Special Methods

- Polymorphism
- Polymorphic Functions (__str__, __repr__)
- Operator Overloading (+ and __add__)
- More Special Methods

Polymorphism

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- Ad Hoc Polymorphism

- Parametric Polymorphism

- Inclusion Polymorphism

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e.g., Overloading:

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foo(int) { xxx }

foo(string) {xx xxx xx}
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e.g., Generic functions:

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Template <typename T>
T foo(T x, T y) {
  return (x > y) ? x : y;
}
```

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foo<int>(3,7)
foo<char>(‘h’,’k’)
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Subtypes and inheritance:

```
T v; // T has many subtypes
… …
v.foo();
```

Polymorphism

- Ad Hoc Polymorphism

Next, we introduce two instances of ad hoc polymorphism to help illustrate some important *special methods* in Python:
polymorphic function (__str__, __repr__)
operator overloading (__add__)

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String Representations

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An object value should behave like the kind of data it is meant to represent

For instance, by producing a string representation of itself

Strings are important: they represent language and programs

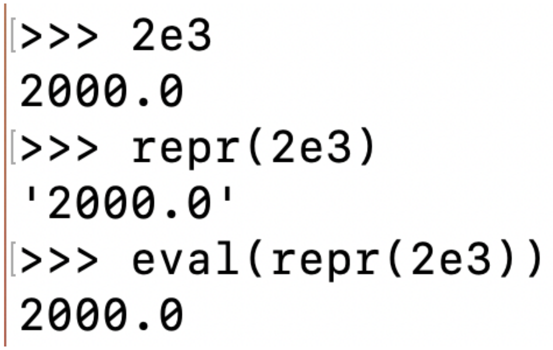
In Python, all objects produce two string representations:

- The **str** is legible to humans
- The **repr** is legible to the Python interpreter

The **str** and **repr** strings are often the same, but not always

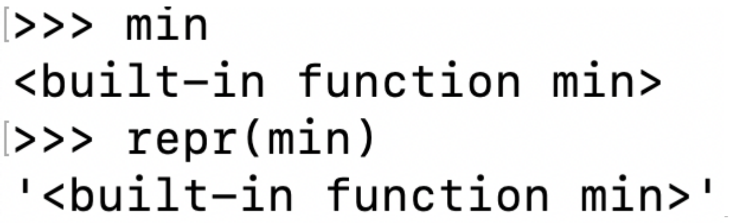
The repr String for an Object

repr: string representation of Python object. For most object types, eval will convert it back to that object, eval(repr(obj)) == obj



```
>>> 2e3
2000.0
>>> repr(2e3)
'2000.0'
>>> eval(repr(2e3))
2000.0
```

The result of calling **repr** on a value is what Python outputs in an interactive session



```
>>> min
<built-in function min>
>>> repr(min)
'<built-in function min>'
```

The str String for an Object

Human interpretable strings are useful as well:

```
>>> from fractions import Fraction
>>> half = Fraction(1, 2)
>>> repr(half)
'Fraction(1, 2)'
>>> str(half)
'1/2'
```

The result of calling **str** on the value of an expression is what Python prints using the **print** function:

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>>>print(half)
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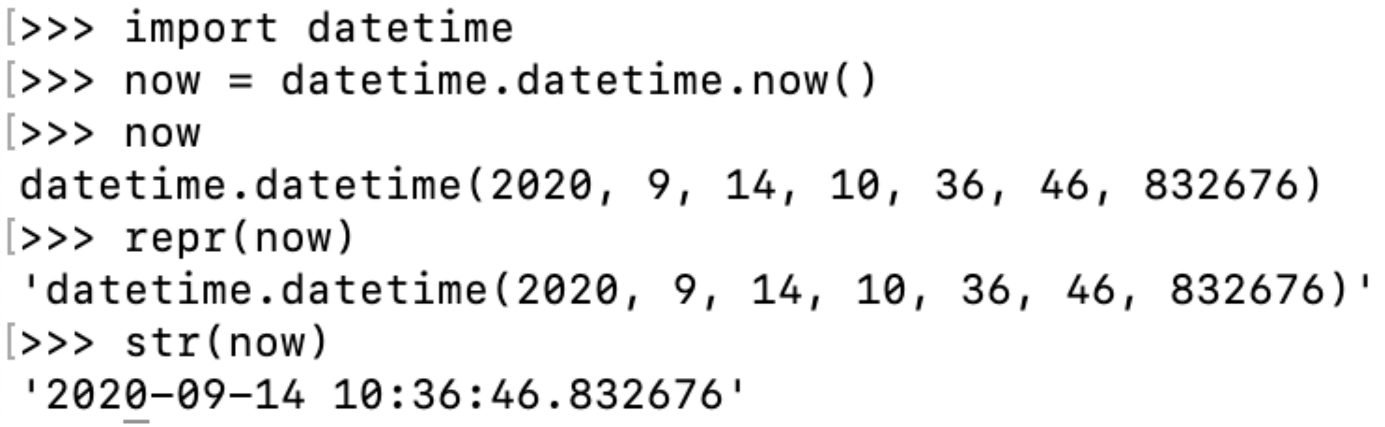

```
[>>> import datetime
[>>> now = datetime.datetime.now()
[>>> now
datetime.datetime(2020, 9, 14, 10, 36, 46, 832676)
[>>> repr(now)
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'2020-09-14 10:36:46.832676'
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The result of calling **str** on the value of an expression is what Python prints using the **print** function:

repr is to be unambiguous
str is to be readable

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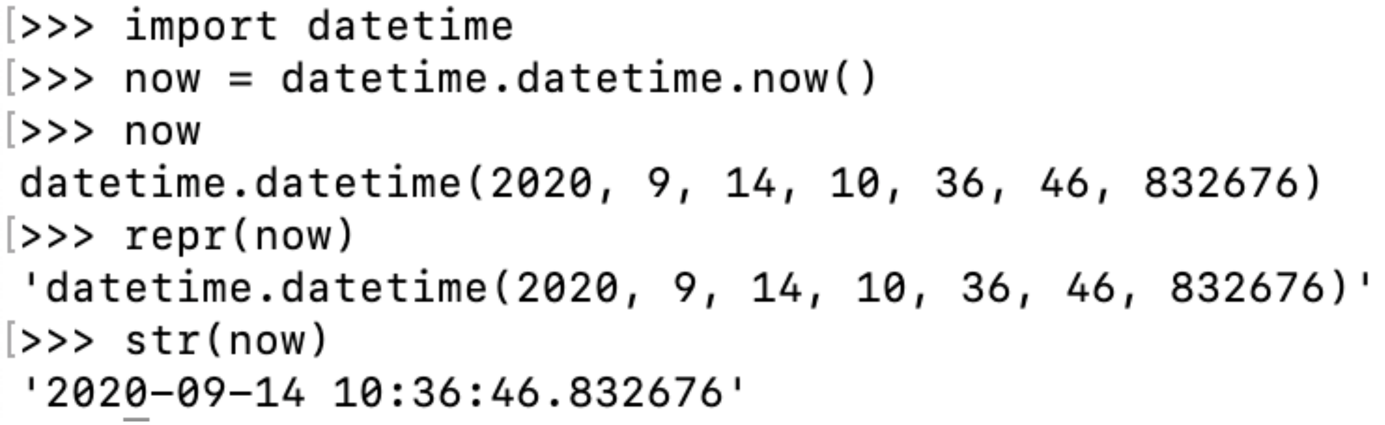

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Polymorphic functions behave differently depending on the types of the arguments come in, while **parametric functions** execute the same code for arguments of any admissible types

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demo_1

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A + B, different behaviors of this adding expression may exhibit, depending on the types of the operands (A or B). Thus we say **operator overloading** is a kind of **polymorphism**.

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demo_2

Special Method Names in Python (Summary)

Certain names are special because they have built-in behaviors
These names always start and end with two underscores

__init__ Method invoked automatically when an object is constructed

__repr/str__ Method invoked to display an object as a Python expression

__add/radd__ Method invoked to add one object to another

__float__ Method invoked to convert an object to a float (real number)

More Special Methods:

http://docs.python.org/py3k/reference/datamodel.html#special-method-names