61A Lecture 16
Announcements
String Representations
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For instance, by producing a string representation of itself.
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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
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The `repr` function returns a Python expression (a string) that evaluates to an equal object.
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repr(object) -> string
```

Return the canonical string representation of the object. For most object types, `eval(repr(object)) == object`. 
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```python
>>> 12e12
12e12
```
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>>> print(repr(12e12))
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```

Some objects do not have a simple Python-readable string
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```python
>>> 12e12
12000000000000.0
>>> print(repr(12e12))
12000000000000.0
```

Some objects do not have a simple Python-readable string

```python
>>> repr(min)
'\lt;built-in function min\gt\'
```
The str String for an Object

Human interpretable strings are useful as well:
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```python
>>> from fractions import Fraction
```
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>>> half = Fraction(1, 2)
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The result of calling `str` on the value of an expression is what Python prints using the `print` function:
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(Demo)
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**Polymorphic Functions**

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*repr* invokes a zero-argument method __repr__ on its argument.
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`repr` invokes a zero-argument method `__repr__` on its argument

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>>> half.__repr__()
'Fraction(1, 2)'
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'Fraction(1, 2)'
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`str` invokes a zero-argument method `__str__` on its argument

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- *Question:* How would we implement this behavior?

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def repr(x):
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```python
def repr(x):
    return x.__repr__()
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```python
def repr(x):
    return type(x).__repr__(x)
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```python
def repr(x):
    return super(x).__repr__()
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The behavior of `str` is also complicated:

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Interfaces

**Message passing:** Objects interact by looking up attributes on each other (passing messages)
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**Example:**
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**Example:**

Classes that implement `__repr__` and `__str__` methods that return Python-interpretable and human-readable strings implement an interface for producing string representations
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**Example:**

Classes that implement `__repr__` and `__str__` methods that return Python-interpretable and human-readable strings implement an interface for producing string representations

(Demo)
Special Method Names
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`__init__`
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- `__init__` Method invoked automatically when an object is constructed.
- `__repr__` Method invoked to display an object as a Python expression.
Special Method Names in Python

Certain names are special because they have built-in behavior.

These names always start and end with two underscores:

- `__init__`: Method invoked automatically when an object is constructed.
- `__repr__`: Method invoked to display an object as a Python expression.
- `__add__`: Method for adding objects.
Special Method Names in Python

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- `__bool__`:
Special Method Names in Python

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__init__     Method invoked automatically when an object is constructed
__repr__     Method invoked to display an object as a Python expression
__add__      Method invoked to add one object to another
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```python
>>> zero, one, two = 0, 1, 2
```
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Certain names are special because they have built-in behavior.

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- `__init__` Method invoked automatically when an object is constructed.
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- `__add__` Method invoked to add one object to another.
- `__bool__` Method invoked to convert an object to True or False.
- `__float__` Method invoked to convert an object to a float (real number).

```python
>>> zero, one, two = 0, 1, 2
>>> one + two
3
```
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- `__init__`: Method invoked automatically when an object is constructed.
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```python
>>> zero, one, two = 0, 1, 2
>>> one + two
3
>>> bool(zero), bool(one)
(False, True)
```
Certain names are special because they have built-in behavior. These names always start and end with two underscores:

- `_init_` - Method invoked automatically when an object is constructed.
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```

Same behavior using methods.
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>>> zero, one, two = 0, 1, 2
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>>> bool(zero), bool(one)
(False, True)
```

```python
>>> zero, one, two = 0, 1, 2
>>> one.__add__(two)
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```
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>>> zero, one, two = 0, 1, 2
>>> one + two
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(False, True)
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>>> zero, one, two = 0, 1, 2
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>>> zero.__bool__(), one.__bool__()
(False, True)
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Special Methods
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Adding instances of user-defined classes invokes either the __add__ or __radd__ method.
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```python
>>> Ratio(1, 3) + Ratio(1, 6)
Ratio(1, 2)
```
## Special Methods

Adding instances of user-defined classes invokes either the \_\_add\_\_ or \_\_radd\_\_ method.

```python
>>> Ratio(1, 3) + Ratio(1, 6)
Ratio(1, 2)

>>> Ratio(1, 3).__add__(Ratio(1, 6))
Ratio(1, 2)
```
Special Methods

Adding instances of user-defined classes invokes either the __add__ or __radd__ method

```python
>>> Ratio(1, 3) + Ratio(1, 6)
Ratio(1, 2)
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>>> Ratio(1, 3).__add__(Ratio(1, 6))
Ratio(1, 2)
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>>> Ratio(1, 6).__radd__(Ratio(1, 3))
Ratio(1, 2)
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Special Methods

Adding instances of user-defined classes invokes either the \_\_add\_\_ or \_\_radd\_\_ method

```python
>>> Ratio(1, 3) + Ratio(1, 6)
Ratio(1, 2)

>>> Ratio(1, 3).\_\_add\_\_(Ratio(1, 6))
Ratio(1, 2)

>>> Ratio(1, 6).\_\_radd\_\_(Ratio(1, 3))
Ratio(1, 2)
```


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

Adding instances of user-defined classes invokes either the __add__ or __radd__ method

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>>> Ratio(1, 3) + Ratio(1, 6)
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>>> Ratio(1, 3).__add__(Ratio(1, 6))
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>>> Ratio(1, 6).__radd__(Ratio(1, 3))
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http://docs.python.org/py3k/reference/datamodel.html#special-method-names


(Demo)
Generic Functions
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**Type Dispatching:** Inspect the type of an argument in order to select behavior
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**Type Coercion:** Convert one value to match the type of another
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A polymorphic function might take two or more arguments of different types

**Type Dispatching:** Inspect the type of an argument in order to select behavior

**Type Coercion:** Convert one value to match the type of another

```python
>>> Ratio(1, 3) + 1
Ratio(4, 3)
```
Generic Functions

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**Type Coercion:** Convert one value to match the type of another

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(Demo)