NUS AI SUMMER EXPERIENCE 2019

CONTROL STATEMENTS AND LOOPS

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OUTLINE

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02 WHILE LOOPS

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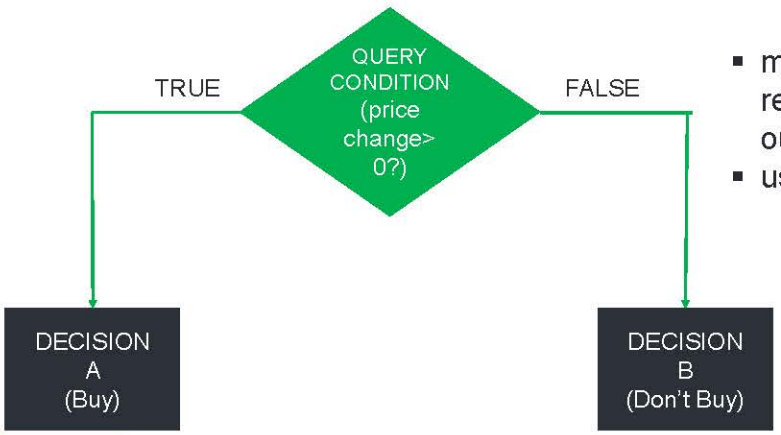
01 CONTROL STATEMENTS

COMPARISON AND DECISION



- most programming tasks requires actions based on outcome of comparison
- use of IF statements

- explicitly define input is a floating number

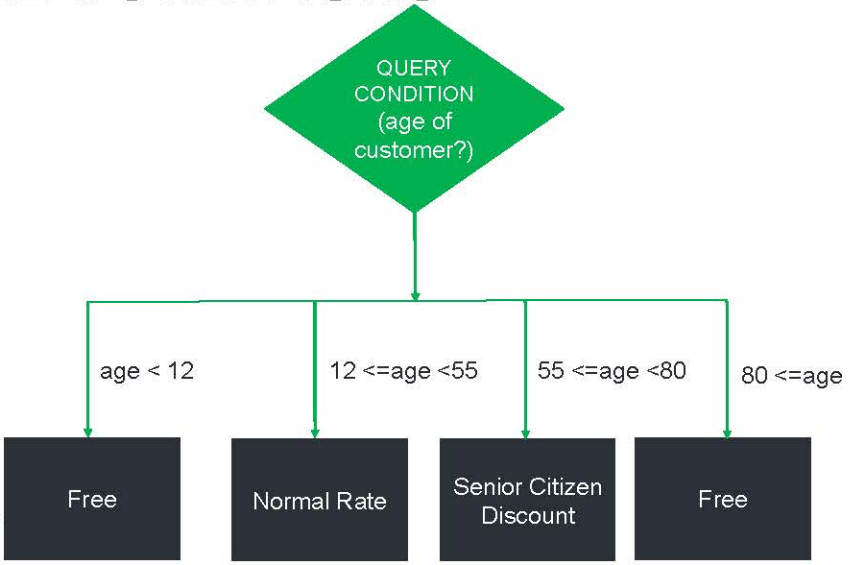
```
priceChange = float(input('What was the change in price: '))
if priceChange > 0:
    print('Buy')
else:
    print("Don't Buy")
```

```
What was the change in price: 10
Buy
```

- if statement used to compare
- if outcome is true, execute statement within the if –block
- Note the syntax
  - the if statement conclude with colon (:)
  - the statements within the if-block is indented with a space

- The statement under the else block is executed if the 'if' condition is false
- Note the quotes used in the statement in this else-block

MULTIPLE CONDITIONS



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```
age = int(input('Enter age of customer: '))
if age < 12 :
    print('Free')
elif age < 55 :
    print ('Normal Rate')
elif age < 80 :
    print ('Senior Citizen Discount')
else:
    print ('free')
```

```
Enter age of customer: 90
 free
```

- Note that the first elif-block should have two conditions (age > =12 and age < 55) but only test for one condition (age <55)
- Would those under 12 be charged normal rate (since they fulfil the condition age < 55
- No. Those under 12 will have fulfilled the if condition in the if-block above. The if-block will be executed and the program will never reach this elif block.
- Hence, there is no need to explicitly test for the age >=12 condition in this elif block. age must be >= 12 for program to reach this block
- Same argument holds for the other elif block

- There are three if, elif, blocks in addition to the else blocks
- The code check each block in the order they are written
  - the if-block first
  - the elif age <55 second
  - the elif age <80 third
- The first block with the condition being tested true is executed. Program is then exited.
- If none of the if, or elif block's condition is true, the else block is executed

NESTED IF

- Several if statements nested together

```
if condition I :
        if condition II :
                statements    #executed if condition I true AND condition II true
        else :
                statements    #executed if condition I true AND condition II false
else :
        statements            #executed if condition I false
```

Outer if-else block

Test if age >=12

If false, 'Free'

If true, go into the other if block

```
age = int(input('Enter age of customer: '))
if age >=12 :
    if age >= 80 :
        print('free')
    else:
        if age >= 55:
            print ('Senior Citizen Discount')
        else :
            print ('Normal Rate')
else:
    print('Free')
```

```
Enter age of customer: 47
Normal Rate
```

come to this innermost if-else block given the outcome of following conditions

age >=12 is true

age >= 80 is false

COMPARISON AND LOGICAL OPERATORS

- Operators for condition testing includes the following
  - comparison between variables
    - <, <=, ==, !=, >, >=
  - Membership checking
    - in, not in
  - Simple comparison combined by logical operators
    - and, or, not

EXAMPLE OF USE OF LOGICAL OPERATORS

Logical operator 'or' used

syntax is: age < 12 or age >= 80

error occur if you write it as age < 12 or >=80 (without the second 'age')

```
age = int(input('Enter age of customer: '))
if age < 12 or age >= 80 :
    print('Free')
elif age >=55 :
    print ('Senior Citizen Discount')
else :
    print ('Normal Rate')
```

```
Enter age of customer: 20
Normal Rate
```

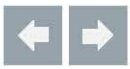

EXAMPLE OF MEMBERSHIP CHECK

Whether the word 'John' appears in the sentence

```
sentence = input()
print (sentence)
if 'john' in sentence:
    print('send to john')
else:
    print('return to sender')
```

```
john is a good boy
john is a good boy
send to john
```

02 WHILE LOOPS



WHAT ARE LOOPS

- Statements that get executed over and over again as long as some conditions a
- Inputs to the statements can differ for each cycle that statements are run
- Control point:
  - while condition (true of false)
  - for condition (as long as there is still something in sequence)
  - deliberate stop
    - break
    - continue

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WHILE LOOP

- General Format

  while condition :

  statements

- Syntax

  colon (:) at end of while expression

  indent for statements after while expression but part of the while block

- Condition is a Boolean expression. Evaluated as True or False
- If condition is true, all statements are executed once.
- Condition is evaluated again. If True, repeat execution of statement
- If false, program exits the while loop

EXAMPLE OF WHILE LOOP

Let's say you want to add a number from 1 to n.
Ask for input to n

- initialize variables
- i - the number to be added
- total – store the sum

- the while expression
- n is the last number to add
- as long as (i <=n) is True, the statements in the while loop will be executed

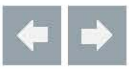
```
n = int(input('Enter the integer that you want to sum to: '))
i = 0
total = 0
while i <=n:
    total += i
    i += 1
print (total)
```

- current value of i is added to total

- current value of i is increased by 1
- last statement in the while block
- after this, it goes back to the while expression to test whether (i <= n) is true.
- Since i is increased at each iteration, there will come a point when (i <= n) is false and the statements in the while block is not executed anymore

- this print statement is outside the while block
- absence of indent
- it is executed after the program exits the while block

03 FOR LOOPS



FOR LOOP

- General Format

  for item in sequence :

  statements #usually related to item

- Syntax

  colon (:) at end of for expression

  indent for statements after while expression but part of the while block

- Sequence can be list, string, dictionary
- item is just a variable name and not a special keyword in Python
- item takes each element from sequence in the order that they appear in sequence.
- once item takes an element, the statements in the for loop is executed
- execution of statements in the for loop stops once the sequence in empty.

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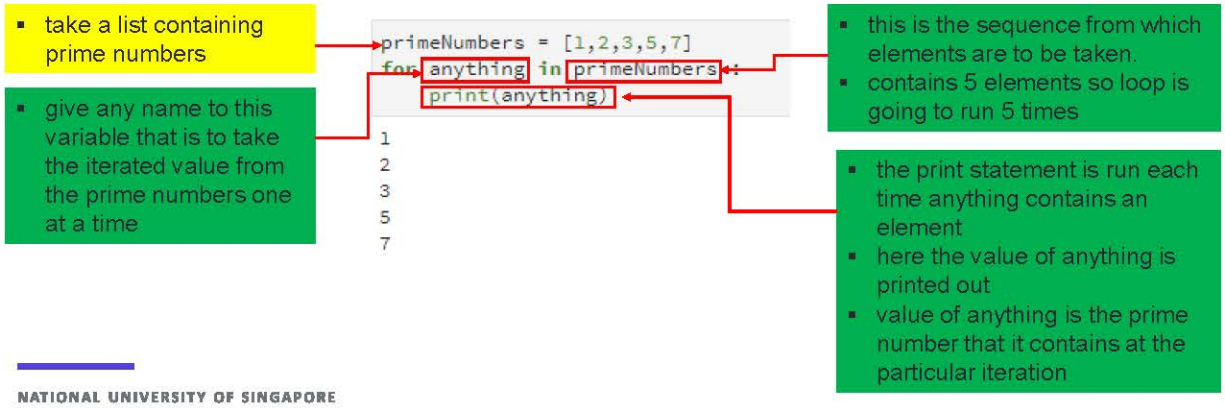
EXAMPLE OF FOR LOOP

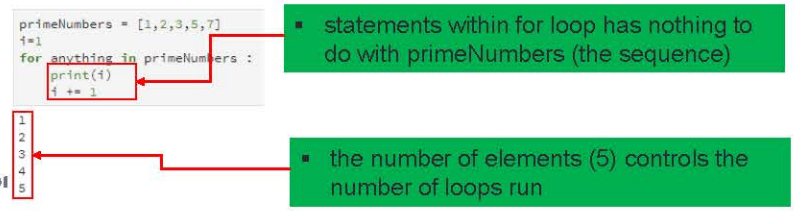


EXAMPLE OF FOR LOOP STATEMENTS

The statements inside the for-loop does not need to have anything to do with the item that carries the value from the sequence:

for item in sequence

The example below illustrates this
However, it usually does because the purpose of the for loop is to operate on the sequence



BREAK COMMAND

- Terminates the execution of a while-loop or a for-loop once it is encountered
- Efficiency of program
- Syntax

```
for item in sequence :
        statements
        if condition :
                statements    #statements to be executed if condition true
                break         # exit the for-loop
else                          #else here is part of for –loop, not part of if statement. Optional.
                              #used with break command.
                              #executed only when break is not executed
statements
```


Example of break COMMAND

- Let's say you want to check whether a given number is a prime number.
- An easy test is to determine whether the given number if divisible by another number
- Just try dividing the given number by numbers smaller than itself/2. Start with 2 and increase the divisor by 1 each time
- Once a divisor is found, we know that given number is not a prime number
- Can stop the test. Use the break command

EXAMPLE: Prime Number

- test all numbers smaller than n as divisors
- range (2,n) will generate a list of integers from 2 to n-1
- assigns generated integer to i, one per loop

- testing whether current i is a divisor
- % is a modulo operator

- if n%i == 0 is true
- print out information
- break out of the for loop
- if n%i == 0 false, program returns to for expression and gets next i

- if n%i == 0 is never true for all i in range (2,n)
- no divisor found
- break is not executed
- else will explain why break is not executed
- else will not be executed if break is executed

```
n= int(input('Enter the integer you wish to test whether is a prime number: '))
for i in range(2,n):
    if n%i == 0:
        print(n, 'is divisible by',i)
        print(n, 'is not a prime number')
        break
else:
    print (str(n) + ' is a prime number')
```

```
125 is divisible by 5
125 is not a prime number
```


CONTINUE COMMAND

- Ends current iteration of a while-loop or a for-loop once it is encountered
- Go directly to next iteration on the loop
- Efficiency of program
- Syntax

```
for item in sequence :
    statements
    if condition :
        statements    #statements to be executed if condition true
        continue          # exit the current iteration
                          #ignore statements below the continue command
    statements
```

EXAMPLE

- Let's say you want to print out all integers from 1 to n that satisfies the two conditions together.
  - condition 1: has remainder of 1 when divided by 2; and
  - condition 2: has remainder of 2 when divided by 3
- Carry out the test for the conditions one at a time
- If an integer does not satisfy condition 1, there is no need to test for condition 2.
- Use continue statement and move on to the next iteration. Test the next number

Example of continue COMMAND

- range (1,n+1) will generate a list of integers from 1 to n

- i%2 != 1 will be True if the remainder is not 1
- condition 1 (remainder of number divided by 2 is 1) is not true
- continue stops iteration and goes back to the top of the for-loop
- all statements below for loop not executed in this iteration

- the print statement is executed only if none of the two continue statements above are not executed
- both conditions satisfied

```
n= int(input('Enter the integer you wish to test up to: '))
for i in range(1,n+1):
    if i%2 !=1:
        continue
    if i%3 != 2:
        continue
    print(i, end = ' ')
```

```
Enter the integer you wish to test up to: 30
 5 11 17 23 29
```

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