

Special Methods

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

Polymorphism



Polymorphism



- Ad Hoc Polymorphism
 - Parametric Polymorphism
 - Inclusion Polymorphism
-

Polymorphism



- Ad Hoc Polymorphism

e.g., Overloading:

```
foo(int) { xxx }
```

```
foo(string) {xx xxx xx}
```

- Parametric Polymorphism

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e.g., Overloading:

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foo(int) { xxx }
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- Parametric Polymorphism

e.g., Generic functions:

```
Template <typename T>
```

```
T foo(T x, T y) {
```

```
    return (x > y) ? x : y;
```

```
}
```

```
foo<int>(3,7)
```

```
foo<char>('h','k')
```

- Inclusion Polymorphism

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- Inclusion Polymorphism

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__`)

- Parametric Polymorphism

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    return (x > y) ? x : y;
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`v.foo();`

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:

```
>>> print(half)
1/2
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[>>> import datetime
>>> now = datetime.datetime.now()
>>> now
datetime.datetime(2020, 9, 14, 10, 36, 46, 832676)
>>> repr(now)
'datetime.datetime(2020, 9, 14, 10, 36, 46, 832676)'  
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>>> str(now)
'2020-09-14 10:36:46.832676'
```

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repr is to be unambiguous
str is to be readable

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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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They apply to any object and do not have much logic, and they defer to the object (comes in) to decide what to do

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>>> half.__repr__()
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Implementing repr and str

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def repr(x):  
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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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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>
