# 程式設計概論
# Programming 101

# 一程式數值變數的操作
# (Numerical operations)

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# Outline

1. Types of numerical value
   - int: integer without decimals
   - float: integer containing one or more decimals
   - bool(boolean): False/True
2. Operator precedence
3. How to import modules
   - math module
   - random module
4. The built-in function: type() function

# The arithmetic operations on numbers

- Addition(+)

- Substation(-)

- Multiplication(*)

- Division(/)

- Integer division: divides one number by another and gives the result as an integer, calculate quotient(//)

- Remainder(%)

- Exponent(**): raises a number to a power

# Examples

- print(6+3)
- print(6-2)
- print(6*2)
- print(10/3)
- print(10//3)
- print(10%3)
- print(3**2)
  ➢ float and int operations are the same

# Numerical operations


Operand vs. operator

- Operator(運算子，運算符號)

- Operand(運算元)

- **The order of operations:**
    A. Parentheses (parentheses come in pairs)  **(the highest)**
    B. Exponent (**)
    C. Multiplication(*), division(/), calculate quotient(//),remainder(%)
    D. Addition, substation **(the lowest)**

    For operations with the same priority, operations are performed from left to right.
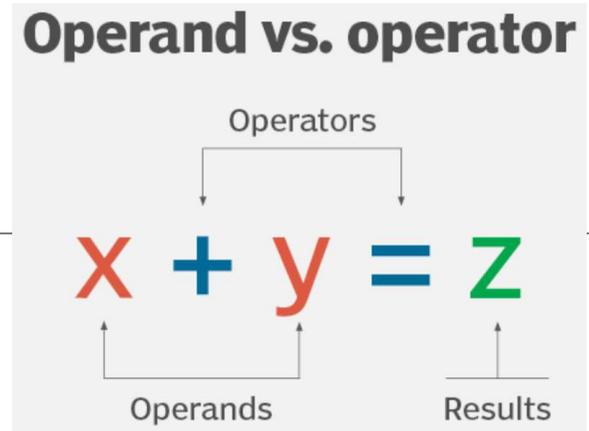
# float

➢ Scientific number with an "e" to indicate the power of 10

```
print(35e3)
print(12E3)
print(-87.7e100)
```

# practise

### basic

- a=3
- print(a+7)
- print(a**2)
- print(100/3)
- print(100//3)
- print(100%3)

### advanced

- x1= 2*(3+4)
- x2= 2**3+4
- x3= 3**2*4
- x4= 2*3/4
- x5 = 2**2**3
- print(x1,x2,x3,x4,x5)

# Built-in function

1. abs(x): Returns the absolute value of x

2. min(x1,x2 [, x3…]): Returns the minimum value in the parameter list
    ◦ min(5,1)
    ◦ min(-1,3,-5,7,10)

3. max(x1,x2 [, x3…]): Returns the maximum value in the parameter list

4. pow(x,y): return the value of x raised to the power of y,  pow(3,4); pow(3,4,5)

\# pow(x,y,z)=pow(x,y) %z

5. int(x): return the integer part of x, discarding the decimal

6. round(x [, precision]): returns a floating point number that is a rounded version of the specified number (x), with the specified number of decimals. Precision: Optional. The number of decimals to use when rounding the number. Default is 0.

# Numeric processing function _math module

➢ Module is some Python files. Example: the math module includes some mathematical constants and mathematical functions.
➢ Such modules need to be imported

**import math (要執行以下函式需先下達該敘述)**

✓ Constants: math.pi, math.e(自然對數的底數e)

math. factorial(n): return n factorial as an integer (ex:5!)

math.gcd(x,y): returns the greatest common divisor of x and y (傳回參數x, y的最大公因數)

math.exp(x): return e raised to the power x (傳回自然對數之底數e的數值的x次方)

math.log10(x): return the base-10 logarithm of *x*.

math.log(x[,base]): return the logarithm of *x* to the given *base* (傳回數值參數x的自然對數值，預設的底數是e，base可以設定底數)，ex: math.log(2,2)

math.sqrt(x): return the square root of *x*

# Practice

1. Find the maximum value from 0, 98, 29, -56, 38, 27.

2. Find the minimum value from 0, 98, 29, -56, 38, 27.

3. Find the area of a circle with a radius of 10 using the pi defined by math.pi.

4. The value of $\sqrt{7}$

5. The greatest common factor of 616 and 1331.

6. Given that x=log2, y=log3, please calculate $10^{2x+3y+1}$ and print the result. Round the answer to an integer.

# Compound operator (複合運算子)

| Operator | Expression | meaning |
|---|---|---|
| = | a=b | The b value is assigned to the a variable (將b值指派給a變數, a變數的值設定為b) |
| += | a += b | a = a + b |
| -= | a -= b | a = a – b |
| *= | a *= b | a = a * b |
| /= | a /= b | a = a / b |
| //= | a //= b | a = a // b |
| %= | a %= b | a = a % b |
| **= | a **= b | a = a ** b |

# Boolean

# Boolean value(布林值)

- Boolean for conditions
  - Boolean type: **True/ False**
  - Comparison operator(比較運算子)
    - Equal: x == y (x等於y)
    - Not equal: x != y (x不等於y)
    - Greater than: x > y (x大於y)
    - Greater than or equal to: x >= y (x大於等於y)
    - Less than: x < y (x小於y)
    - Less than or equal to: x <= y (x小於等於y)

'=' 表示指派指令(右邊值給左邊的變數)
'==' 表示判斷兩邊是否相等或一致

Example code

- 5==5
- 5 !=2+4
- a=8
- a>=7+3
- a < 7+3

# Example

num1=34   #int

num2=67.5  # float

flag=True

num3=34.0

num4=9+True

# Multiple conditions

- Logical operator: and, or, not

| A | B | A and B | A or B |
|---|---|---------|--------|
| True | True | True | True |
| True | False | False | True |
| False | True | False | True |
| False | False | False | False |

Truth table

A and B respectively represent a condition

| A | not A |
|---|-------|
| True | False |
| False | True |

# Boolean practics

- Use print() function to show True/False
  - x = 7
  - y = 8
  - 0<x and x<10
  - 0<x <10
  - not(y<6)
  - x%2==0 or y%3==0
  - not (x%2==0 and y%3==0)
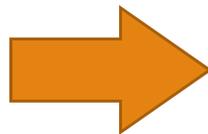
```
x = 7
y=8
print(0<x and x<10)
print(0<x <10)
print(not(y<6))
print(x%2==0 or y%3==0)
print(not (x%2==0 and y%3==0))
```

# The priority level of Boolean + Numeric

| Priority (由高至低) | meaning | Operators |
|---|---|---|
| 8 (the highest) | Parentheses | ( ) |
| 7 | Exponent | ** |
| 6 | Multiplication, division | *, /, //(quotient), %(remainder) |
| 5 | Addition, substation | +, - |
| 4 | Comparison | ==, !=, <, >, <=, >= |
| 3 | logic | not |
| 2 | logic | and |
| 1 (the lowest) | logic | or |

- Example code
  - x=3
  - y=10
    - print(10<x*5 and y-6<2)
      - # 1. compute x*5, y-6
      - # 2. relation 10<15, 4<2
      - # 3. logical  True and False
      - # Finally, result: False

# The functions of the random module

import random

random.randint(x,y): returns a random number between the given range (傳回數值x,y之間的數值包含x,y)

random.random(): returns a random float number between 0 and 1

x = [1,2,6,4,8, 13] # list is a sequence

random.shuffle(x)   # Takes a sequence (x) and returns the sequence in a random order (將變數x中的元素隨機重排後再把結果給x)

print(x)

print(random.choice(x)): return a random element from the given sequence(x)  (將變數x中的元素隨機選出一個)

# type() function

➢ type(x): What data type is x?

➢ Example:
  ➢ a1=10
  ➢ a2=20.55
  ➢ a3= a1+a2
  ➢ print(type(a1))
  ➢ print(type(a2))
  ➢ print(type(a3))

# References

# keyword

| False | await | else | import | pass |
|-------|-------|------|--------|------|
| None | break | except | in | raise |
| True | class | finally | is | return |
| and | continue | for | lambda | try |
| as | def | from | nonlocal | while |
| assert | del | global | not | with |
| async | elif | if | or | yield |

**Uppercase and lowercase characters are different.**

# built-in function

內建函式

**A**
abs()
aiter()
all()
any()
anext()
ascii()

**B**
bin()
bool()
breakpoint()
bytearray()
bytes()

**C**
callable()
chr()
classmethod()
compile()
complex()

**D**
delattr()
dict()
dir()
divmod()

**E**
enumerate()
eval()
exec()

**F**
filter()
float()
format()
frozenset()

**G**
getattr()
globals()

**H**
hasattr()
hash()
help()
hex()

**I**
id()
input()
int()
isinstance()
issubclass()
iter()

**L**
len()
list()
locals()

**M**
map()
max()
memoryview()
min()

**N**
next()

**O**
object()
oct()
open()
ord()

**P**
pow()
print()
property()

**R**
range()
repr()
reversed()
round()

**S**
set()
setattr()
slice()
sorted()
staticmethod()
str()
sum()
super()

**T**
tuple()
type()

**V**
vars()

**Z**
zip()

**_**
__import__()

# Exercise 1

# Questions

Q1. i=12, j=3, print result False/True
◦ (1) 10<i*2 or j-6<2**(-1)
◦ (2) 1<i%5 and i//4<j
◦ (3)  not i//7>j and i%2==0

Q2. Python to design a program with 4 students and 25 apples, distributing the apples evenly among the students. Each student should receive the maximum number of apples, and the apple count per student must be equal. Print "the number of apples each student receives XX apples and the number of remaining YY apples".

Q3. A company has determined that its annual profit is typically 23 percent of total sales. Write a program that the projected amount of total sales is 5000, and then display the profit that will be made from that amount.

# Qustions(cont.)

Q4. Define x1="python programming" (course name), x2=2025(year), x3=1900.98765 (amount of consumption),  data type: x1 is string, x2 is int, x3 is float
Print:

(1) "You expenditure amount to ? NTD"(? Is x3, display up to four decimal places and round the number)

(2) "You're taking ?? course in ???."(?? is x1, ??? is x2)

(3) "You purchased goods worth ? dollars"(? is x3, display up to two decimal places and round the number)

# Review

Chapter 2: 2.7 (number) and Chapter 4: 4.5, 4.6 (Boolean)