

程式設計概論
Programming 101
一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-selection statement: one-way conditional statement (單向判斷式): if statement
 - A double-selection statement: two-way conditional statement (雙向判斷式): if-else statement
 - nested conditional structure (巢狀判斷式): nested if statement
 - multi-way selection statement (多向判斷式): if-elif-else statement

Goal of flowchart

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

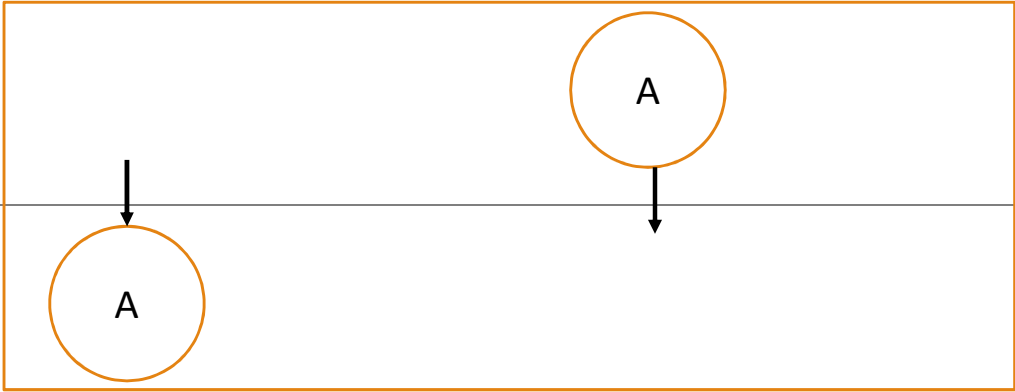
Flowchart symbol



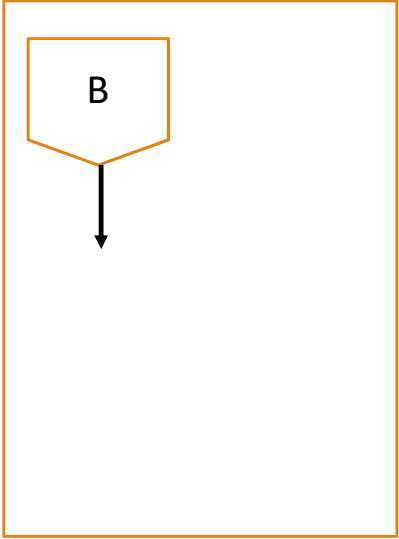
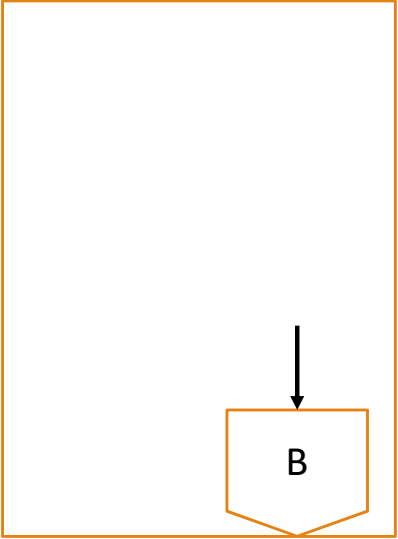
name	symbol	meaning
start or finish		start and finish of a flowchart
process symbol		the direction
program processing symbol		a task to be done
input or output symbol		input or output
decision making symbol		determine the direction based on conditional expression
connection point (same page)		connect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

Connection point

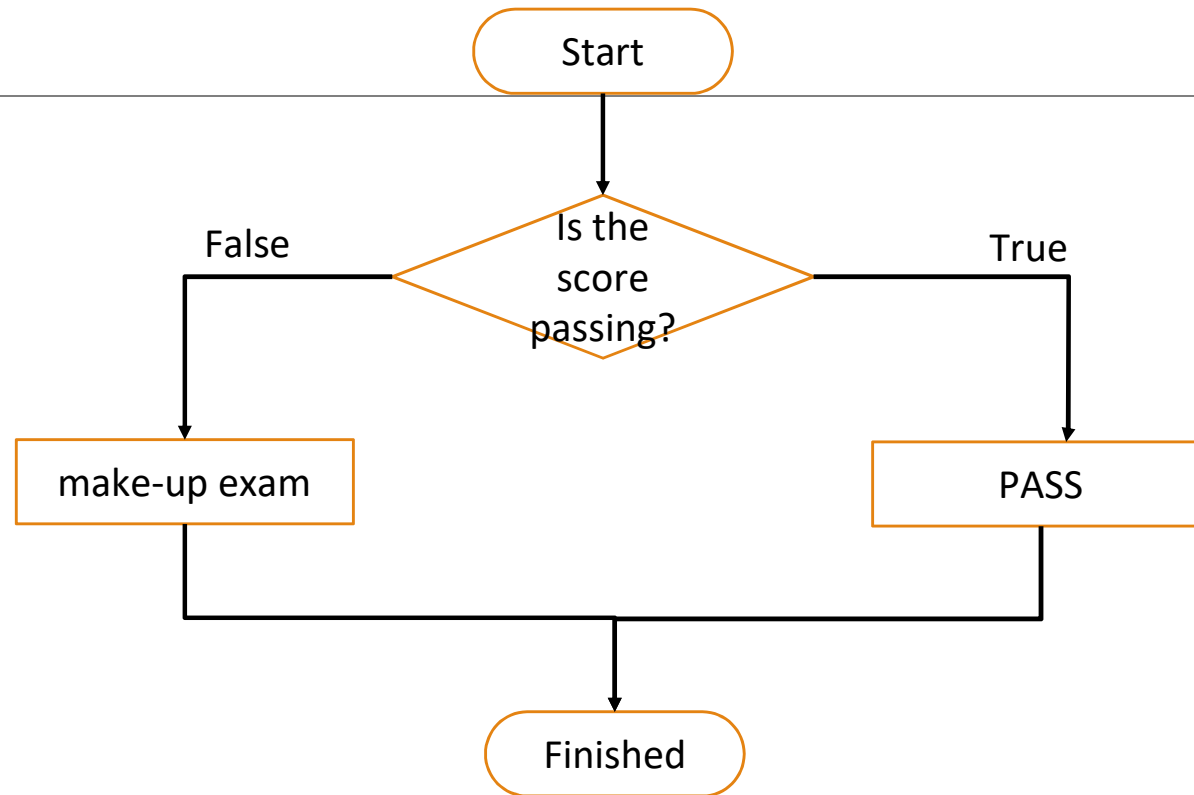
same page



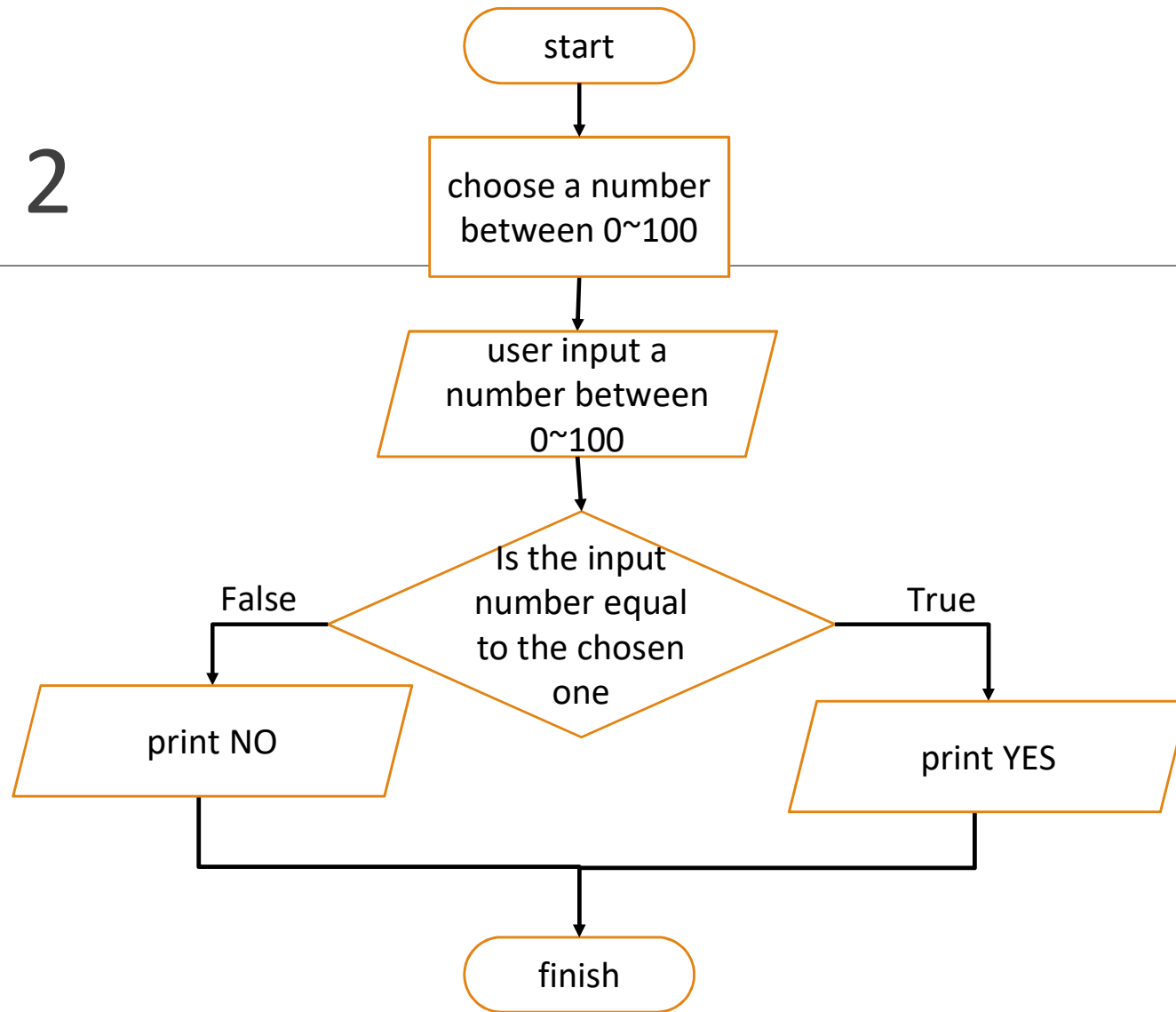
change page



Example 1



Example 2

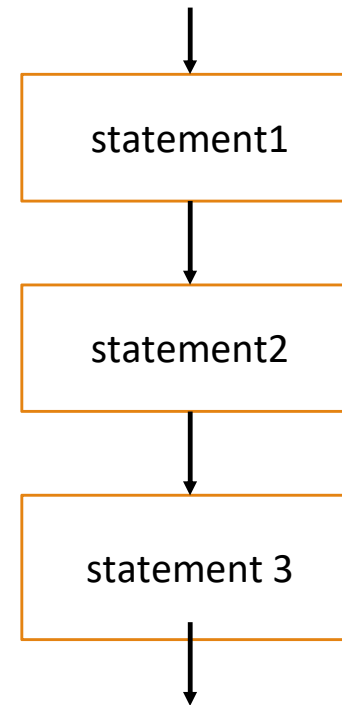


Three basic program structures

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')`



Four decision structures

- A single-selection statement: one-way conditional statement (單向判斷式): if statement
- A double-selection statement: two-way conditional statement (雙向判斷式): if-else statement
- Nested conditional structure (巢狀判斷式): nested if statement
- Multi-way selection statement (多向判斷式): if-elif-else statement

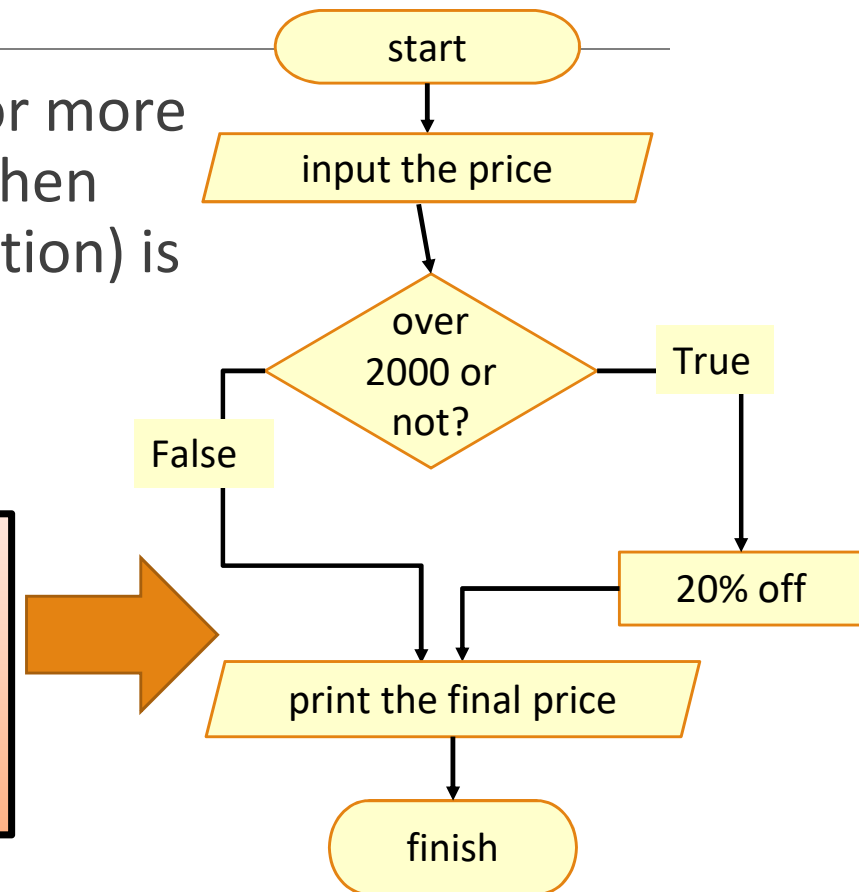
A single-selection statement: if statement

```
if condition:  
    statement  
    statement  
    ...  
sequence statement  
...
```

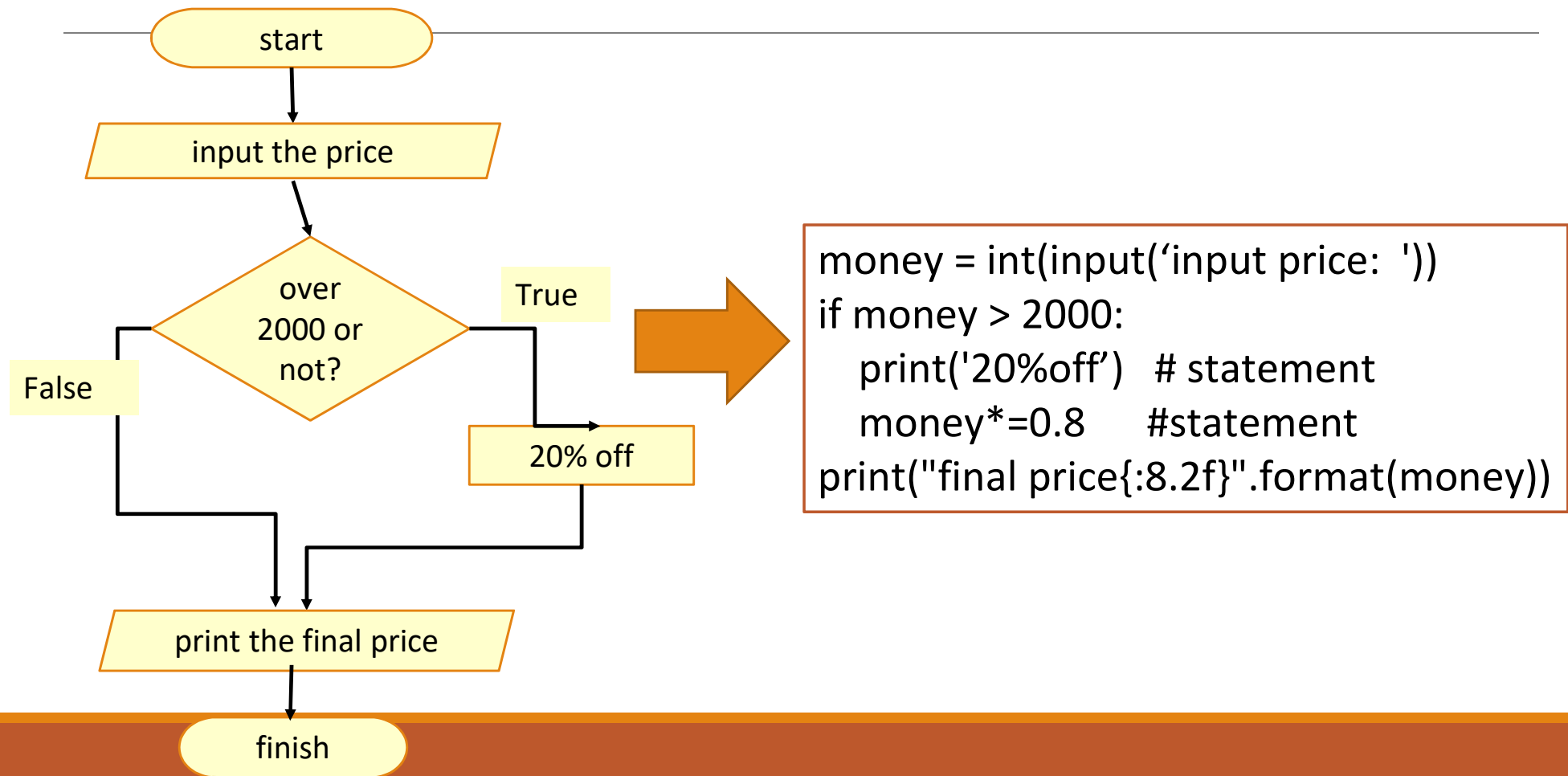
- The if statement causes one or more statements to execute only when the Boolean expression(condition) is True.

Question:

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

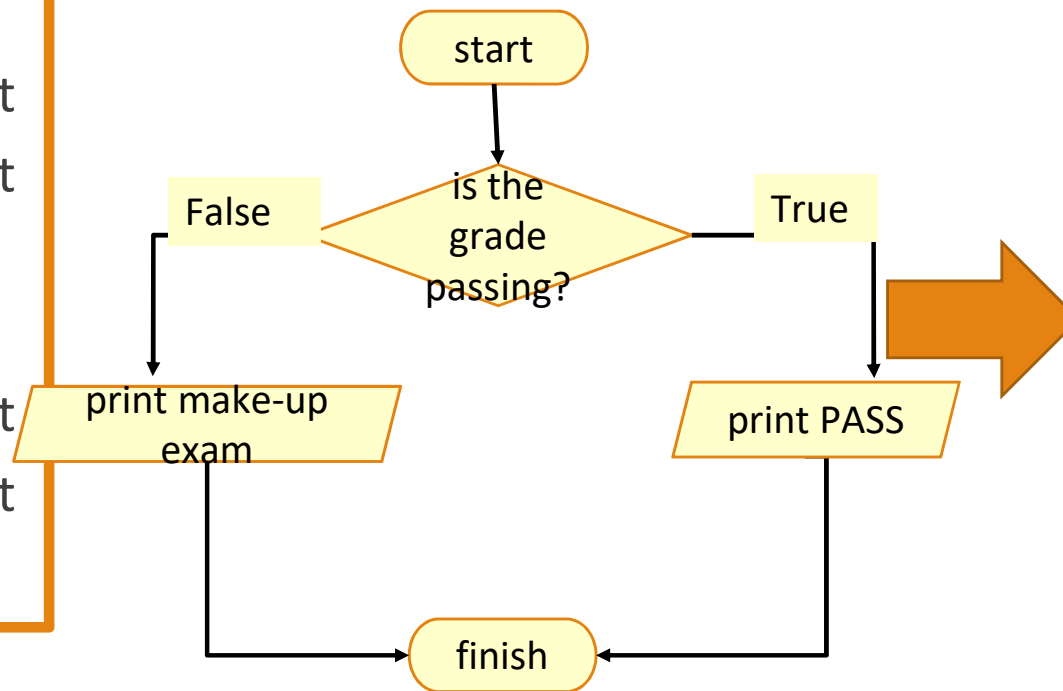


A single-selection statement(cont.)



A double-selection statement: if-else statement

```
if condition:  
    statement  
    statement  
    ...  
else:  
    statement  
    statement  
    ...
```

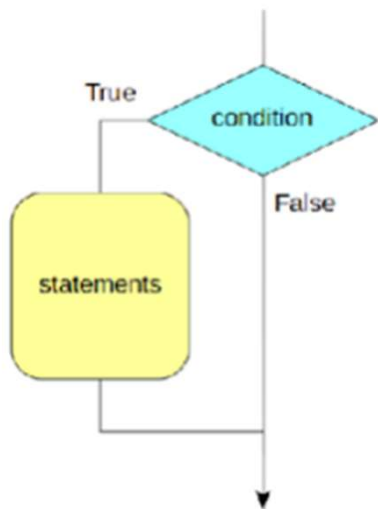


```
grade = float(input('input grade: '))  
if grade >= 60:  
    print('PASS')  
else:  
    print("make-up exam")
```

if vs if-else

if condition:

statements



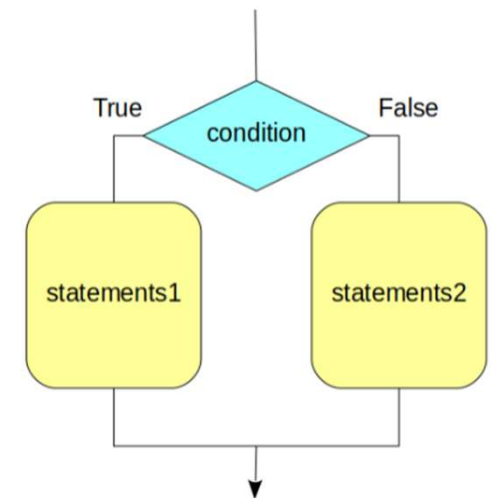
if condition:

statement1

else:

statement2

**either statement1
or statement2**



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 conditional 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 」

Practice

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

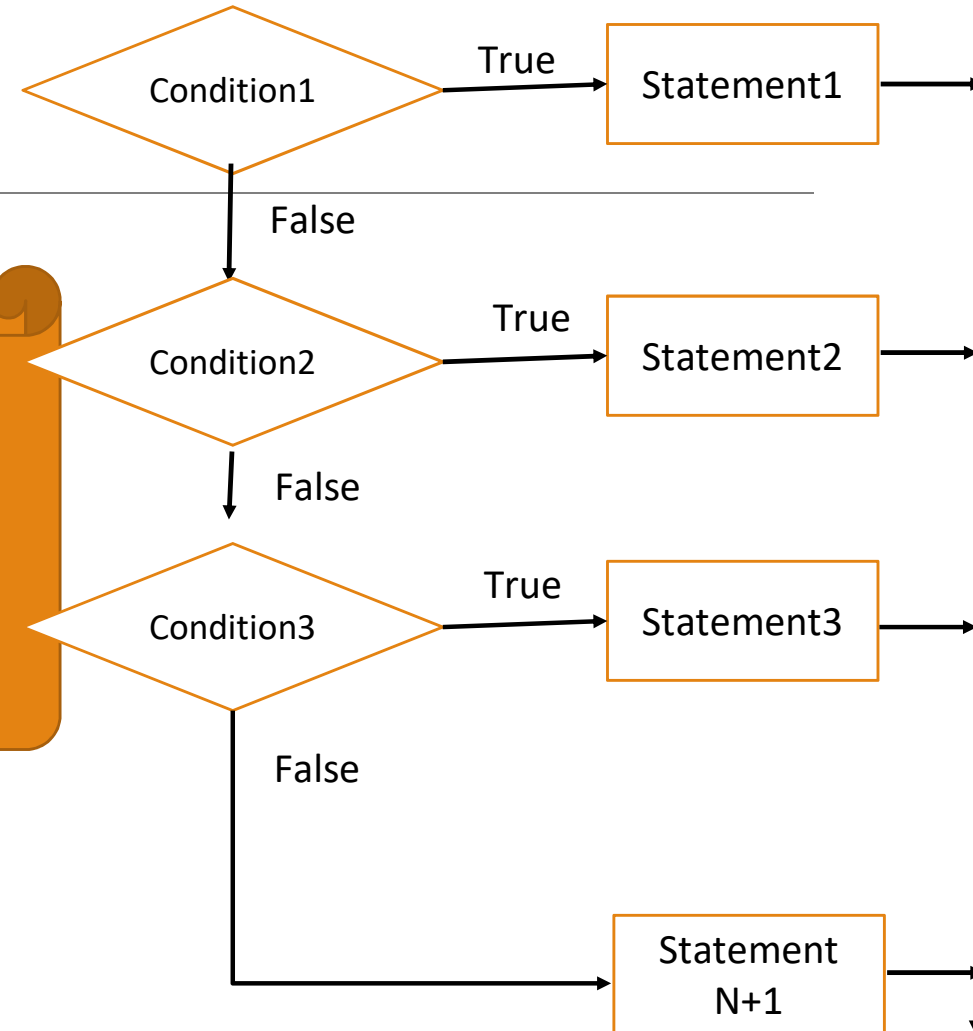
Multi-way selection statement: if-elif-else statement

flowchart

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.



Multi-way selection statement: if-elif-else statement practice

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 conditional 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')
```

Exercise



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 :

$$\text{BMI} = \text{weight}(\text{kg}) / \text{height}^2(\text{m}^2).$$

- 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

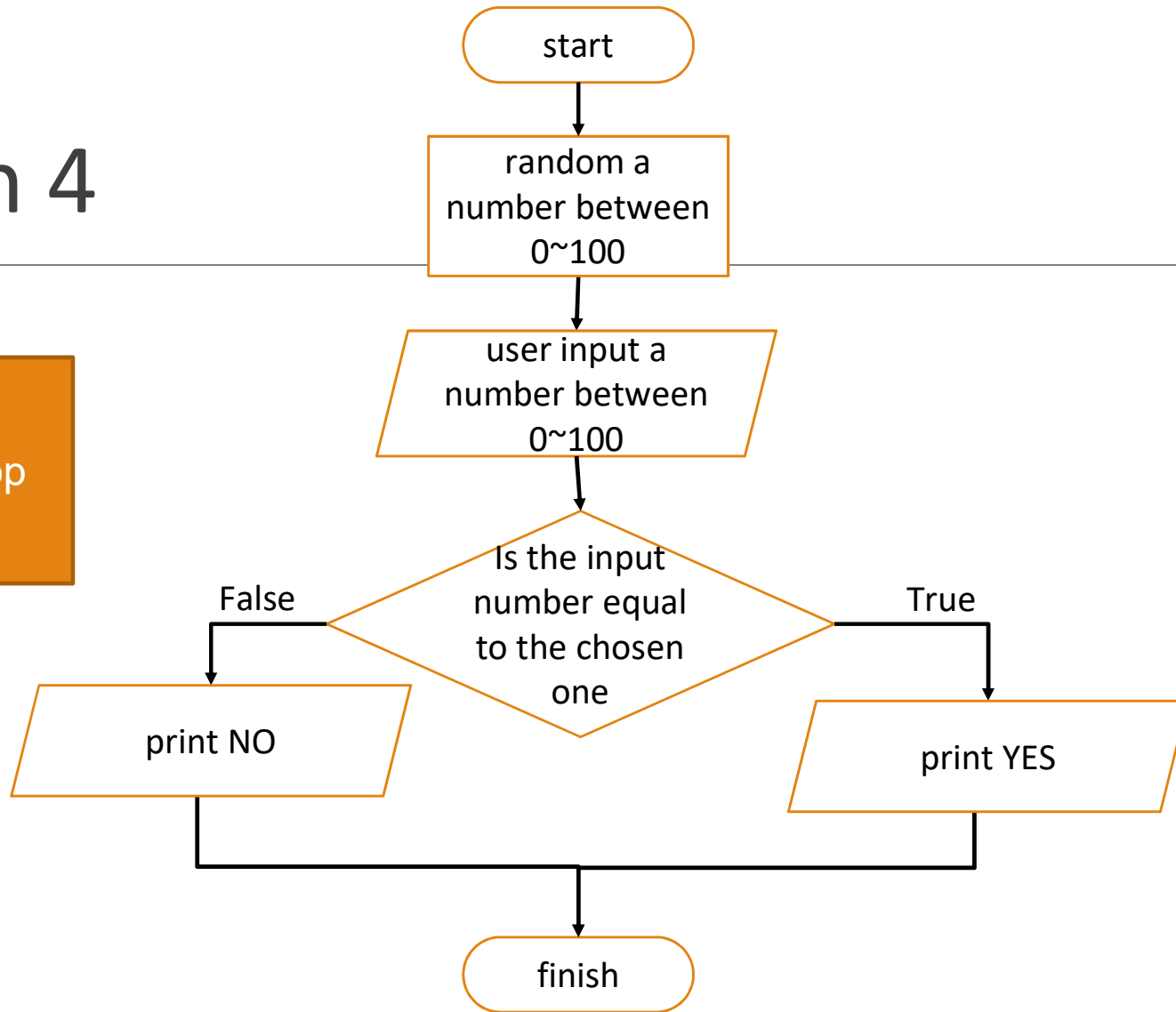
Serendipity Booksellers has a book club that awards points to its customers based on the number of books purchased each month. The points are awarded as follows:

- 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

Question 4

Advance: use loop



Question 5: Shipping Charges

➤ The Fast Freight Shipping Company charges the following rates:

Weight of Package: Rate per Pound

➤ 1. 2 pounds or less: \$1.10

➤ 2. Over 2 pounds but not more than 6 pounds: \$2.20

➤ 3. Over 6 pounds but not more than 10 pounds: \$3.70

➤ 4. Over 10 pounds: \$3.80

Write a program that asks the user to enter the weight of a package and then displays the shipping charges

Review

- Textbook chapter4: 4.1, 4.2, 4.4