Basics of using Python

Rob Hackman

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University of Alberta

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Makeup of a program

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Source code is a series of symbols, which we typically call *tokens*, that has meaning in the given programming language. The order of the tokens must follow the rules of the language called the *syntax* of the language.

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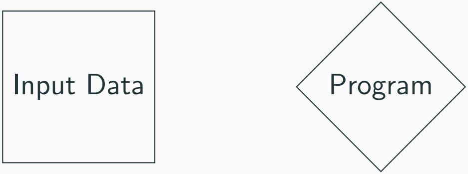

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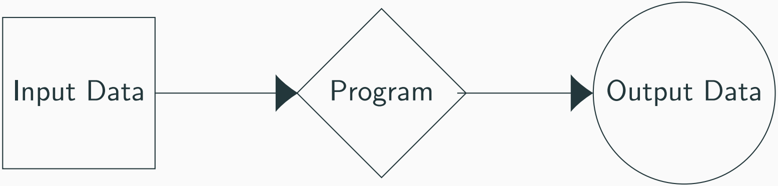

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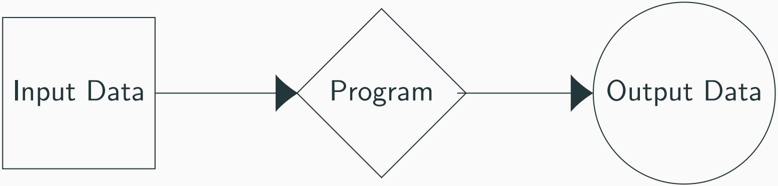

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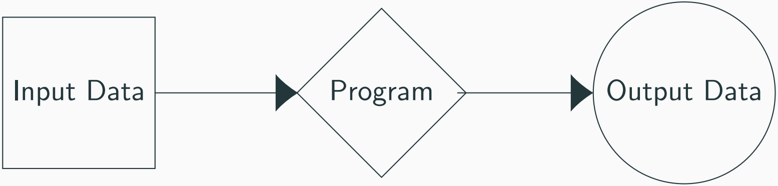

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So a program takes input data that can be pretty much anything, and translates it into output data that could be pretty much anything. Seems familiar!

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Our expressions in Python can always be evaluated to a final value.

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- An *identifier*

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An example of a literal value in a Python program would be 25, which would represent the decimal number twenty-five.

Types of data

In programming our data comes in different *types*. The type of a particular piece of data is important because it dictates what sort of operations can be applied to it. We will learn of many types in Python but for now we will start with just four:

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- Integers — Python type name `int`
- Real Numbers[1]— Python type name `float` short for *floating point number*
- Text — Python type name `str` short for string. Represents a sequence of characters.

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Since a literal is one of our atomic expressions, each of these examples is also an example of an expression! The value these expressions evaluate to are their literal value.

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Each language has its own rules for what constitutes a valid identifier. In Python the rules are quite simple.

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Keywords are reserved words that have special meaning in a programming language, and as such are reserved for that purpose. We will see some Python keywords shortly.

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Our tokens for these operators are `+`, `-`, `*`, `/`, `**` respectively.

So a binary operator expression takes the form of `lhs operator rhs`. What can we substitute for `lhs` or `rhs` though?

Thinking about algebraic expressions

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- Just numbers? e.g. $3 + 5$
  - Counter example: $x + 5$
- Only numbers and variables?
  - Counter example: $3 * 2 + 7/2$
- The operands of our arithmetic operators are themselves also expressions! This is true in mathematics as well as in Python

Format of a binary operator expression in Python

expr operator expr

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So a valid expression in Python is also `(expr)`, where `expr` can be replaced with any of our expressions.

Unary operator expressions

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e.g. -(3+2)

Example of an expression so far

$$-(3+2)*5-10/2$$

To break this down into its components we have to start from the *last* operator to take place. That is whatever is the lowest precedence, then repeat.

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- Our `rhs` is the expression `lhs DIVISION 2`
  - Here, again, our operands are literals (10 and 2 respectively), so we are finally done.

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As we just saw, even this relatively small expression is fairly complex in how many expressions it comprises.

A note on expressions and types

In Python the resultant type of the evaluation of an expression depends on the expression. One place we can see this occur is in arithmetic in Python.

$$3 * 5 \longrightarrow 15$$
$$3 * 2.0 \longrightarrow 10.0$$
$$10/2 \longrightarrow 5.0$$

The type of the operands can affect the behaviour of an operator. The multiplication operator is shown to produce an integer when multiplying two integers. However, when multiplying an integer by a float the result is a float. This is also true of addition and subtraction.

Division, however, always produces a float.

Function call expression

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A function application[2] is also an expression, as it evaluates to a final value.

[2] Called a function call in Python, and most programming languages.

Function call expression format

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Series of expressions separated by commas

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Example function call

```
myFn(3+2, 27.58*3.14*1e-5, "hello")
```

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Operations on strings

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However, given the existence of our `str` type we must have other types of expressions.

A note on sequences

A `str` in Python is an ordered collection of characters. We will also learn about many other ordered collections in the future.

For discussing behaviours, it is often helpful to group together similar data types into a general classification. The general classification of most of the ordered collection data types we'll discuss belong to what we'll call a *sequence*.

The operations we are going to now discuss that work on strings work on any sequence.

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The expression `"cave"+"man"` yields the value `"caveman"`.

Repetition

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The expression `"abc"*3` yields the value `"abcabcabc"`.

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The resultant value is the item in the sequence at the position indicated by the integer.

Indexing behaviour in Python

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In order for an indexing expression to be valid, the index must correspond to a valid position within the sequence. The valid positions go from 0 to $n - 1$ where n is the *length* of the sequence.

Indexing behaviour in Python

$$\text{“}\textit{Oilers}\text{”}[0] \longrightarrow \text{“}\textit{O}\text{”}$$

$$\text{“}\textit{Oilers}\text{”}[1] \longrightarrow \text{“}\textit{i}\text{”}$$

$$\text{“}\textit{Oilers}\text{”}[2] \longrightarrow \text{“}\textit{l}\text{”}$$

$$\text{“}\textit{Oilers}\text{”}[3] \longrightarrow \text{“}\textit{e}\text{”}$$

$$\text{“}\textit{Oilers}\text{”}[4] \longrightarrow \text{“}\textit{r}\text{”}$$

$$\text{“}\textit{Oilers}\text{”}[5] \longrightarrow \text{“}\textit{s}\text{”}$$

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Knowledge Check: What is the result of the expression `("abc"[1]+"hello")[3]`?

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    - `s`, `i`, and `j` — same as above
    - `k` — an expression that evaluate to an integer
- Omitting either `i` or `j` will replace them with either the beginning or end of the string depending on context.

Slicing examples

$$\texttt{"CMPUT 274 is fun"[4:9]} \longrightarrow \texttt{"T 274"}$$

$$\texttt{"CMPUT 274 is fun"[10:16]} \longrightarrow \texttt{"is fun"}$$

$$\texttt{"CMPUT 274 is fun"[0:16:2]} \longrightarrow \texttt{"CPT24i u"}$$

$$\texttt{"CMPUT 274 is fun"[1:16:2]} \longrightarrow \texttt{"MU 7 sfn"}$$

$$\texttt{"CMPUT 274 is fun"[1:]} \longrightarrow \texttt{"MPUT 274 is fun"}$$

$$\texttt{"CMPUT 274 is fun"[16::-1]} \longrightarrow \texttt{"nuf si 472 TUPMC"}$$

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Keyword list

We mentioned earlier that an identifier could not be a keyword, as keywords are reserved in Python and each have their own special meaning.

We now present a list of the keywords, however we will not elaborate on all of them now. Rather we will define keywords purposes as they become relevant.

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

Keyword meanings

Each keyword has its own special meaning, there is no general rule of thumb that dictates what keywords do.

Some keywords act as literals, `True`, `False`, and `None` are some such examples.

Some keywords define language features for us.

Some keywords even work as operators...