ITT 205 Problem Solving using Python

Contents

Session 1:

Python Interpreter

- An interpreter is a kind of program that executes other programs.
- When you write a Python program, the Python interpreter reads your program and carries out the instructions it contains.

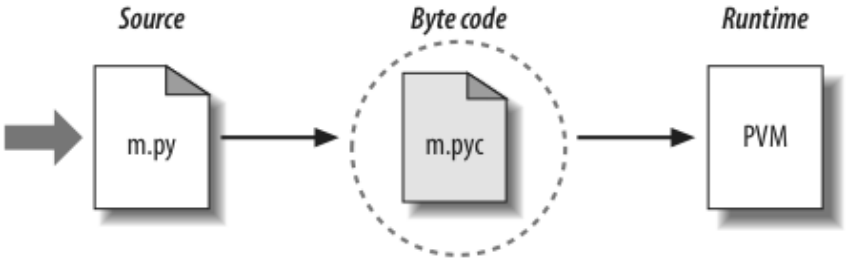
- In effect, the interpreter is a layer of software logic between your code and the computer hardware on your machine.
- Depending on which flavor of Python you run, the interpreter itself may be implemented as a C program, a set of Java classes.
- Whatever form it takes, the Python code you write must always be run by this interpreter.

Python Byte Code

- Internally, and almost completely hidden from you, when you execute a program Python first compiles your *source code* (the statements in your file) into a format known as *byte code*.
- This byte code translation is performed to speed execution—byte code can be run much more quickly than the original source code statements in your text file.
- If the Python process has write access on your machine, it will store the byte code of your programs in files that end with a *.pyc* extension (".pyc" means compiled ".py" source).

The Python Virtual Machine (PVM)

- Once your program has been compiled to byte code (or the byte code has been loaded from existing .pyc files), it is shipped off for execution to something generally known as the Python Virtual Machine
- PVM is just a big loop that iterates through your byte code instructions, one by one, to carry out their operations
- The PVM is the runtime engine of Python; it's always present as part of the Python system, and it's the component that truly runs your scripts.



Python Implementation Alternatives

- CPython - Coded in portable ANSI C language code
- Jython - Java classes that compile Python source code to Java byte code
- IronPython - Microsoft's .NET Framework for Windows

Write a program which accepts the radius of a circle and compute the area.

```
r = float(input ("Input the radius of the circle : "))
print ("The area of the circle with radius " + str(r) + " is: " + str(3.14 * r**2))
```

Additional Reading

- Python is a programming language that lets you work quickly and integrate systems more effectively. https://www.python.org/

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- What you can do with Python? Let's have a look: https://realpython.com/
- Go professional: https://www.jetbrains.com/pycharm/
- Repositories related to the Python Programming language https://github.com/python
- Where you will work? https://www.python.org/jobs/
- Coursera https://www.coursera.org/learn/python-data-analysis
- Interested in another Language? https://www.r-project.org/about.html
- Want to become a Data Scientist? http://courses.csail.mit.edu/18.337/2015/docs/50YearsDataScience.pdf
- Python do wonders. Want to See? https://numpy.org/learn/

Session 2

Python Enhancement Proposals (PEPs)

- https://www.python.org/dev/peps/

Keywords

- Keywords are the reserved words in Python.
- In Python, keywords are case sensitive.

```
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
```

Identifiers

- The uppercase and lowercase letters A through Z, the underscore _ and, except for the first character, the digits 0 through 9.
- PEP 3131 -- Supporting Non-ASCII Identifiers

Values and types

A value is one of the fundamental things like a letter or a number that a program manipulates.

- >>> type("Hello, World!")
- <type 'str'>
- >>> type(17)
- <type 'int'>
- >>> type(3.2)
- <type 'float'>

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Variables

- A variable is a name that refers to a value.
- >>> message = "What's up, Doc?"
- >>> n = 17
- >>> pi = 3.14159

Operators and operands

- Operators are special symbols that represent computations like addition and multiplication.
- The values the operator uses are called operands.

```
+       -       *       **      /       //      %       @
<<      >>      &       |       ^       ~       :=
<       >       <=      >=      ==      !=
```

-

Operator	Description
:=	Assignment expression
lambda	Lambda expression
if – else	Conditional expression
or	Boolean OR
and	Boolean AND
not x	Boolean NOT
in, not in, is, is not, <, <=, >, >=, !=, ==	Comparisons, including membership tests and identity tests
|	Bitwise OR
^	Bitwise XOR
&	Bitwise AND
<<, >>	Shifts
+, -	Addition and subtraction
*, @, /, //, %	Multiplication, matrix multiplication, division, floor division, remainder 5
+x, -x, ~x	Positive, negative, bitwise NOT
**	Exponentiation 6
await x	Await expression
x[index], x[index:index], x(arguments...), x.attribute	Subscription, slicing, call, attribute reference
(expressions...), [expressions...], {key: value...}, {expressions...}	Binding or parenthesized expression, list display, dictionary display, set display

- In general, you cannot perform mathematical operations on strings, even if the strings look like numbers.
- Illegal expressions (assuming that message has type string):
    - message-1
    - "Hello"/123
    - message*"Hello"
    - "15"+2
    - + operator represents concatenation
    - fruit = "banana"
    - bakedGood = " nut bread"
    - print (fruit + bakedGood)
    - The * operator also works on strings; it performs repetition. For example,
    - "Fun"*3 is "FunFunFun"
-

Expressions

- An expression is a combination of values, variables, and operators

Statements

- A statement is an instruction that the Python interpreter can execute
- When you type a statement on the command line, Python executes it and displays the result, if there is one.
- A script usually contains a sequence of statements.

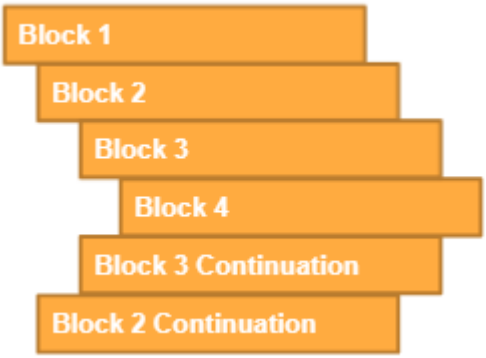
Evaluation of expressions

- Atoms are the most basic elements of expressions
- The simplest atoms are identifiers or literals
- Forms enclosed in parentheses, brackets or braces are also categorized syntactically as atoms
- The evaluation of an expression produces a value, which is why expressions can appear on the right hand side of assignment statements.
- A value all by itself is a simple expression, and so is a variable.
- Evaluating a variable gives the value that the variable refers to.
- Left-hand side of an assignment statement has to be a variable name, not an expression.
- So, the following is illegal: minute+1 = hour.
- In a script, an expression all by itself is a legal statement, but it doesn't do anything
    - 17
    - 3.2
    - "Hello, World!"
    - 1 + 1
- produces no output at all. How would you change the script to display the values of these four expressions?

Indentation

Code Blocks are defined by indentation

Leading whitespace (spaces and tabs) at the beginning of a logical line is used to compute the indentation level of the line, which in turn is used to determine the grouping of statements



Indentation errors

- https://docs.python.org/2.0/ref/indentation.html

Session 3

Conditional execution

➢ if x > 0:

  print "x is positive“

- The boolean expression after the if statement is called the condition.
- If it is true, then the indented statement gets executed. If not, nothing happens.

Syntax of if statement:

- if statement is made up of a header and a block of statements
- The First unindented statement marks the end of the block.

➢ **HEADER:**

➢ **FIRST STATEMENT**

➢ **…**

➢ **LAST STATEMENT**

- There is no limit on the number of statements that can appear in the body of an if statement, but there has to be at least one.
- **You can use** pass statement if you plan to add code later

Alternative execution:

- There are two possibilities and the condition determines which one gets executed.

➢ if x%2 == 0:

  print x, "is even"

➢ else:

  print x, "is odd“

- Condition must be true or false, exactly one of the alternatives will be executed.

- The alternatives are called branches, because they are branches in the flow of execution.

Chained conditionals:

- if x < y:

  print x, "is less than", y

- elif x > y:

  print x, "is greater than", y

- else:

  print x, "and", y, "are equal“

- There is no limit of the number of elif statements

Nested conditionals:

- if x == y:

  print x, "and", y, "are equal"

- else:
  - if x < y:

    print x, "is less than", y

  - else:

    print x, "is greater than", y

  Logical operators often provide a way to simplify nested conditional statements.

- if 0 < x:
- if x < 10:
- print "x is a positive single digit."

Keyboard input:

- The input function always builds a string from the user's keystrokes and returns it to the program
- >>>first = int(input(“Enter the first number: “))
- Enter the first number: 23
- >>> second = int(input(“Enter the second number: “))
- Enter the second number: 44
- >>> print(“The sum is”, first + second)
- The sum is 67

Session 4:

For Loop:

```
for number in range(10):
    print(number)
```

```
n = 10
for i in range(4, n):
    print(i)
```

```
for number in range(0, 10, 3):  # last one is step
    print(number)
```

```
my_list = [1, 2, 3, 4, 'Python', 'is', 'neat']
for item in my_list:
    print(item)
```

break

```
my_list = [1, 2, 3, 4, 'stop', 'is', 'neat']
for item in my_list:
    if item == 'stop':
        break
    print(item)
print("After for loop")
```

continue

```
my_list = [1, 2, 3, 4, 'Python', 'is', 'neat']
for item in my_list:
    if item == 2:
        continue
    print(item)
```

Iterating over a String

```
s = "Mango"
for i in s :
    print(i)
```

Looping dictionaries

```
my_dict = {'hacker': True, 'age': 72, 'name': 'John Doe'}
for i in my_dict:
    print(i,":",my_dict[i])
```

```
for key, val in my_dict.items():
    print(key, val)
```

For Else

```
for i in range(1, 4):
        print(i)
else: # Executed because no break in for
        print("Print else statement")
```

```
for i in range(1, 4):
        print(i)
        break
else: # Not executed as there is a break
        print("No Break")
```

While loop

```
n=4
while n > 0:
  print(n)
  n = n-1
print ("Blastoff!")
```

While Else

```
i=1
while i<99:
    if i % 2 == 0:
        print ("list contains an even number")
        break
    i+=2
else:
    print ("list does not contain an even number")
```

```
while True:
  reply = input('Enter text:')
  if reply == 'stop': break
  try:
    num = int(reply)
  except:
    print('Bad Input!')
  else:
    print(int(reply) ** 2)
    print('Calculation Done')
```