Review Slides

COMP1021 midterm

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Note

- These slides covers important concepts in COMP1021
  - Common functions, Loop, Sequences, …
- These concepts are essential to midterm/exam
  - But only knowing these concepts is not sufficient
  - Practice: learn how to analyze problems
- These concepts are not complete
  - Feel free to add more as needed

If you find anything should be improved, please let me know!

I will acknowledge your contributions!

Basic concept

- Python – interpreted: each line of code is executed one by one
- In python, the index always starts from 0!
    - Not 1!

- Indentation (spaces before each line) is extremely important!

Input and Output

- `var = input("give me an input")`
  - note: `var` is always a string, not int/float
  - use `int(var)` as needed
- `print("Today it is windy!")`
- `print("Today it is windy!", var)`
  - Print strings and variables
- `print("Today it is windy!", end="??")`
  - `end` is used to control the ending after string.

Common functions

- `import random`
- `random.randint(1,10)`
  - `1 and 10 are inclusively`

Turtle – basic concepts

- `import turtle`
- Three key elements:
  - Position, default is origin point (0,0)
  - Orientation: default is right
  - Pen: can be lifted up or put down: default is down; has color and thickness
- `turtle.done()`
- `turtle.setup(width, height)`

Turtle – pen

- Pen has color and thickness
  - `turtle.width(width), turtle.color("red")`
- Pen can be lifted or put down; **nothing** is drawing after `up()`
  - `turtle.up() and turtle.down()`
  - `Does not affect turtle.dot()`
- `Color:`
  - Pen color: `turtle.color("red")`
  - Fill color: `turtle.fillcolor("red")`
  - Both: `turtle.color("red", "green")=>` Pen: `red;` fill: `green`
- `turtle.speed(speed):`
  - `1 is slow, 10 is fast, 0 is fastest`

Turtle – movement

- `turtle.forward(distance)`
- `turtle.backward(distance)`
  - Orientation is not changed when moving forwards/backwards!
  - Example of `distance: 100`
- `turtle.right(degree)`
- `turtle.left(degree)`
  - Change orientation of turtle
  - Example of `degree: 45/90/180/360`
- `turtle.goto(x, y)`
  - `x` and `y` are locations
  - `x` is horizontal, and `y` is vertical.

Turtle – drawing shapes

```
turtle.begin_fill()
xxxxx (code for drawing)
turtle.end_fill()
```

- `turtle.circle(radius)`
  - Center is radius pixel left of the turtle
  - counterclockwise if `radius>0`
- `turtle.circle(radius, degree)`
  - `Degree = 180` means half circle
- `turtle.clear():` clear the screen

Turtle – other

- `turtle.hideturtle()`
- `turtle.write(string)`
  - Cannot be int
- `turtle.write(string, font=("Arial", 20, "bold"))`
  - Write with specific font
- `turtle.dot(size)`
  - `Not affected by turtle.up() or down()`

Decision

```
if a >= b:
    print()
```

```
if a >= b:
    print()
elif b>=c:
    print()
else:
    print()
```

```
Common operators:
>=, <=, >, <, ==, !=
and, not, or
```

Be careful!

- **indentation** is critical!
- **Colon** is necessary!
- if can be **nested**!

```
if 5%3:
    do_something if 5%3 != 0
```

Loops: while and for

```
while a < b:
    do_something()
```

Do something as long as a<b is true

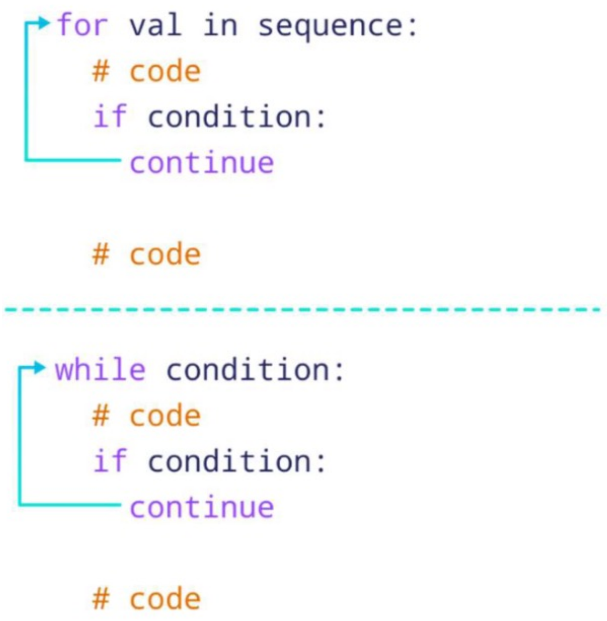
```
for item in list:
    do_something()
```

Do something for each item

```
for item in range(1,4):
    do_something()
```

Loops -- control loops

In nested loop, break/continue only works on the loop where they are

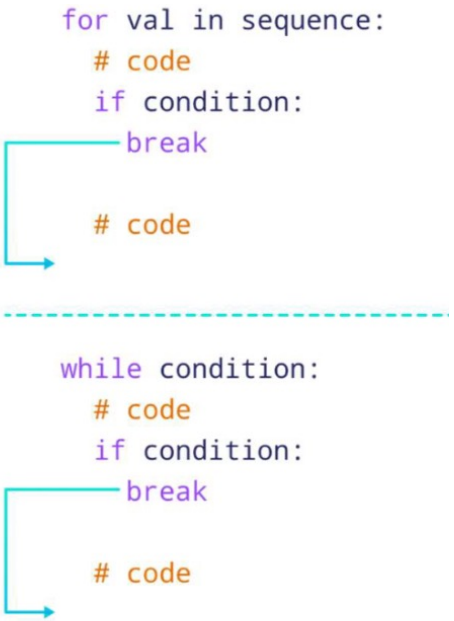


```
for val in sequence:
    # code
    if condition:
        continue

    # code
```

```
while condition:
    # code
    if condition:
        continue

    # code
```



```
for val in sequence:
    # code
    if condition:
        break

    # code
```

```
while condition:
    # code
    if condition:
        break

    # code
```

`continue`: skip current iteration and start the next iteration.

`break`: stop entire loop and jump out of the loop `end` **will never be generated!**

`range(start, end, step)`

- `range(1, 6)`
  - `1,2,3,4,5`
- `range(1, 6, 2)`
  - `1,3,5`
- `range(6, 1, -1)`
  - `6,5,4,3,2`

```
for x in range(1, 6)
    print(x)
```

```
for _ in range(1, 6)
    print()
```

- `range(6)`
  - **`0`**`,1,2,3,4,5`
- `list(range(0)) is []`
  - `Empty list`

`list(range(start,end,step))` **will generate a list**

`print(list(range(1,6)))` `=>` `[1,2,3,4,5]`

`print(range(1,6))` `=>` `range(1,6)`

List, tuple, string

- `list_friends = ["Chan", "May", "Peter"]`
  - `list_friends[0]: "Chan"`
  - `len(list_friends): 3`
- `tuple_friends = ("Chan", "May", "Peter")`
  - `tuple_friends[0]: "Chan"`
  - `len(tuple _friends): 3`
- `string_friend = "chan"`
  - `string_friend[0]: "C“`
  - `len(string_friend): 4`

List, tuples, strings – common functions

- `len():` the number of elements in list
- `insert(index, x):` insert x at index
- `remove(x):` remove the first element that is equal to x
- `count(x):` sort how many x in list
- `index(x):`the index of the first element that is equal to x
- `append(x):` add something after the last one
- `sort():` sort elements in list (from small to large)
- `reverse():` reverses the elements of list
  - `words.reverse() or words.sort()`
  - not `words = words.reverse()`
  - not `words = words.sort()`

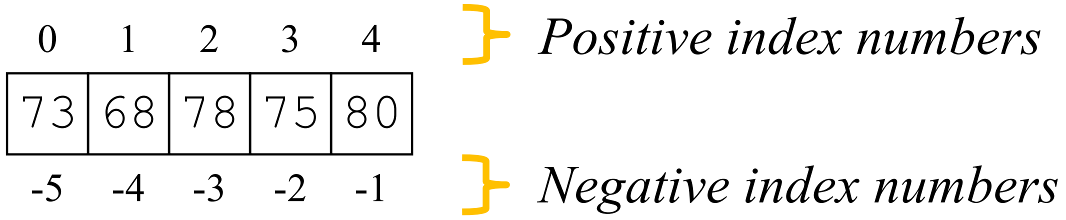
```
A + B : add two sequences
A * int: repeat A for int times
```

```
["Chan", "Mary"] + ["May", "Wong"] = ["Chan", "Mary", "May", "Wong"]

["left", "right"] * 2 = ["left", "right", "left", "right"]
```

```
info = [21, 19, 18, 25, 20, 26]
print(info[1:3])   =>      [19, 18]
```

```
x = [ 73, 68, 78, 75, 80 ]
```



Positive index numbers

Negative index numbers

```
things =   [ [ [1, 2],   [3, 4]    ],
             [ [5, 6],   [7, 8]    ],
             [ [9, 10],  [11, 12]  ] ]
```

```
len(things)=3
len(things[0])=2
```

```
print( things[1][0][1] ) ➡ 6
```

List, tuples, strings – indexing

```
       0    1    2    3    4     Positive index numbers
x = [A,  B,  C,  D,  E]
      -5   -4   -3   -2   -1     Negative index numbers
```

```
x[3]-> [D]
x[0]-> [A]
x[-1]-> [E]
```

List, tuples, strings – Slicing

```
mydata[ start_index : target_index : step]
```

```
       0    1    2    3    4    Positive index numbers
x = [A,  B,  C,  D,  E]
      -5   -4   -3   -2   -1    Negative index numbers
```

```
x[:3]-> [A,B,C]
x[0:5:2]-> [A,B,C]
x[3:]-> [D,E]
```

```
x[4:0:-1]-> [E,D,C,B]
x[4::-1]-> [E,D,C,B,A]
x[::-1]-> [E,D,C,B,A]
x[4:-:-1]-> []
```

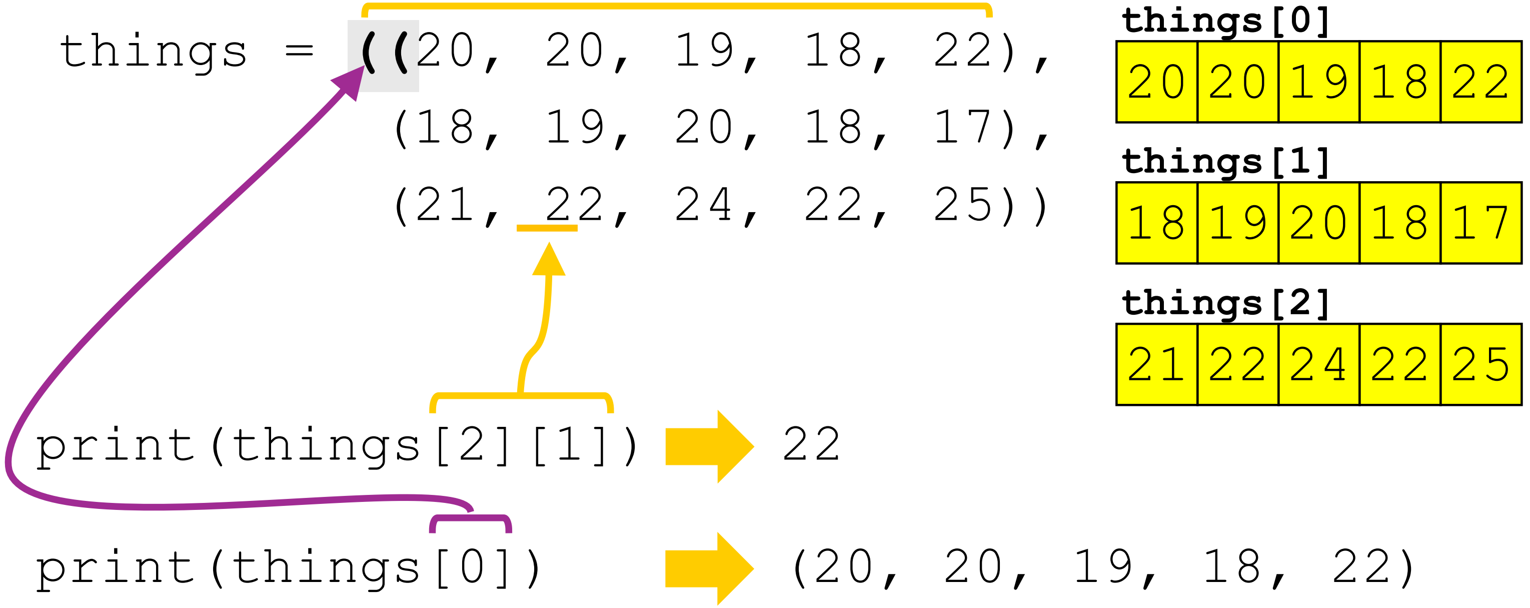
```
samples[ ::3]-> keep every third one (skip two of them)
samples[ :int(len(samples)*.25)]
```

Slicing – change data (only for list!)

```
info = [21, 19, 18, 21, 20, 19]
info[1:3] = [25, 27]
print(info)    [21, 25, 27, 21, 20, 19]
```

N-D sequences

```
Two (( means that this is a 2-D tuple
Three [[[ means that this is a 3-D list
```



```
things = ((20, 20, 19, 18, 22),
          (18, 19, 20, 18, 17),
          (21, 22, 24, 22, 25))
```

things[0]

20	20	19	18	22

things[1]

18	19	20	18	17

things[2]

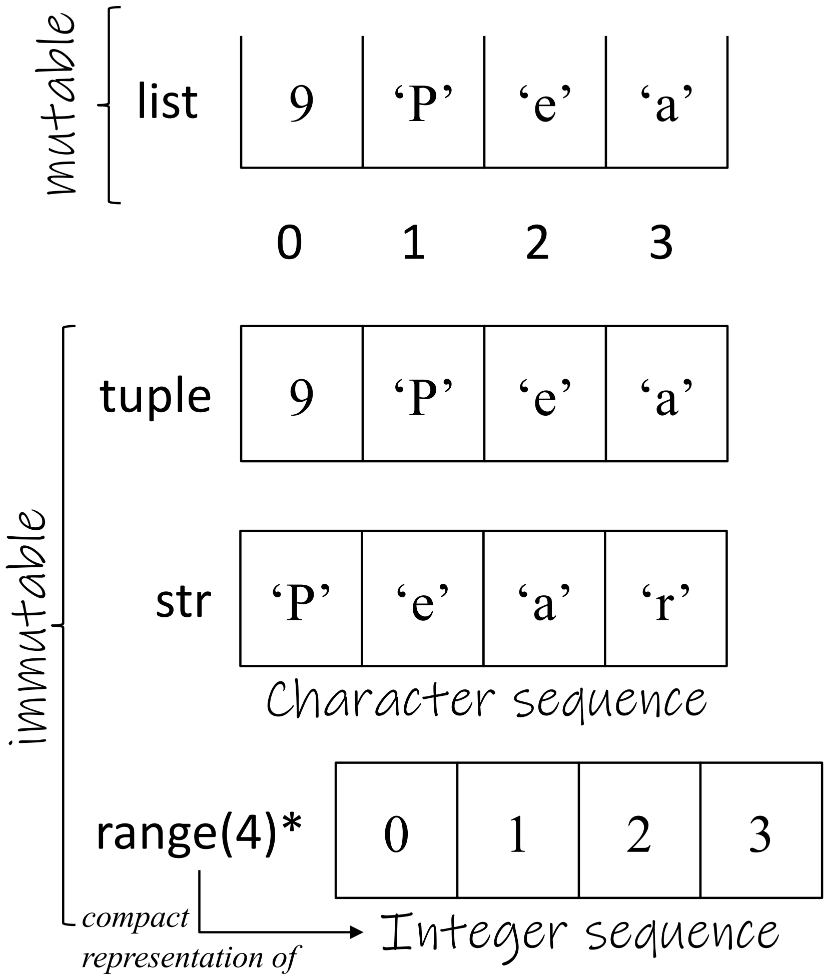
21	22	24	22	25

```
print(things[2][1])  ➡ 22

print(things[0])     ➡ (20, 20, 19, 18, 22)
```

```
len(things) = 3
len(things[0]) = 5
```

- `len()` doesn't count inside the lists which are inside the list



Mutable	[], for, len, count, index, insert, remove, append, reverse, sort, extend
Immutable	[], for, len, count, index

```
a = [9,'P','e','a']
    (9,'P','e','a')
    "Pear"
    range(4)

print(a[3])

for e in [9,'P','e','a']
         (9,'P','e','a')
         "Pear"
         range(4)
  print(e)
```

Functions

function name

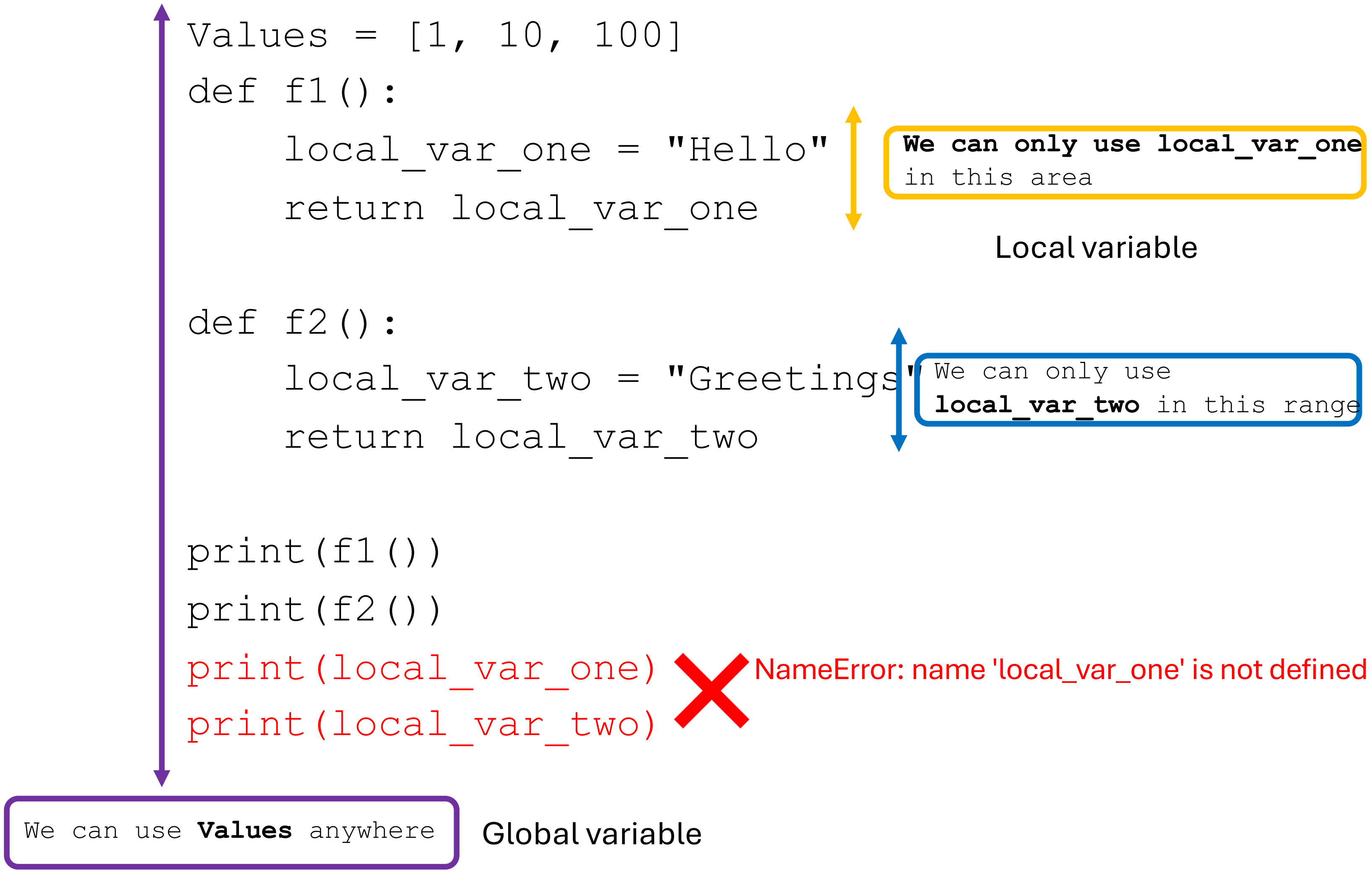
variable name, can be multiple variables

```
def show_response( name ):
    if name == "Dave":
        print("What a good name!")
    else:
        print("How are you?")
    return name, 1

name, x = show_response(name)
```

Function must be used after it is defined

Functions – local and global variables



```
Values = [1, 10, 100]
def f1():
    local_var_one = "Hello"
    return local_var_one

def f2():
    local_var_two = "Greetings"
    return local_var_two

print(f1())
print(f2())
print(local_var_one)
print(local_var_two)
```

✗ NameError: name 'local_var_one' is not defined

We can only use local_var_one in this area

Local variable

We can only use **local_var_two** in this range

We can use **Values** anywhere

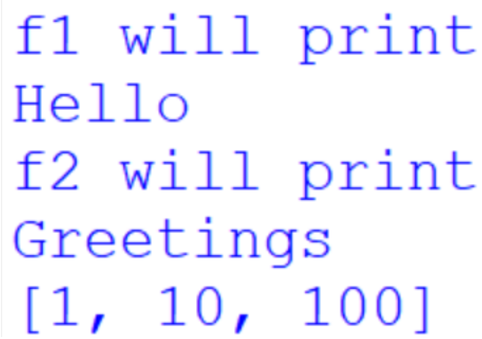
Global variable

Functions – local and global variables

```
var = [1, 10, 100]
def f1():
    var = "Hello"
    print(var)
def f2():
    var = "Greetings"
    print(var)
```

If a local variable and a global variable have the same name, priority is given to the local variable

```
print("f1 will print")
f1()
print("f2 will print")
f2()
print(var)
```



```
f1 will print
Hello
f2 will print
Greetings
[1, 10, 100]
```

Change local variable will not affect global variables

Functions – local and global variables

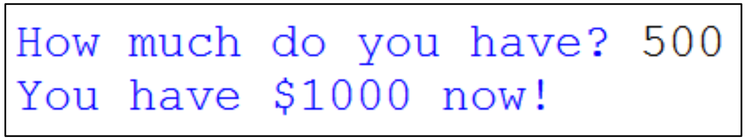
```
def magic_trick():
    global money

    if money < 1000:
        money = money + 500

money = int(input("How much do you have? "))
magic_trick()
print("You have $" + str(money) + " now!")
```

We tell Python that when we refer to `money` *in the function, it means the global variable* `money`

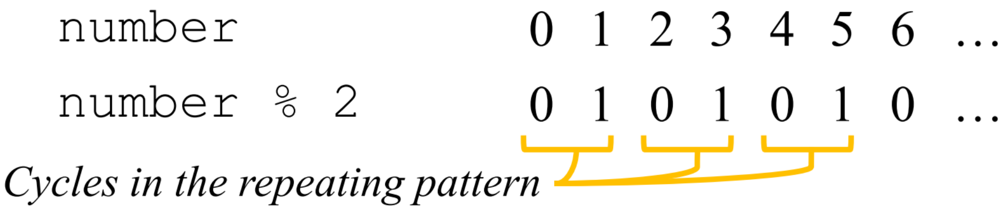
This line changes the value of the global variable



```
How much do you have? 500
You have $1000 now!
```

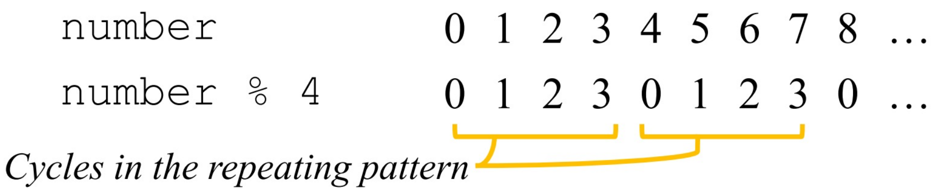
Numbers – remainder

- A % B: the remainder after division
- 10 % 2 = 0
- 10 % 3 = 1
- Remainder is useful for controlling repeated patterns



`number`	0	1	2	3	4	5	6	…
`number % 2`	0	1	0	1	0	1	0	…

Cycles in the repeating pattern



`number`	0	1	2	3	4	5	6	7	8	…
`number % 4`	0	1	2	3	0	1	2	3	0	…

Cycles in the repeating pattern

Numbers – int and float

- int(1.9) = 1
  - always discard the number after decimal place
- int("1") -> 1
- int("right") -> error

- float(1) = 1.0

- round(0.5) -> 0, round(1.5) -> 2
  - For x.5 -> round to the nearest even int
- round(0.4) -> 0.4, round(1.4) -> 1, round(1.9) -> 2
  - Other wise, round to the nearest int

Types

- `type(1) -> int`
- `type(1.0) -> float`
- `type("1") -> string`
- `type(["1"]) -> list`

Common mistakes

```
list(range(0)) is []
No error!
```

```
list(range(2)) is [0,1]
Start from 0
```

```
if 5%3:
    do_something if 5%3 is not 0
```

Function must be used after it is defined

We cannot change things in tuple and string!

Square brackets and parentheses must be paired

Common mistakes

Square brackets and parentheses must be paired

```
list(range(0))
list(range(0) is wrong!
```

" " is a string with space, len(" ") is 1
"" is an empty string, len("") is 0

```
ALWAYS read the questions carefully!
ALWAYS understand what is asked for you to input!
```

Tips

- Use `turtle.speed()` to save your time in execution
  - Faster speed: quickly see the results
  - Slower speed: check the steps
- Use `turtle.hideturtle()` and `showturtle()` smartly
  - To show the current orientation of turtle!

- ALWAYS read the questions carefully!
- ALWAYS understand what is asked for you to input!
  - a full command? A number?
  - capital letter or not?
- Validate your code using the examples