程式設計概論
Programming 101
—程式的流程控制與邏輯判斷語法
(Decision structures)

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Outline

- Flowchart
- Four decision structures
  - A single alternative decision structure: one-way conditional statement (單向判斷式)
  - A dual alternative decision structure: two-way conditional statement (雙向判斷式)
  - nested decision structure (巢狀判斷式)
  - if-elif-else statement (多向判斷式)

Goal of flowchart

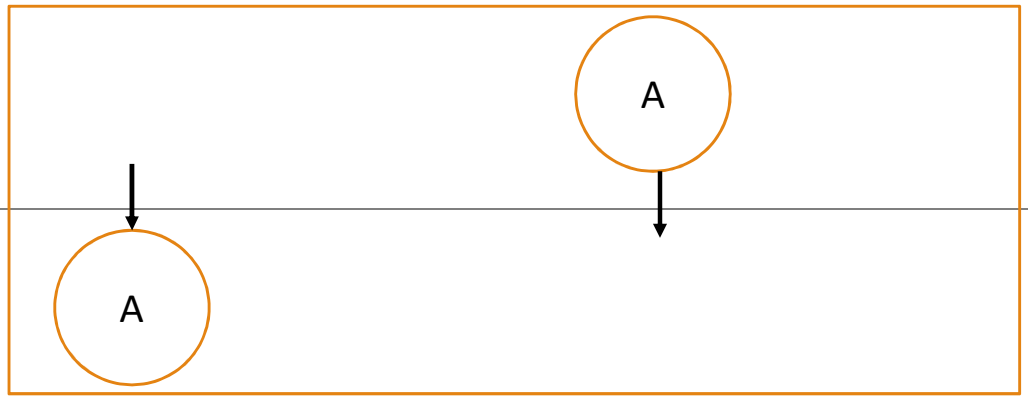
- Summarize the program flow graphically.
- It can be used as a planning tool before programing.
- It can provide an overview of the program process and communicate with others.

flowchart symbol

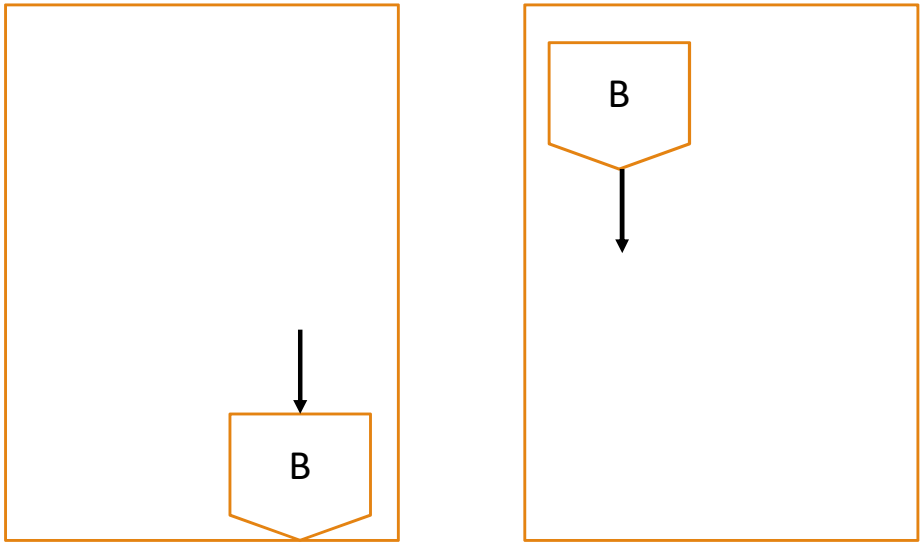
name	symbol	meaning
start or finish		start and finish of a flowchart
process symbol		the direction
program processing symbol		a task to be done
input or output symbol		input or output
decision making symbol		determine the direction based on conditional expression
connection point (same page)		connect the process on the same page
connection point (change page)		connect the process to the next page

Connection point

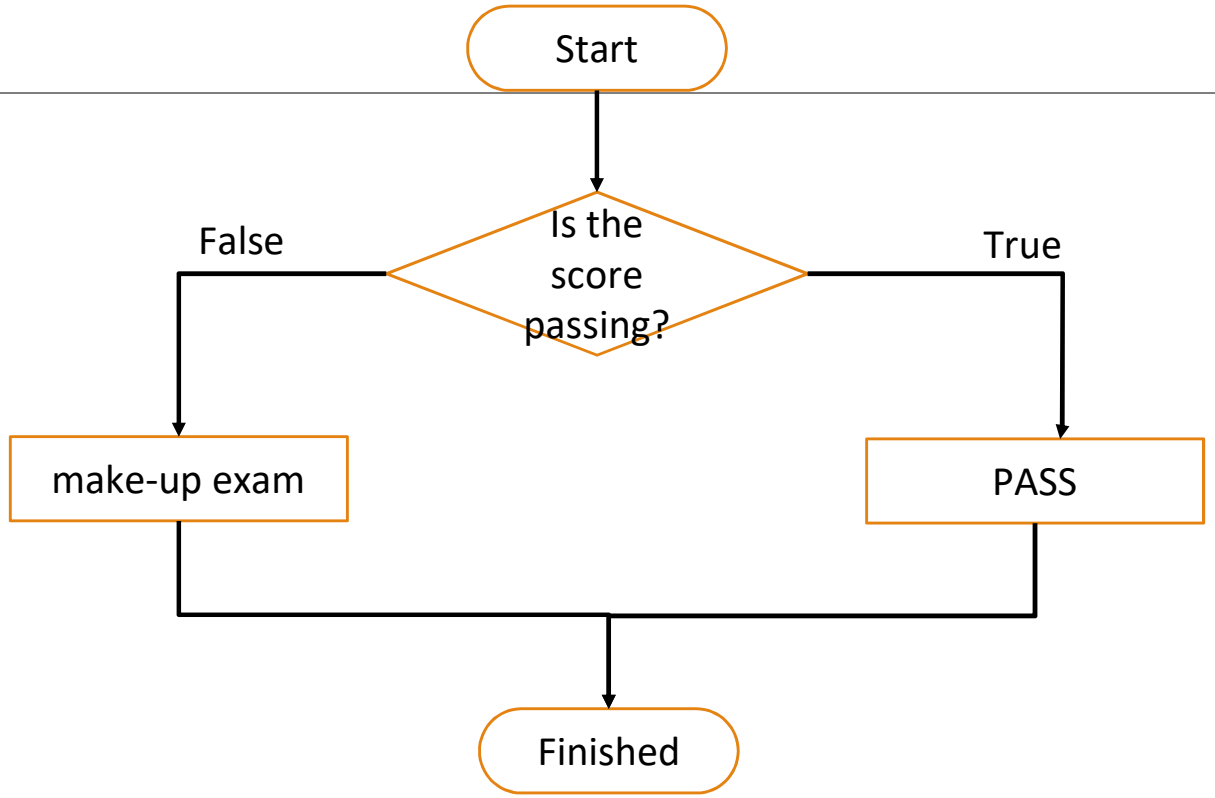
same page



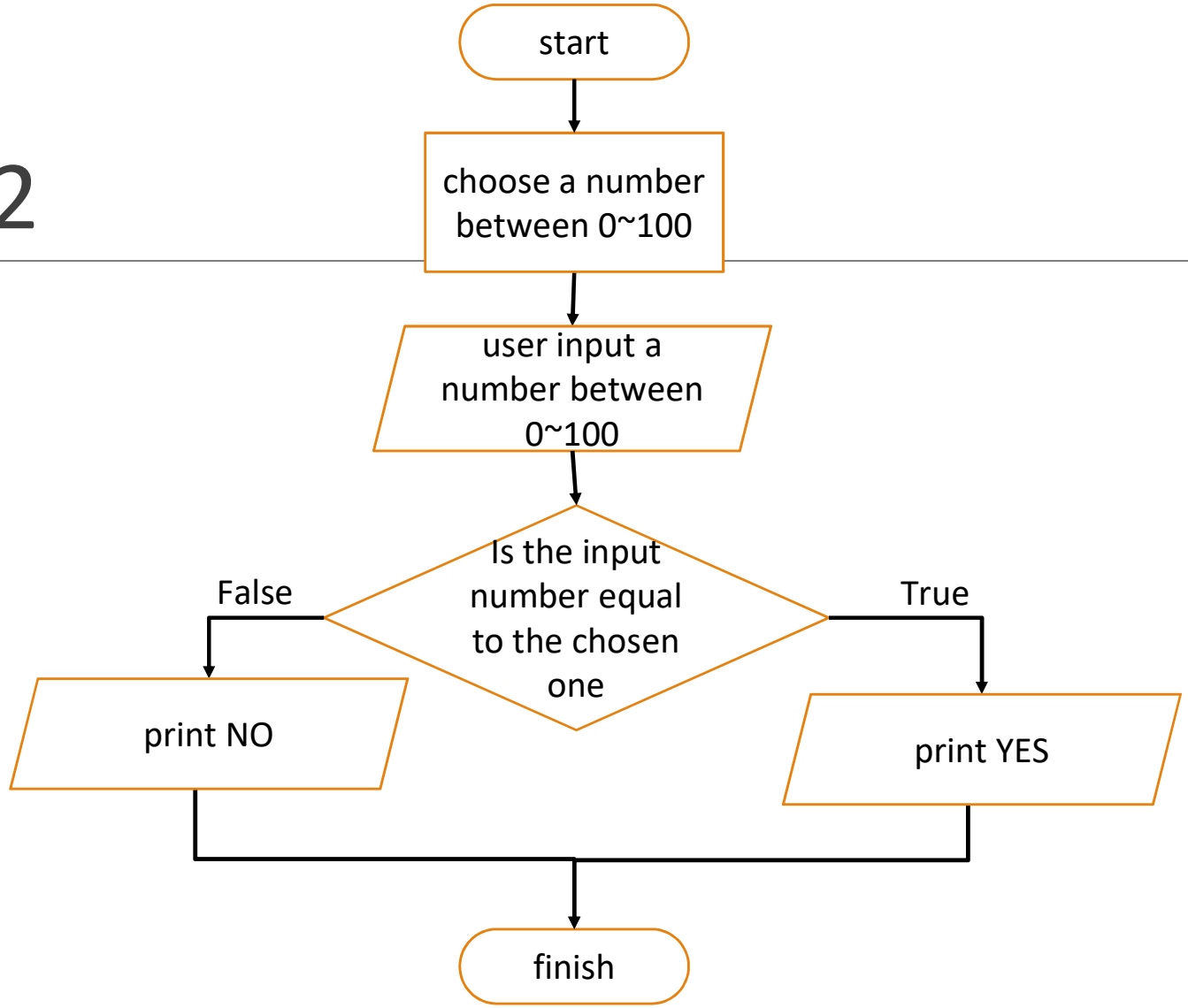
change page



Example 1


Start
Is the score passing?
False
True
make-up exam
PASS
Finished

Example 2

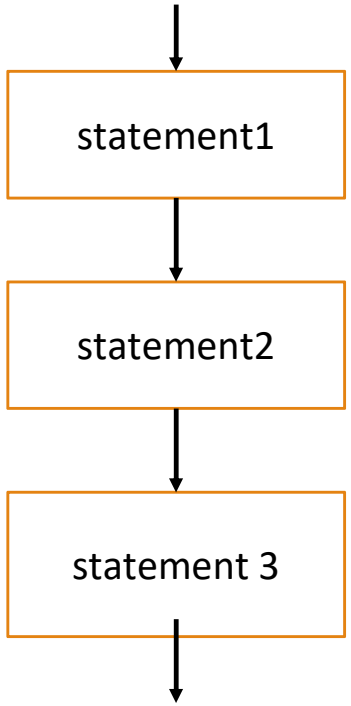

start
choose a number between 0~100
user input a number between 0~100
Is the input number equal to the chosen one
False
True
print NO
print YES
finish

Three basic program structures

1. The sequence structure
2. The decision structure
3. The repetition structure(will talk about it next chapter)

1. The sequence structure

- print(‘Hello World!’)
- a= 128//7
- print(a+3)
- print(‘Hello’+’Everyone’)



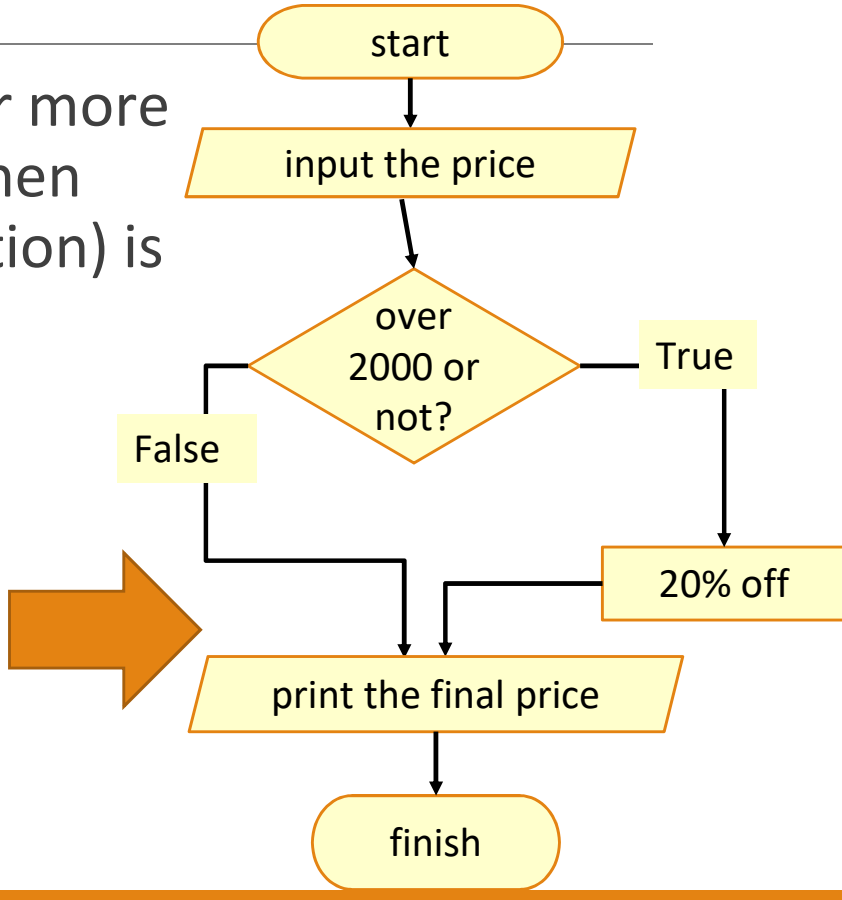
2. The decision structure
--- A single alternative decision structure: if statement

```
if condition:
        statement
        statement
        …
sequence statement
…
```

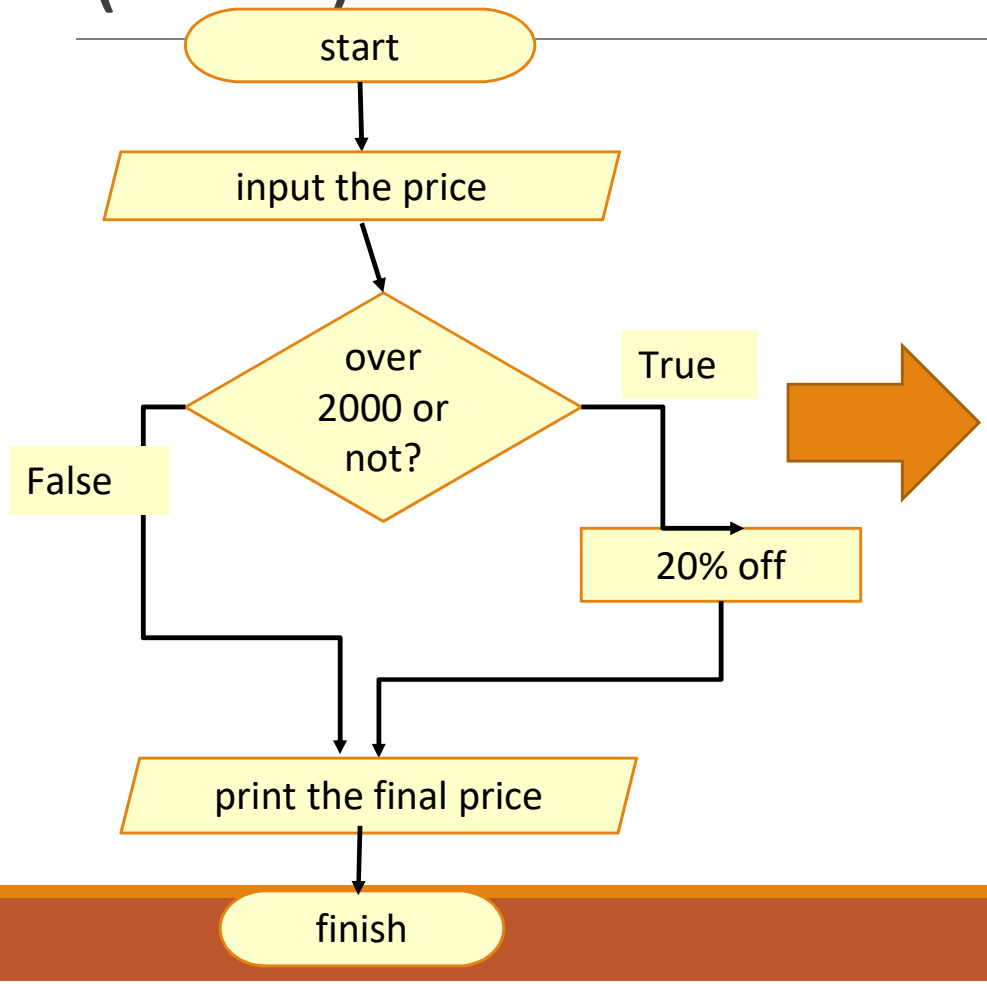
- The if statement causes one or more statements to execute only when the Boolean expression(condition) is True.

Question:

Users input the price and determine whether the price is over 2000. If true, 20% off. Print out the final price.



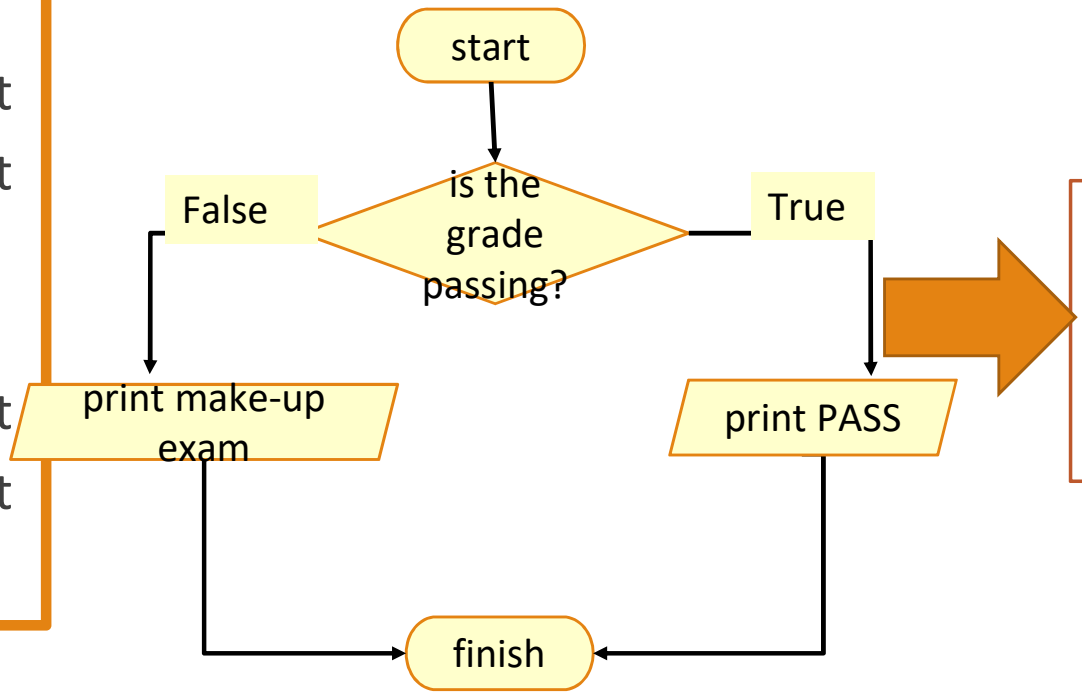
The decision structure
--- A single alternative decision structure (cont.)




```
money = int(input('input price:  '))
if money > 2000:
    print('20%off')   # statement
    money*=0.8      #statement
print("final price{:8.2f}".format(money))
```

A dual alternative decision structure: if-else statement

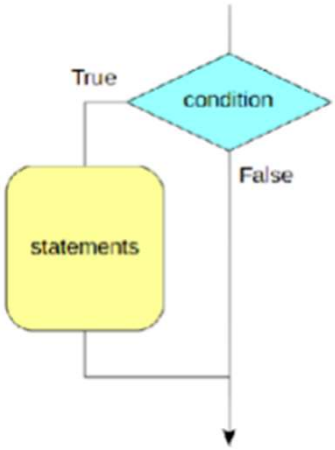
```
if condition:
        statement
        statement
        …
else:
        statement
        statement
        …
```



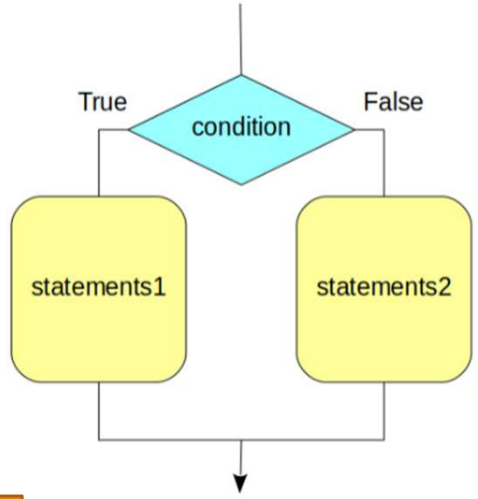

```
grade = float(input('input grade:  '))
if grade >= 60:
    print('PASS')
else:
    print("make-up exam")
```

2. decision structure: if vs if-else

```
if condition:
        statements
```




```
if condition:
        statement1
else:
        statement2
```



either statement1 or statement2

Source: http://yltang.net/tutorial/python/7/

The conditional expression

- 「>=」:conditional operator, determine whether the operation result on the left is greater than or equal to the right.
- conditional operator
  - equal to ：「==」
  - not equal to：「!=」
  - greater than：「>」
  - greater than or equal to：「>=」
  - less than：「<」
  - less than or equal to：「<=」

```
grade = int(input('input grade:  '))
if grade >= 60:
    print('Pass')
else:
    print("Fail")
```

if-else statement practice

- Write a Python program that requires user to input a integer and able to determine whether it is an odd or even number.
- Print ”it is odd” if it is odd, otherwise, print ”it is even”.

Python code

- Write a Python program that requires user to input a integer and able to determine whether it is an odd or even number.
- Print ”it is odd” if it is odd, otherwise, print ”it is even”.

```
x= int(input('input an integer: '))
if x%2==0:
   print('{:d}, it is even.'.format(x))
else:
   print('{:d}, it is odd.'.format(x))
```

=

```
x= eval(input(“input an integer: “))
if x%2==0:
            print(f‘{x}  it is even.’)
else:
            print(f’{x}  it is odd.’)
```

Nested decision structure

```
if <condition1>:
    if <condition2>:
        statement1
    else:
        statement2
else:
    if <condition3>:
        statement3
    else:
        statement4
```

example: find the biggest number

```
a, b, c=3, 5, 7
x=0
if a < b:
    if b < c :
        x = c
    else:   # (b>=c)
        x = b
else:    # (a>=b)
    if a < c :
        x = c
    else:   # (a>=c)
        x = a
print(x)
```

Multiple conditional expression

- and
  - example：「a == b and 5 == c」
- or
  - example：「x != y or z == 3」

Practise

- Write a Python program that requires users to input a number and determine whether it able to divide by 3 and 4. If true, print ”correct”, otherwise, print ”incorrect”.

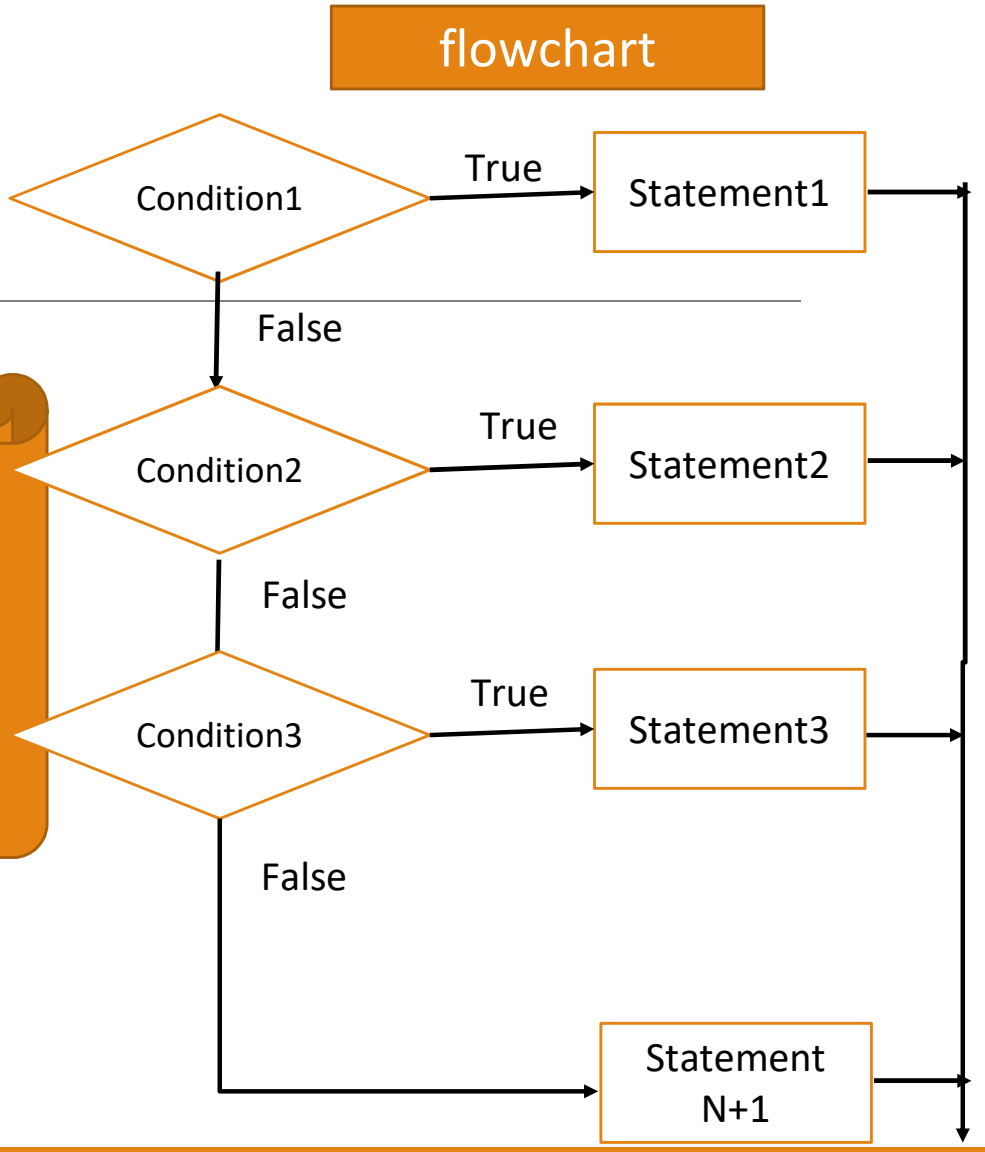
if-elif-else statement

program

```
if <condition1>:
        statement1
elif <condition2>:
        statement2
elif <condition3>:
        statement3
...
else:
        statement
```

elif = else if

1. elif : one, more than one or none.
2. else: one or none.



if-elif-else statement practise

Practice_1

Write a Python program that requires the user to input two numbers (a1 and a2) and compare the two numbers.

Practice_2

Write a Python program that requires the user to input their score(0~100) and divide the score into A, B, C, D, and E based on the following rule:

A:90 or more.

B:89~80.

C:79~70.

D:69~60.

E:59 or less

solve the question using a nested decision structure

- Write a Python program that require a user to input their score(0~100) and divide the score into A, B, C, D, and E based on the following rule:

  A:90 or more.

  B:89~80.

  C:79~70.

  D:69~60.

  E:59 or less

```
score= float(input("input a class score(0-100): "))
if score >=90:
        print('You got A')
else:
    if score >= 80:
            print('You got B')
    else:
            if score >= 70:
                    print('You got C')
            else:
                    if score >= 60:
                            print('You got D')
                    else:
                            print(You got E')
```

Student exercise_3

Question 1: calculates BMI

- Write a Python program that requires user to input height(cm)and weight(kg) and determine the BMI based on the following formula :

  $BMI=weight(kg)/height^2(m^2)$.

  - If less than 18.5 (excluding 18.5), print underweight
  - If between 18.5~24 (excluding 24), print normal
  - If between 24 ~ 27 (excluding 27), print overweight
  - If greater than 27, print obese

Question 2

Write an program that displays 'Speed is normal' if the speed variable is within the range of 24 to 56. If the speed variable’s value is outside this range, display 'Speed is abnormal'.

Question 3

Serendipity Booksellers has a book club that awards points to its customers based on the number of books purchased each month. The points are awarded as follows:

- If a customer purchases 0 books, he or she earns 0 points.
- If a customer purchases 1 book, he or she earns 5 points.
- If a customer purchases 2 books, he or she earns 15 points.
- If a customer purchases 3 books, he or she earns 30 points.
- If a customer purchases 4 or more books, he or she earns 60 points.

Write a program that asks the user to enter the number of books

Review

- Textbook chapter4: 4.1, 4.2, 4.4