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NGEE ANN
SCHOOL OF INFOCOMM TECHNOLOGY

Repetition Structure II
for loop and flow control

Programming I (PRG1)

Diploma in Information Technology
Diploma in Financial Informatics
Diploma in Cybersecurity & Digital Forensics
Common ICT Programme
Year 1 (2019/20), Semester 1

Objectives

At the end of this lecture, you will ….

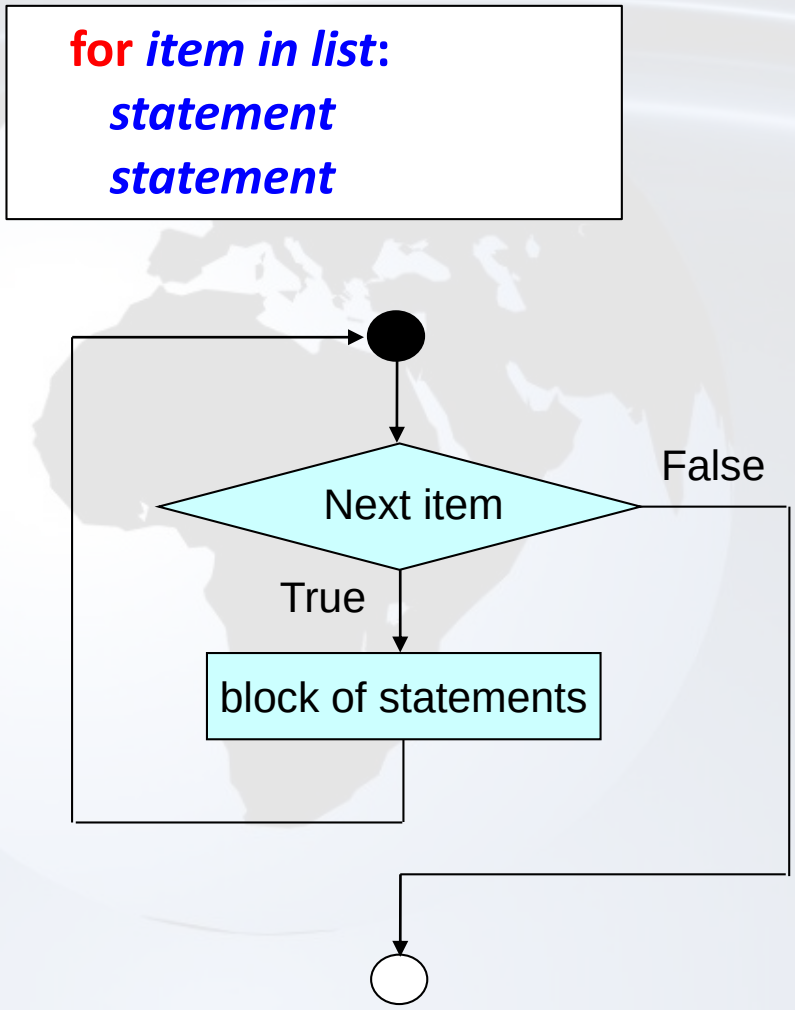
- Be able to code using for loop
- Be able to alter the program flow of loops with `break` and `continue` statements

`for` loop

for Loop

1. Retrieve item from list
2. Executes the block of statements in the loop *if there is item*
3. Repeat from step 1 until *all items* in the list have been *iterated*

```
prime_list = [2, 3, 5, 7]
for i in prime_list:
    print(i)
```



`range`

- `range` is an immutable(non-modifiable) sequence type (list is also a sequence type) that represents arithmetic progression
- To generate the range sequence, `range()` is called.
- `range` is especially useful when we need to iterate over a sequence of numbers in loops

range

```
range(stop)
range(start, stop)
range(start, stop, step)
```

- `Start:` Starting number of the sequence
- `Stop:` Generate numbers up to, but not including this number
- `Step:` difference between each number

- Parameters can be passed in `range()` to determine the range of sequence generated
- All parameters must be integers
- All parameters can be positive or negative

`for` Loop with `range()` - examples

```
# Prints out the numbers 0,1,2,3,4
for x in range(5):
    print(x)

# Prints out 3,4,5
for x in range(3, 6):
    print(x)

# Prints out 3,5,7
for x in range(3, 8, 2):
    print(x)
```

Loops – temperature sensor example

A room is installed with sensor that measures the temperature at an hourly interval.

- ✓ Create a list that stores 24 temperature figures.
- ✓ For each of the following techniques, calculate the average temperature reading for the day.

1) Use a `while` loop

3) Use a `for` loop with `range`

2) Use a `for` loop

Solution with `while` loop

```
temp_list = [ 20.1, 24, 27.3, 30.1, 26.4, 22.2, 20.1, 24, \
                        27.3, 30.1, 26.4, 20.1, 24, 27.3, 30.1, 26.4, \
                        20.1, 24, 27.3, 30.1, 26.4, 20.1, 24, 27.3 ]
total = 0
i = 0
while i < len(temp_list):
        total = total + temp_list[i]
        i = i + 1
average = total / len(temp_list)
```

Solution with `for` loop using `range`

```
temp_list = [ 20.1, 24, 27.3, 30.1, 26.4, 22.2, 20.1, 24, \
                        27.3, 30.1, 26.4, 20.1, 24, 27.3, 30.1, 26.4, \
                        20.1, 24, 27.3, 30.1, 26.4, 20.1, 24, 27.3 ]

total = 0
for i in range (0 , len(temp_list):
        total = total + temp_list[i]

average = total / len(temp_list)
```

Trace Table for `for` loop with `range`

`i from range sequence`	Iteration	temp_list[i]
-	Before start	
0	1	temp_list[0], i.e. 20.1
1	2	temp_list[2], i.e. 24
2	3	27.3
3	4	30.1
:	:	
22	23	24
23	24	27.3
-	stop	

Solution with `for` loop

```
temp_list = [ 20.1, 24, 27.3, 30.1, 26.4, 22.2, 20.1, 24,
              27.3, 30.1, 26.4, 20.1, 24, 27.3, 30.1, 26.4,
              20.1, 24, 27.3, 30.1, 26.4, 20.1, 24, 27.3 ]

total = 0
for i in temp_list:
    total = total + i

average = total / len(temp_list)
```

Trace Table for `for` loop

`i from temp_list`	Iteration
	Before start
20.1	1
24	2
27.3	3
30.1	4
26.4	:
:	23
27.3	24
-	stop

Control Flow

- `Break`
- `continue`

Temperature sensor using `break`

A room is installed with sensor that measures the temperature at an hourly interval.

- ✓ Create a list that stores 24 temperature figures.
- ✓ With a for loop, check if any reading exceeds 25 degrees Celsius. If so, print a warning message and end the loop

Solution using `for` loop and `break`

```
temp_list = [ 20.1, 24, 27.3, 30.1, 26.4, 22.2, 20.1, 24,
              27.3, 30.1, 26.4, 20.1, 24, 27.3, 30.1, 26.4,
              20.1, 24, 27.3, 30.1, 26.4, 20.1, 24, 27.3 ]
```

Solution using `for` loop with `range` and `break`

```
temp_list = [ 20.1, 24, 27.3, 30.1, 26.4, 22.2, 20.1, 24,
              27.3, 30.1, 26.4, 20.1, 24, 27.3, 30.1, 26.4,
              20.1, 24, 27.3, 30.1, 26.4, 20.1, 24, 27.3 ]
```

Temperature sensor using `continue`

A room is installed with sensor that measures the temperature at an hourly interval.

- ✓ Create a list that stores 24 temperature figures.
- ✓ Then, for each of the following techniques, calculate the average temperature reading for the day.
- ✓ With a for loop with *continue*, find the highest reading of the day.

Solution using `for` loop and `continue`

```
temp_list = [ 20.1, 24, 27.3, 30.1, 26.4, 22.2, 20.1, 24,
              27.3, 30.1, 26.4, 20.1, 24, 27.3, 30.1, 26.4,
              20.1, 24, 27.3, 30.1, 26.4, 20.1, 24, 27.3 ]
```

Solution using `for` loop with `range` and `continue`

```
temp_list = [ 20.1, 24, 27.3, 30.1, 26.4, 22.2, 20.1, 24,
              27.3, 30.1, 26.4, 20.1, 24, 27.3, 30.1, 26.4,
              20.1, 24, 27.3, 30.1, 26.4, 20.1, 24, 27.3 ]
```

Summary

- A `for` loop can be used to iterate through a list of items
- The `break` statement breaks out of the `for` loop
- The `continue` statement skips the remaining part of the loop body and proceed with the next loop

Reading Reference

- Python 3.7.x Documentation
  - https://docs.python.org/3/tutorial/controlflow.html
- Learn Python Tutorial
  - https://www.learnpython.org/en/Loops