Python Programming

Lecture 2 Conditional Execution, Lists

2.1 Boolean Expressions (布尔表达式)

A boolean expression is an expression that is either true or false.

```
print(5==5)
print(5==6)
```

```
True
False
```

Note that here we use a double equal sign ==.

True and False are special values that belong to the class bool, not strings.

```
print(type(True))
print(type(False))
```

```
bool
bool
```

There are other ways of comparison.

```
x != y # x is not equal to y
x > y # x is greater than y
x < y # x is less than y
x >= y # x is greater than or equal to y
x <= y # x is less than or equal to y
```

Logical operators: and, or, not

```
1 print(True and True)
2 print(True and False)
3 print(False and False)
4 print(5 > 3 and 3 > 1)
```

```
True
False
False
True
```

```
1 print(True or True)
2 print(True or False)
3 print(False or False)
4 print(5 > 3 or 1 > 3)
```

```
True
True
False
True
```

```
1 print(not True)
2 print(not False)
3 print(not 1>2)
```

```
False
True
True
```

Any nonzero number is interpreted as "true".

```
1 print(17 and True)
```

```
True
```

Short-circuit evaluation

- Python evaluates the expression from left to right.
- If there are multiple expressions, Python evaluates them one by one.
- If there is nothing to be gained by evaluating the rest of a logical expression, it stops its evaluation.

```
1 x = 6
2 y = 2
3 print(x >= 2 and (x/y) > 2)
```

```
True
```

```
1 x = 1
2 y = 0
3 print(x >= 2 and (x/y) > 2)
```

```
False
```

```
1 x = 6
2 y = 0
3 print(x >= 2 and (x/y) > 2)
```

```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ZeroDivisionError: division by zero
```

- While this may seem like a fine point, the short-circuit behavior leads to a clever technique called the guardian pattern.

```
1 x = 1
2 y = 0
3 print(x >= 2 and y!= 0 and (x/y) > 2)
```

```
False
```

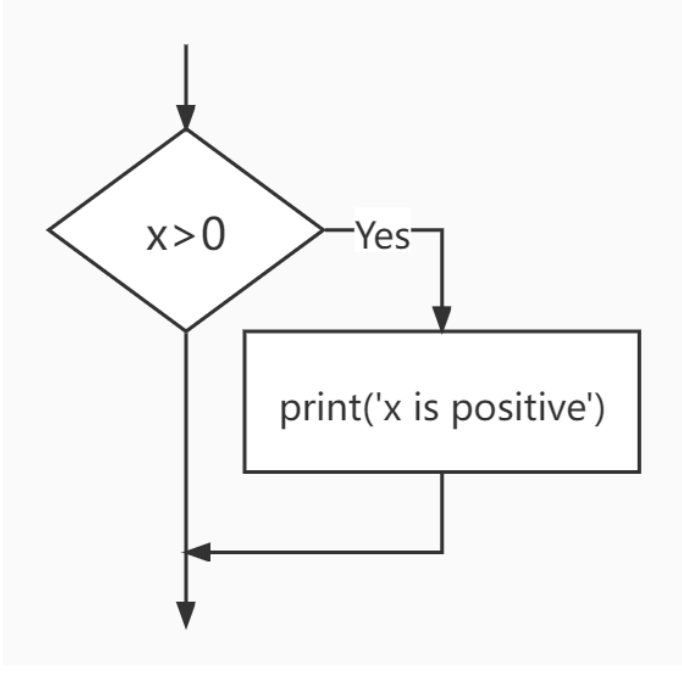
```
1 x = 6
2 y = 0
3 print(x >= 2 and y!= 0 and (x/y) > 2)
4 #y!= 0 acts as a guard.
```

```
False
```

```
1 x = 6
2 y = 0
3 print(x >= 2 and (x/y) > 2 and y != 0)
```

```
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ZeroDivisionError: division by zero
```

2.2 Conditional Execution (条件判断)



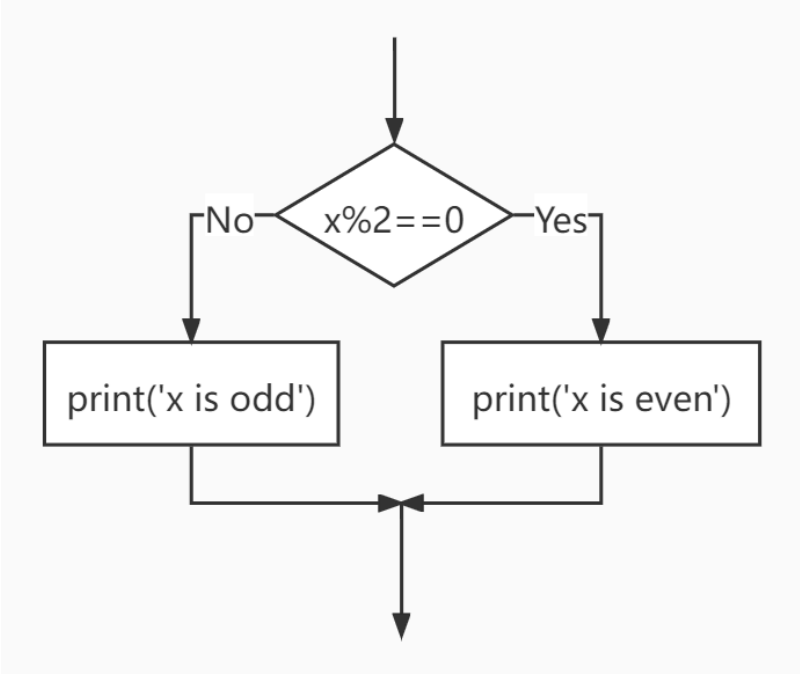

```
1 x = 10
2 if x > 0:
3     print('x is positive')
```

- The boolean expression after the if statement is called the condition.
- We end the if statement with a colon character :
- If the logical condition is true, then the indented statement gets executed.
- The indent is important!

- There is no limit on the number of statements, but there must be at least one.
- If there is no statement, you can use pass statement, which does nothing.

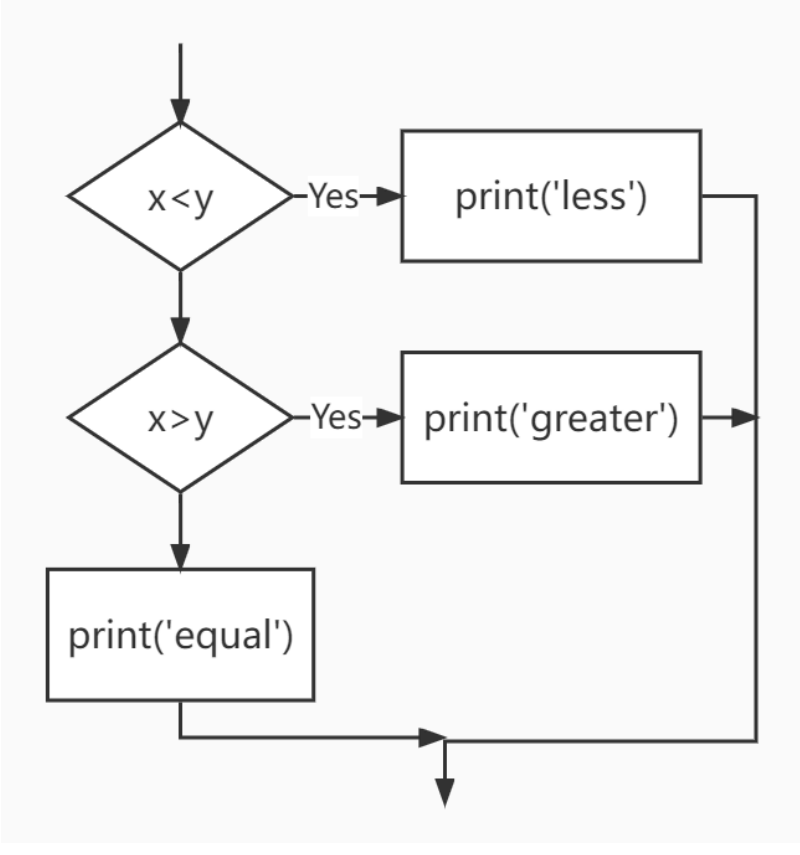
```
1 if x < 0:
2     pass
3 # need to handle negative values!
```

Alternative Execution




```
1 x = 10
2 if x % 2 == 0:
3     print('x is even')
4 else:
5     print('x is odd')
```

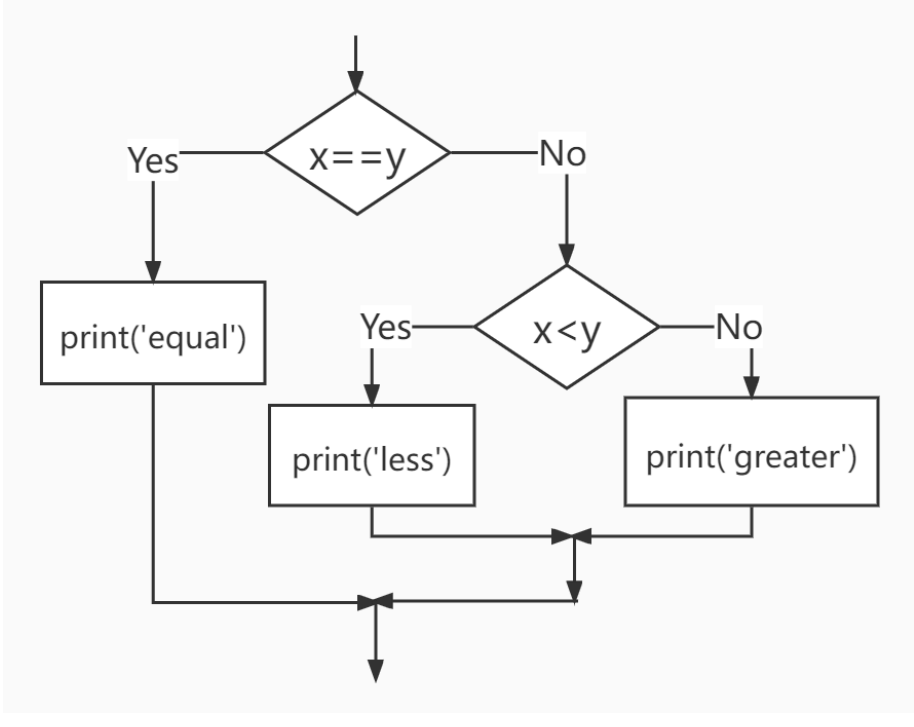
Chained Conditionals




```
x = 5
y = 10
if x < y:
    print('x is less than y')
elif x > y:
    print('x is greater than y')
else:
    print('x and y are equal')
```

- elif is an abbreviation of “else if.”
- No limit on the number of elif statements. If there is an else clause, it has to be at the end, but there does not have to be one.
- Each condition is checked in order. If the first is false, the next is checked. If one of them is true, then it executes, and the statement ends.

Nested Conditionals




```
if x == y:
    print('x and y are equal')
else:
    if x < y:
        print('x is less than y')
    else:
        print('x is greater than y')
```

- Nested conditionals are difficult to read. In general, it is a good idea to avoid them when you can.

Try and Except

```
1 inp = input('Enter Fahrenheit Temperature: ')
2 fahr = float(inp)
3 cel = (fahr - 32.0) * 5.0 / 9.0
4 print(cel)
```

```
Enter Fahrenheit Temperature:72
22.22222222222222

Enter Fahrenheit Temperature:fred
```

```
Traceback (most recent call last):
File "fahren.py", line 2, in <module>
fahr = float(inp)
ValueError: could not convert string to float: 'fred'
```

The idea of try and except is that you know that some sequence of instruction(s) may have a problem and you want to add some statements to be executed if an error occurs. These extra statements (the except block) are ignored if there is no error.

```
inp = input('Enter Fahrenheit Temperature:')
try:
    fahr = float(inp)
    cel = (fahr - 32.0) * 5.0 / 9.0
    print(cel)
except:
    print('Please enter a number')
```

```
Enter Fahrenheit Temperature:72
22.22222222222222

Enter Fahrenheit Temperature:fred
Please enter a number
```

Example 1: BMI Calculator v1.0

```
print("BMI指数计算器\n")
inp_1 = input('请输入您的体重(kg):\n')
inp_2 = input('请输入您的身高(cm):\n')
weight = float(inp_1)
height = float(inp_2)
```

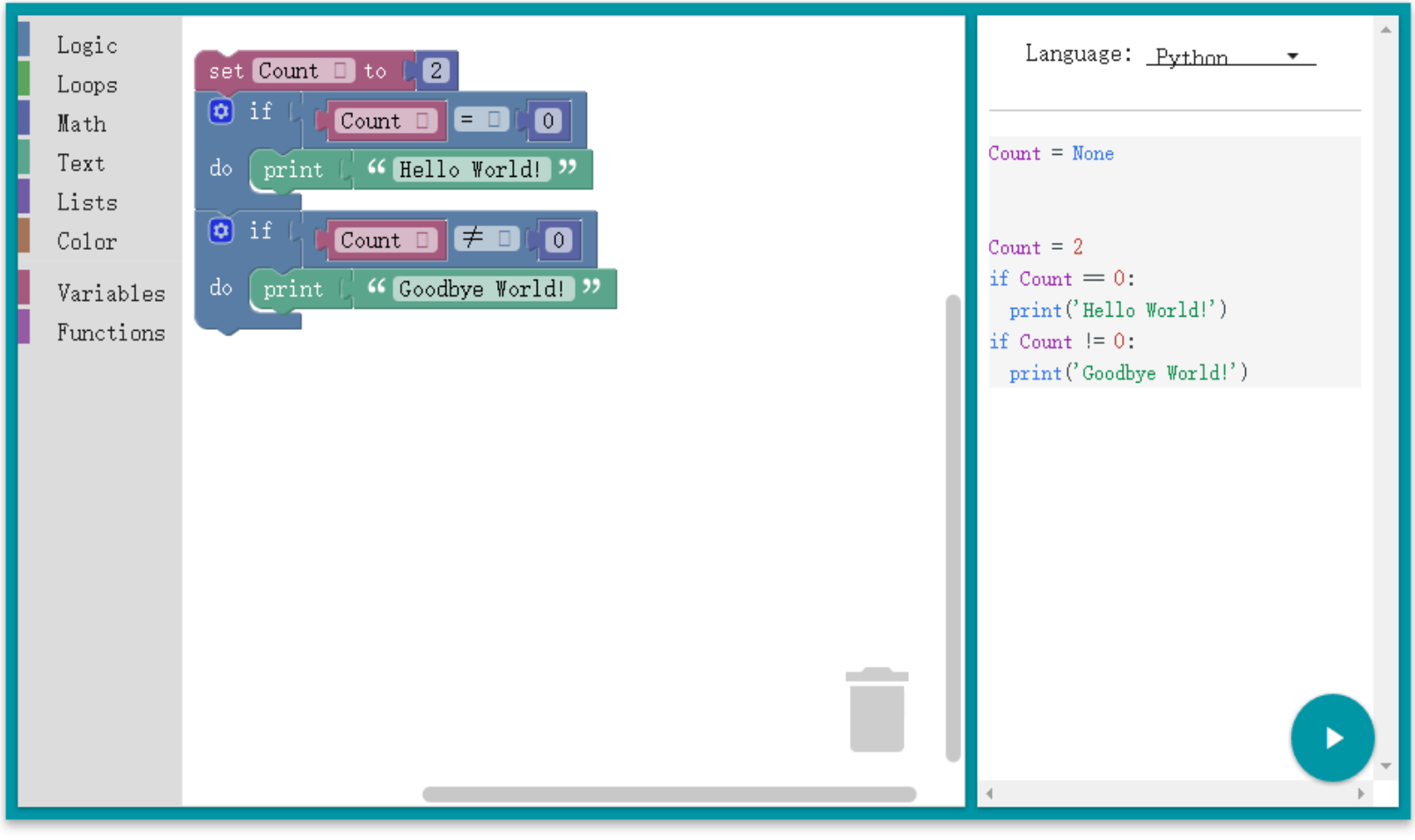
```
BMI = weight/(height/100)**2
if BMI < 18.5:
    print("您的体型偏瘦")
elif BMI < 24 and BMI >= 18.5:
    print("您的体型正常")
elif BMI < 28 and BMI >= 24:
    print("您的体型偏胖")
elif BMI < 32 and BMI >= 28:
    print("您的体型肥胖")
elif BMI >= 32:
    print("您的体型过于肥胖")
```

Example 2: A Simple Game

- What are the key elements of a game?
- Making a choice and feedback.

Visual programming language

- Scratch
- Blockly (Google)



2.3 Lists (1): Basics

- A list (列表) is a sequence of values. A list that contains no elements is called an empty list; you can create one with empty brackets, []. The boolean value of an empty list is false.

```
>>> numbers = [10, 20, 30, 40]
>>> fruit = ['apple', 'banana', 'orange']
>>> mix = ['spam', 2.0, 5, [10, 20]]
>>> empty = []

>>> print(numbers, fruit, empty)
[10, 20, 30, 40] ['apple', 'banana', 'orange'] []
```

- The + operator concatenates lists, and the * operator repeats a list a specified number of times.

```
>>> a = [1, 2, 3]
>>> b = [4, 5, 6]
>>> c = a + b
>>> print(c)
[1, 2, 3, 4, 5, 6]
```

```
>>> [0] * 4
[0, 0, 0, 0]

>>> [1, 2, 3] * 3
[1, 2, 3, 1, 2, 3, 1, 2, 3]
```

- Lists are ordered collections, so you can access any element in a list by telling Python the position, or index, of the item desired. Python considers the first item in a list to be at position 0, not position 1.

```
>>> print(fruit[0])
apple
```

- By asking for the item at index -1, Python always returns the last item in the list:

```
>>> print(fruit[-1])
orange

>>> print(fruit[-2])
banana
```

- You can reassign an item in a list.

```
>>> numbers = [17, 123]
>>> numbers[1] = 5
>>> print(numbers)
[17, 5]
```

List slices（列表切片）

```
>>> t = ['a', 'b', 'c', 'd', 'e', 'f']
>>> t[1:3]
['b', 'c']
```

- The first slice starts at 1, and ends at 2. The slice does not contain the 3rd element.

```
>>> t[:4]
['a', 'b', 'c', 'd']

>>> t[3:]
['d', 'e', 'f']

>>> t[:]
['a', 'b', 'c', 'd', 'e', 'f']
```

```
>>> t = ['a', 'b', 'c', 'd', 'e', 'f']
>>> t[1:3] = ['x', 'y']
>>> print(t)
['a', 'x', 'y', 'd', 'e', 'f']
```

- 编号：从零开始；修改：直接赋值；切片：左闭右开

2.4 Lists (2): Adding and Deleting

- append adds a new element to the end of a list:

```
>>> t = ['a', 'b', 'c']
>>> t.append('d')
>>> print(t)
['a', 'b', 'c', 'd']
```

- extend takes a list as an argument and appends all of the elements:

```
>>> t1 = ['a', 'b', 'c']
>>> t2 = ['d', 'e']
>>> t1.extend(t2)
>>> print(t1)
['a', 'b', 'c', 'd', 'e']
```

- insert adds a new element at any position in your list

```
>>> t = ['a', 'b', 'c']
>>> t.insert(1, 'd')
>>> print(t)
['a', 'd', 'b', 'c']
```

- What is Method? (方法) Is it the same with function? (函数)
- The return value of the above three methods is None. What is None in Python?

```
>>> t = ['a', 'b', 'c']
>>> x = t.insert(1, 'd')
>>> print(t)
['a', 'd', 'b', 'c']

>>> print(t.insert(1, 'd'))
None
>>> print(x)
None
```

- The None keyword is used to define a null value, or no value at all. None is not the same as 0, False, or an empty string. None is a datatype of its own (NoneType) and only None can be None.

Deleting elements

- If you know the index of the element you want, you can use pop.
- pop modifies the list and returns the element that was removed. If you don't provide an index, it deletes and returns the last element.

```
>>> t = ['a', 'b', 'c']
>>> x = t.pop(1)
>>> print(t)
['a', 'c']

>>> print(x)
b
```

```
>>> t = ['a', 'b', 'c']
>>> x = t.pop()
>>> print(t)
['a', 'b']

>>> print(x)
c
```

- If you know the element you want to remove (but not the index), you can use remove

```
>>> t = ['a', 'b', 'c']
>>> t.remove('b')
>>> print(t)
['a', 'c']
```

- There is a possibility that the value appears more than once in the list, but the remove method deletes only the first occurrence.

- del is an operator, not a method. It directly modifies the state of an object by removing it from memory or from a collection.

```
>>> t = ['a', 'b', 'c']
>>> del t[1]
>>> print(t)
['a', 'c']

>>> t = ['a', 'b', 'c', 'd', 'e', 'f']
>>> del t[1:5]
>>> print(t)
['a', 'f']
```

- If you want to modify a list without changing the original, you can create a copy.

```
>>> t1 = ['a', 'b', 'c']
>>> t2 = t1[:]
>>> t1.remove('b')
>>> print(t1)
['a', 'c']

>>> print(t2)
['a', 'b', 'c']
```

2.5 Lists (3): Organizing a list

- sort arranges the elements of the list from low to high. It modifies the list and returns None.

```
>>> t = ['d', 'c', 'e', 'b', 'a']
>>> t.sort()
>>> print(t)
['a', 'b', 'c', 'd', 'e']
```

```
>>> t = ['d', 'c', 'e', 'b', 'a']
>>> t.sort(reverse=True)
>>> print(t)
['e', 'd', 'c', 'b', 'a']
```

- To reverse the original order of a list, you can use the reverse() method.

```
>>> t = ['d', 'c', 'e', 'b', 'a']
>>> t.reverse()
>>> print(t)
['a', 'b', 'e', 'c', 'd']
```

- The reverse() method changes the order of a list permanently, but you can revert to the original order anytime by applying reverse() to the same list a second time.

Some Functions

- To maintain the original order of a list but present it in a sorted order, you can use the sorted() function .

```
>>> t = ['d', 'c', 'e', 'b', 'a']
>>> print(sorted(t))
['a', 'b', 'c', 'd', 'e']

>>> print(t)
['d', 'c', 'e', 'b', 'a']
```

- You can quickly find the length of a list by using the len() function.

```
>>> s = [3, 8, 10, 7]
>>> len(s)
4
>>> min(s)
3
>>> max(s)
10
>>> sum(s)
28
```

```
>>> x = ['banana', 'jack', 'jessica']
>>> min(x)
banana
>>> max(x)
jessica
>>> sum(x)

TypeError: unsupported operand
type(s) for +: 'int' and 'str'
```

Lists: Summary

- The element can be number, string, list, and empty [].
- Features: Ordered, Repeatable
- Operator: + for concatenation and * for repetition.
- The indices start at 0. Index -1 means the last item. (编号：从零开始)
- The item can be changed by reassign a new item. (修改：直接赋值)
- In slicing, the start is inclusive, and the end is exclusive.（切片：左闭右开）
- Methods (方法):
  - append, extend, insert (添加)
  - pop, remove (删除, del)
  - sort, reverse (整理)

  Functions (函数): sorted(), len(), sum(), max(), min()

Summary

- Boolean Expressions
- Conditional Execution
- Lists
  - Reading: Python for every body Chapter 3, 8.1-8.7