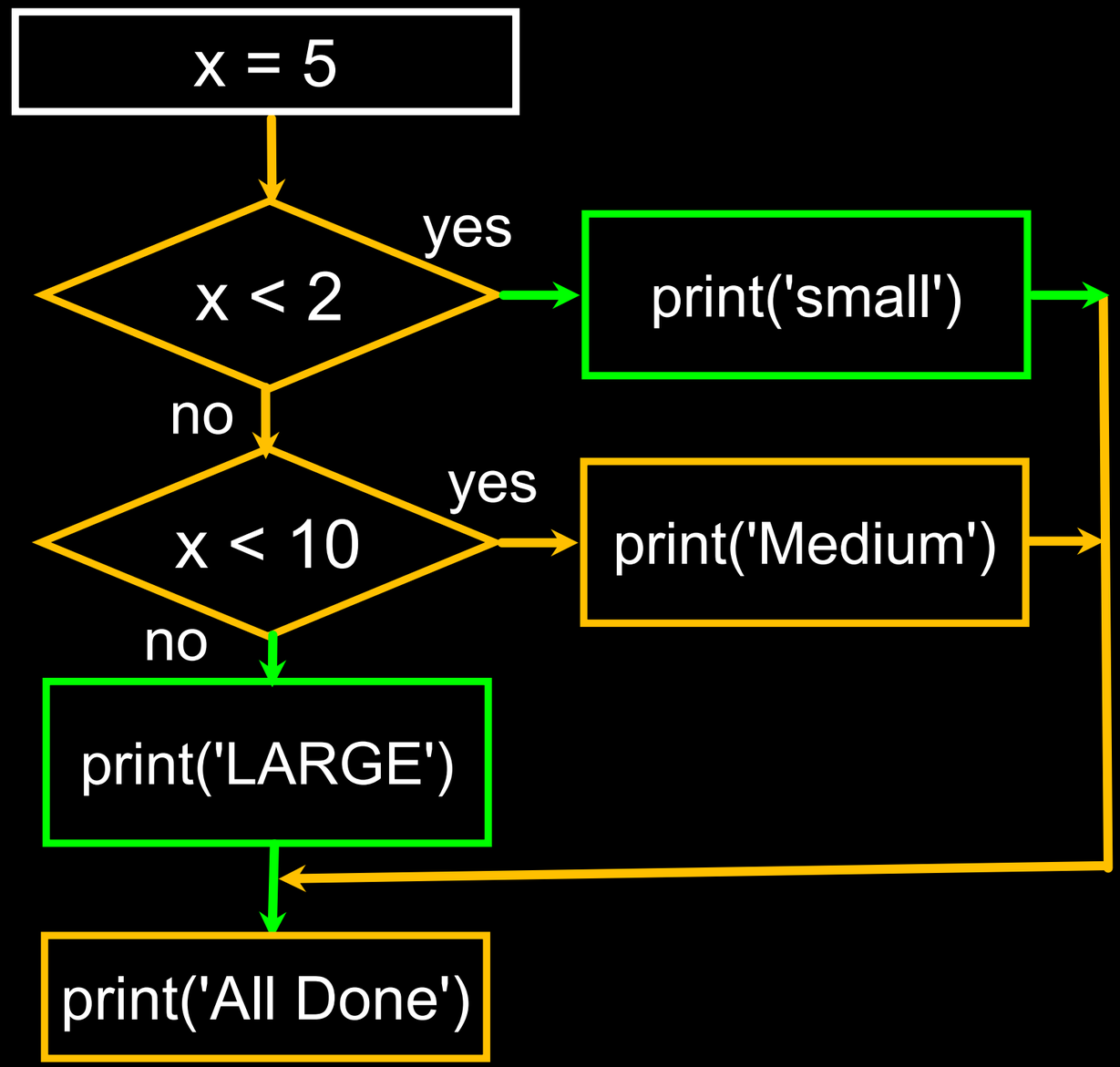
if … elif … else

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



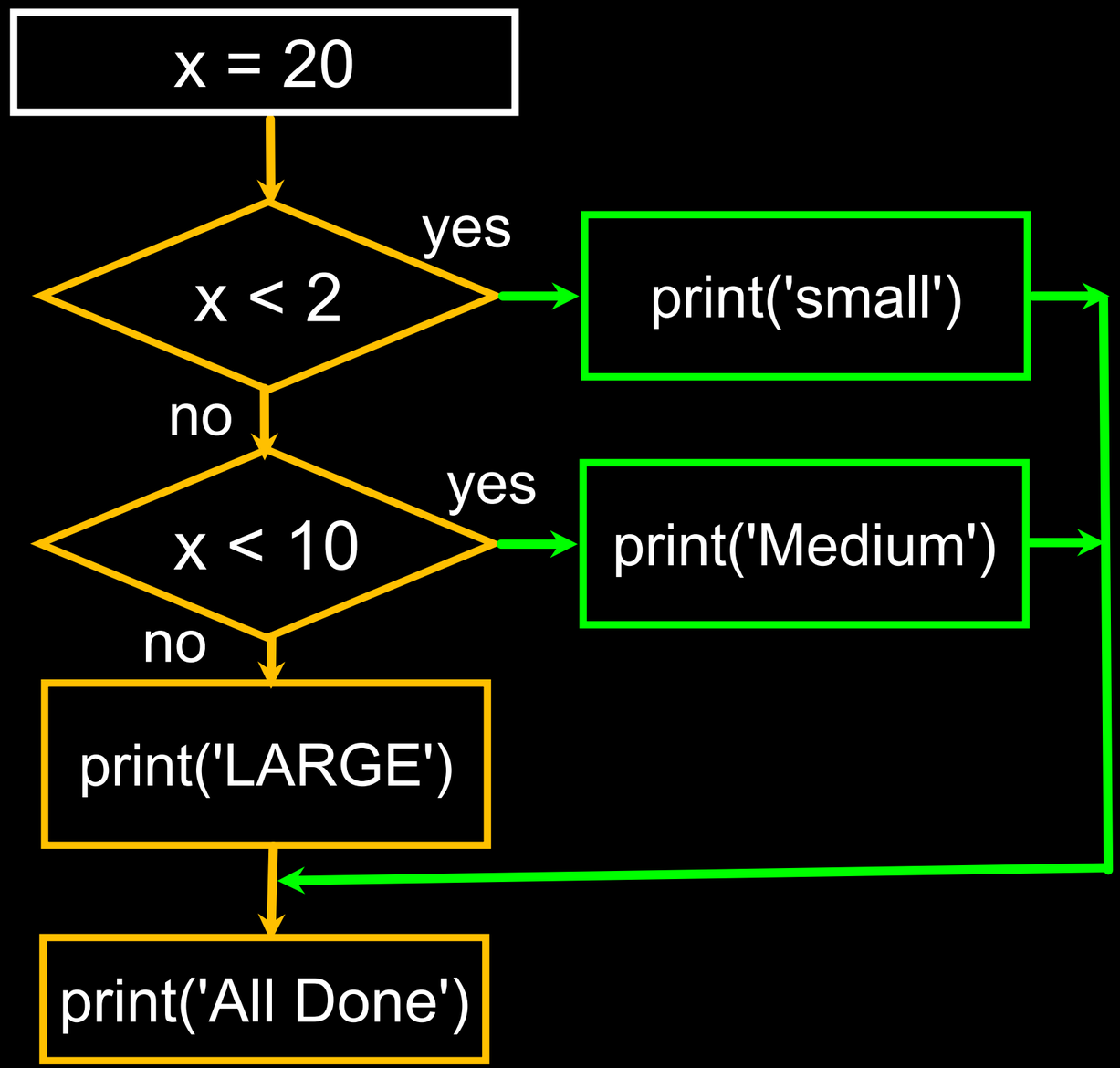
Multi-way

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



Multi-way

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



Multi-way Puzzles

```
if test1:
    block1
elif test2:
    block2
elif test3:
    block3
else:
    block4
```

test1	test2	test3	What applies?
True	True	True	block1
True	True	False	block1
True	False	False	block1
False	True	True	block2
False	False	True	block3
False	False	False	block4

User Input

- We can instruct Python to pause and read data from the user using the input() function
- The input() function returns a string

```
>>>nam = input(‘Type your name: ‘)
>>>print('Welcome', nam)
```

```
Type your name: Lucy
‘Welcome Lucy’
```

Converting User Input

- If we want to read a number from the user, we must convert it from a string to a number using a type conversion function
- Later we will deal with bad input data

```
inp = input('Europe floor?')
usf = int(inp) + 1
print('US floor', usf)
```

Europe floor? 0
US floor 1

Acknowledgements / Contributions

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