Announcements

- Project 2 due Thursday 10/9 @ 11:59pm
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• Homework 5 due Wednesday 10/15 @ 11:59pm
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- Special event on Tuesday 10/14 @ 7pm, John interviews Dropbox CEO/founder Drew Houston
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  "No video, so come to Wheeler"
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  ▸ No video, so come to Wheeler
  ▸ Suggest questions and vote for your favorites at http://goo.gl/HtkXFf or on Piazza
Object-Oriented Programming
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A method for organizing modular programs
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A method for organizing modular programs

- Data abstraction
Object-Oriented Programming

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• Data abstraction
• Bundling together information and related behavior
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A metaphor for computation using distributed state
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- Each object has its own local state
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• Each object has its own local state
• Each object also knows how to manage its own local state, based on method calls
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• Each object has its own local state
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• Several objects may all be instances of a common type
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Specialized syntax & vocabulary to support this metaphor
Classes
A class serves as a template for its instances.
Classes

A class serves as a template for its instances.

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.
A class serves as a template for its instances.

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```python
>>> a = Account('Jim')
```
A class serves as a template for its instances.

Idea: All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```python
>>> a = Account('Jim')
>>> a.holder
'Jim'
```
A class serves as a template for its instances.

Idea: All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```python
>>> a = Account('Jim')
>>> a.holder
'Jim'
>>> a.balance
0
```
A class serves as a template for its instances.

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```python
golden Rule: a = Account('Jim')
>>> a.holder
'Jim'
>>> a.balance
0
```

**Idea:** All bank accounts should have "withdraw" and "deposit" behaviors that all work in the same way.
Classes

A class serves as a template for its instances.

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```python
>>> a = Account('Jim')
>>> a.holder
'Jim'
>>> a.balance
0
>>> a.deposit(15)
15
```

**Idea:** All bank accounts should have "withdraw" and "deposit" behaviors that all work in the same way.
A class serves as a template for its instances.

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```
>>> a = Account('Jim')
>>> a.holder
'Jim'
>>> a.balance
0
>>> a.deposit(15)
15
>>> a.withdraw(10)
5
```
Classes

A class serves as a template for its instances.

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```python
>>> a = Account('Jim')
>>> a.holder
'Jim'
>>> a.balance
0
>>> a.deposit(15)
15
>>> a.withdraw(10)
5
>>> a.balance
5
```

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**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```python
>>> a = Account('Jim')
>>> a.holder
'Jim'
>>> a.balance
0

>>> a.deposit(15)
15
>>> a.withdraw(10)
5
>>> a.balance
5
>>> a.withdraw(10)
'Insufficient funds'
```

**Idea:** All bank accounts should have "withdraw" and "deposit" behaviors that all work in the same way.
A class serves as a template for its instances.

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each newly created instance.

```python
>>> a = Account('Jim')
>>> a.holder
'Jim'
>>> a.balance
0
```

**Idea:** All bank accounts should have "withdraw" and "deposit" behaviors that all work in the same way.

```python
>>> a.deposit(15)
15
>>> a.withdraw(10)
5
>>> a.balance
5
```

**Better idea:** All bank accounts share a "withdraw" method and a "deposit" method.

```python
>>> a.withdraw(10)
'Insufficient funds'
```
Class Statements
The Class Statement
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class <name>:
    <suite>
A class statement creates a new class and binds that class to `<name>` in the first frame of the current environment.
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The Class Statement

class <name>:
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The suite is executed when the class statement is executed.

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```python
>>> class Clown:
...     nose = 'big and red'
...     def dance():
...         return 'No thanks'
...```

The Class Statement

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The suite is executed when the class statement is executed.

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```python
>>> class Clown:
    ...    nose = 'big and red'
    ...    def dance():
    ...        return 'No thanks'
    ...
>>> Clown.nose
'big and red'
```
The Class Statement

class <name>:
    <suite>

A class statement creates a new class and binds that class to <name> in the first frame of the current environment.

Assignment & def statements in <suite> create attributes of the class (not names in frames)

>>> class Clown:
...    nose = 'big and red'
...    def dance():
...        return 'No thanks'
...    
>>> Clown.nose
'big and red'
>>> Clown.dance()
'No thanks'
The Class Statement

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A class statement creates a new class and binds that class to `<name>` in the first frame of the current environment.

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```python
>>> class Clown:
...    nose = 'big and red'
...    def dance():
...        return 'No thanks'
...    
>>> Clown.nose
'big and red'
>>> Clown.dance()
'No thanks'
>>> Clown
<class '__main__.Clown'>
```
Object Construction
Object Construction

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each of its instances

```python
>>> a = Account('Jim')
```
Object Construction

**Idea:** All bank accounts have a balance and an account holder; the `Account` class should add those attributes to each of its instances

```python
>>> a = Account('Jim')
```

When a class is called:
Object Construction

Idea: All bank accounts have a balance and an account holder; the Account class should add those attributes to each of its instances

```python
>>> a = Account('Jim')
```

When a class is called:

1. A new instance of that class is created:
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When a class is called:

1. A new instance of that class is created:

2. The `__init__` method of the class is called with the new object as its first argument (named `self`), along with any additional arguments provided in the call expression.
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```python
class Account:
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder
```
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>>> a = Account('Jim')
```

When a class is called:

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   - balance: 0

2. The `__init__` method of the class is called with the new object as its first argument (named `self`), along with any additional arguments provided in the call expression.

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```python
>>> a = Account('Jim')
```

When a class is called:

1. A new instance of that class is created:

   ```python
   balance: 0   holder: 'Jim'
   ```

2. The `__init__` method of the class is called with the new object as its first argument (named `self`), along with any additional arguments provided in the call expression.

   ```python
   class Account:
       def __init__(self, account_holder):
           self.balance = 0
           self.holder = account_holder
   ```
Object Construction

**Idea:** All bank accounts have a balance and an account holder; the Account class should add those attributes to each of its instances

```python
>>> a = Account('Jim')
>>> a.holder
'Jim'
```

When a class is called:

1. A new instance of that class is created:

```
balance: 0  holder: 'Jim'
```

2. The `__init__` method of the class is called with the new object as its first argument (named `self`), along with any additional arguments provided in the call expression.

```python
class Account:
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder
```

__init__ is called a constructor
Object Construction

Idea: All bank accounts have a balance and an account holder; the Account class should add those attributes to each of its instances

```python
>>> a = Account('Jim')
>>> a.holder
'Jim'
>>> a.balance
0
```

When a class is called:

1. A new instance of that class is created:

2. The `__init__` method of the class is called with the new object as its first argument (named `self`), along with any additional arguments provided in the call expression.

```python
class Account:
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder
```

__init__ is called a constructor
Object Identity
Object Identity

Every object that is an instance of a user-defined class has a unique identity:
Object Identity

Every object that is an instance of a user-defined class has a unique identity:

```python
>>> a = Account('Jim')
>>> b = Account('Jack')
```
Object Identity

Every object that is an instance of a user-defined class has a unique identity:

```python
>>> a = Account('Jim')
>>> b = Account('Jack')
```

Every call to `Account` creates a new `Account` instance. There is only one `Account` class.
Object Identity

Every object that is an instance of a user-defined class has a unique identity:

```python
>>> a = Account('Jim')
>>> b = Account('Jack')
>>> a.balance
0
>>> b.holder
'Jack'
```

Every call to Account creates a new Account instance. There is only one Account class.
Object Identity

Every object that is an instance of a user-defined class has a unique identity:

```python
>>> a = Account('Jim')
>>> b = Account('Jack')
>>> a.balance
0
>>> b.holder
'Jack'
```

Identity operators "is" and "is not" test if two expressions evaluate to the same object:

Every call to Account creates a new Account instance. There is only one Account class.
Object Identity

Every object that is an instance of a user-defined class has a unique identity:

```python
>>> a = Account('Jim')
>>> b = Account('Jack')
>>> a.balance
0
>>> b.holder
'Jack'
```

Identity operators "is" and "is not" test if two expressions evaluate to the same object:

```python
>>> a is a
True
>>> a is not b
True
```
Every object that is an instance of a user-defined class has a unique identity:

```python
>>> a = Account('Jim')
>>> b = Account('Jack')
>>> a.balance
0
>>> b.holder
'Jack'
```

Identity operators "is" and "is not" test if two expressions evaluate to the same object:

```python
>>> a is a
True
>>> a is not b
True
```

Binding an object to a new name using assignment does not create a new object:
Object Identity

Every object that is an instance of a user-defined class has a unique identity:

```python
>>> a = Account('Jim')
>>> b = Account('Jack')
>>> a.balance
0
>>> b.holder
'Jack'
```

Identity operators "is" and "is not" test if two expressions evaluate to the same object:

```python
>>> a is a
True
>>> a is not b
True
```

Binding an object to a new name using assignment does not create a new object:

```python
>>> c = a
>>> c is a
True
```
Methods
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Methods are functions defined in the suite of a class statement
Methods

Methods are functions defined in the suite of a class statement

class Account:
Methods

Methods are functions defined in the suite of a class statement

```python
    def __init__(self, account_holder):
```
Methods

Methods are functions defined in the suite of a class statement

```python
self.balance = 0
```
Methods

Methods are functions defined in the suite of a class statement

```python
self.holder = account_holder
```
Methods

Methods are functions defined in the suite of a class statement

```python
def deposit(self, amount):
```
Methods

Methods are functions defined in the suite of a class statement

```python
def __init__(self, account_holder):
    self.balance = 0
    self.holder = account_holder

def deposit(self, amount):
```

*Self should always be bound to an instance of the Account class*
Methods

Methods are functions defined in the suite of a class statement

```python
self should always be bound to an instance of the Account class

self.balance = self.balance + amount
```
Methods

Methods are functions defined in the suite of a class statement

```python
self should always be bound to an instance of the Account class

return self.balance
```
Methods

Methods are functions defined in the suite of a class statement

```python
class Account:
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder

    def deposit(self, amount):
        self.balance = self.balance + amount
        return self.balance

    def withdraw(self, amount):
        # self should always be bound to an instance of the Account class

    def __str__(self):
        return f'Account holder: {self.holder} | Balance: {self.balance}
```
Methods

Methods are functions defined in the suite of a class statement.

def __init__(self, account_holder):
    self.balance = 0
    self.holder = account_holder

def deposit(self, amount):
    self.balance = self.balance + amount
    return self.balance

def withdraw(self, amount):
    if amount > self.balance:
        # self should always be bound to an instance of the Account class
        if amount > self.balance:
            return False
        return True

if amount > self.balance:
Methods

Methods are functions defined in the suite of a class statement

```python
class Account:
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder

    def deposit(self, amount):
        self.balance = self.balance + amount
        return self.balance

    def withdraw(self, amount):
        if amount > self.balance:
            return 'Insufficient funds'
        self.balance -= amount
        return self.balance
```

self should always be bound to an instance of the Account class

```python
return 'Insufficient funds'
```
Methods

Methods are functions defined in the suite of a class statement

```python
self.balance = self.balance - amount
```

`self` should always be bound to an instance of the `Account` class.
Methods

Methods are functions defined in the suite of a class statement

```python
self should always be bound to an instance of the Account class

return self.balance
```
Methods

Methods are functions defined in the suite of a class statement.

```python
class Account:
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder

    def deposit(self, amount):
        self.balance = self.balance + amount
        return self.balance

    def withdraw(self, amount):
        if amount > self.balance:
            return 'Insufficient funds'
        self.balance = self.balance - amount
        return self.balance
```

These `def` statements create function objects as always, but their names are bound as attributes of the class.

*Note: `self` should always be bound to an instance of the Account class.*
Methods

Methods are functions defined in the suite of a class statement.

```
self should always be bound to an instance of the Account class
```

```
return self.balance
```

These def statements create function objects as always, but their names are bound as attributes of the class.
Invoking Methods
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All invoked methods have access to the object via the self parameter, and so they can all access and manipulate the object's state.
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All invoked methods have access to the object via the self parameter, and so they can all access and manipulate the object's state.

class Account:
    ...
    def deposit(self, amount):
        self.balance = self.balance + amount
        return self.balance
Invoking Methods

All invoked methods have access to the object via the self parameter, and so they can all access and manipulate the object's state.

class Account:
    ...
    def deposit(self, amount):
        self.balance = self.balance + amount
    return self.balance
Invoking Methods

All invoked methods have access to the object via the self parameter, and so they can all access and manipulate the object's state.

```python
class Account:
    ...
    def deposit(self, amount):
        self.balance = self.balance + amount
        return self.balance
```

Dot notation automatically supplies the first argument to a method.
Invoking Methods

All invoked methods have access to the object via the self parameter, and so they can all access and manipulate the object's state.

```python
class Account:
    ...
    def deposit(self, amount):
        self.balance = self.balance + amount
        return self.balance
```

Dot notation automatically supplies the first argument to a method.

```python
>>> tom_account = Account('Tom')
>>> tom_account.deposit(100)
100
```
Invoking Methods

All invoked methods have access to the object via the self parameter, and so they can all access and manipulate the object's state.

```python
class Account:
    ...
    def deposit(self, amount):
        self.balance = self.balance + amount
        return self.balance
```

Dot notation automatically supplies the first argument to a method.

```python
>>> tom_account = Account('Tom')
>>> tom_account.deposit(100)
100
```
Dot Expressions
Objects receive messages via dot notation.
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Dot notation accesses attributes of the instance or its class.
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<expression> . <name>
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The <expression> can be any valid Python expression.
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The <name> must be a simple name.
Dot Expressions

Objects receive messages via dot notation.

Dot notation accesses attributes of the instance or its class.

<expression> . <name>

The <expression> can be any valid Python expression.

The <name> must be a simple name.

Evaluates to the value of the attribute looked up by <name> in the object that is the value of the <expression>. 
Dot Expressions

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<expression> . <name>

The <expression> can be any valid Python expression.

The <name> must be a simple name.

Evaluates to the value of the attribute looked up by <name> in the object that is the value of the <expression>.

```
tom_account.deposit(10)
```
Dot Expressions

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Dot notation accesses attributes of the instance or its class.

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Evaluates to the value of the attribute looked up by <name> in the object that is the value of the <expression>.

tom_account.deposit(10)

Dot expression
Dot Expressions

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Dot notation accesses attributes of the instance or its class.

\(<\text{expression}>\ . \ <\text{name}>\)

The \(<\text{expression}>\) can be any valid Python expression.

The \(<\text{name}>\) must be a simple name.

Evaluates to the value of the attribute looked up by \(<\text{name}>\) in the object that is the value of the \(<\text{expression}>\).
Dot Expressions

Objects receive messages via dot notation.

Dot notation accesses attributes of the instance or its class.

<expression> . <name>

The <expression> can be any valid Python expression.

The <name> must be a simple name.

Evaluates to the value of the attribute looked up by <name> in the object that is the value of the <expression>.

(Demo)
Attributes
Accessing Attributes
Accessing Attributes

Using `getattr`, we can look up an attribute using a string.
Accessing Attributes

Using getattr, we can look up an attribute using a string

```python
>>> getattr(tom_account, 'balance')
10
```
Accessing Attributes

Using `getattr`, we can look up an attribute using a string

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>>> getattr(tom_account, 'balance')
10
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```python
>>> hasattr(tom_account, 'deposit')
True
```
Accessing Attributes

Using getattr, we can look up an attribute using a string

```python
>>> getattr(tom_account, 'balance')
10

>>> hasattr(tom_account, 'deposit')
True
```

global

global and dot expressions look up a name in the same way
Accessing Attributes

Using `getattr`, we can look up an attribute using a string

```python
>>> getattr(tom_account, 'balance')
10

>>> hasattr(tom_account, 'deposit')
True
```

`getattr` and dot expressions look up a name in the same way

Looking up an attribute name in an object may return:
Accessing Attributes

Using getattr, we can look up an attribute using a string

```python
>>> getattr(tom_account, 'balance')
10
```

```python
>>> hasattr(tom_account, 'deposit')
True
```

getattr and dot expressions look up a name in the same way

Looking up an attribute name in an object may return:

- One of its instance attributes, or
Accessing Attributes

Using `getattr`, we can look up an attribute using a string:

```python
>>> getattr(tom_account, 'balance')
10
```

```python
>>> hasattr(tom_account, 'deposit')
True
```

`getattr` and dot expressions look up a name in the same way.

Looking up an attribute name in an object may return:

- One of its instance attributes, or
- One of the attributes of its class
Methods and Functions
Methods and Functions

Python distinguishes between:
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- Functions, which we have been creating since the beginning of the course, and
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\text{Object } + \text{ Function } = \text{ Bound Method}
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```python
>>> type(Account.deposit)
```
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Object + Function = Bound Method

>>> type(Account.deposit)
<class 'function'>
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>>> type(Account.deposit)
<class 'function'>
>>> type(tom_account.deposit)
```
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\text{Object} + \text{Function} = \text{Bound Method}
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>>> type(Account.deposit)
<class 'function'>
>>> type(tom_account.deposit)
<class 'method'>
```
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\[
\text{Object} + \text{Function} = \text{Bound Method}
\]

```python
>>> type(Account.deposit)
<class 'function'>
>>> type(tom_account.deposit)
<class 'method'>

>>> Account.deposit(tom_account, 1001)
1011
```
Methods and Functions

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>>> type(Account.deposit)
<class 'function'>
>>> type(tom_account.deposit)
<class 'method'>
```

```python
>>> Account.deposit(tom_account, 1001)
1011
>>> tom_account.deposit(1003)
2014
```
Methods and Functions

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Object + Function = Bound Method

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1011
>>> tom_account.deposit(1003)
2014
```

*Function: all arguments within parentheses*
Methods and Functions

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• Functions, which we have been creating since the beginning of the course, and
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Object  +  Function  =  Bound Method

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>>> type(tom_account.deposit)
<class 'method'>

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>>> tom_account.deposit(1003)
2014

**Function:** all arguments within parentheses

**Method:** One object before the dot and other arguments within parentheses
Looking Up Attributes by Name

<expression> . <name>
Looking Up Attributes by Name

\[ \text{<expression> . <name>} \]

To evaluate a dot expression:
Looking Up Attributes by Name

To evaluate a dot expression:

1. Evaluate the \texttt{<expression>} to the left of the dot, which yields the object of the dot expression.
Looking Up Attributes by Name

<expression> . <name>

To evaluate a dot expression:

1. Evaluate the <expression> to the left of the dot, which yields the object of the dot expression.

2. <name> is matched against the instance attributes of that object; if an attribute with that name exists, its value is returned.
Looking Up Attributes by Name

<expression>. <name>

To evaluate a dot expression:

1. Evaluate the <expression> to the left of the dot, which yields the object of the dot expression.

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Looking Up Attributes by Name

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To evaluate a dot expression:

1. Evaluate the <expression> to the left of the dot, which yields the object of the dot expression.

2. <name> is matched against the instance attributes of that object; if an attribute with that name exists, its value is returned.

3. If not, <name> is looked up in the class, which yields a class attribute value.

4. That value is returned unless it is a function, in which case a bound method is returned instead.
Class Attributes
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Class attributes are "shared" across all instances of a class because they are attributes of the class, not the instance.
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Class attributes are "shared" across all instances of a class because they are attributes of the class, not the instance.

class Account:
    interest = 0.02  # A class attribute
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder
    # Additional methods would be defined here
Class Attributes

Class attributes are "shared" across all instances of a class because they are attributes of the class, not the instance.

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>>> tom_account = Account('Tom')
Class Attributes

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>>> tom_account = Account('Tom')
>>> jim_account = Account('Jim')
Class Attributes

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    interest = 0.02  # A class attribute
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder
        # Additional methods would be defined here

>>> tom_account = Account('Tom')
>>> jim_account = Account('Jim')
>>> tom_account.interest
0.02
Class Attributes

Class attributes are "shared" across all instances of a class because they are attributes of the class, not the instance.

class Account:
    interest = 0.02  # A class attribute
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder
    # Additional methods would be defined here

>>> tom_account = Account('Tom')
>>> jim_account = Account('Jim')
>>> tom_account.interest
0.02

The interest attribute is not part of the instance; it's part of the class!
Class Attributes

Class attributes are "shared" across all instances of a class because they are attributes of the class, not the instance.

class Account:
    interest = 0.02  # A class attribute
    def __init__(self, account_holder):
        self.balance = 0
        self.holder = account_holder
    # Additional methods would be defined here

>>> tom_account = Account('Tom')
>>> jim_account = Account('Jim')
>>> tom_account.interest
0.02
>>> jim_account.interest
0.02

The interest attribute is not part of the instance; it's part of the class!
Attribute Assignment
Assignment Statements and Attributes
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression.
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```python
>>> jim_account = Account('Jim')
```
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```python
>>> jim_account = Account('Jim')
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```
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```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest
```
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```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest
0.02
```
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression

- If the object is an instance, then assignment sets an instance attribute
- If the object is a class, then assignment sets a class attribute

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest
0.02
>>> jim_account.interest
```
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression

- If the object is an instance, then assignment sets an instance attribute
- If the object is a class, then assignment sets a class attribute

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest
0.02
>>> jim_account.interest
0.02
```
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression

- If the object is an instance, then assignment sets an instance attribute
- If the object is a class, then assignment sets a class attribute

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest
0.02
>>> jim_account.interest
0.02
>>> Account.interest = 0.04
```
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression

• If the object is an instance, then assignment sets an instance attribute
• If the object is a class, then assignment sets a class attribute

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest
0.02
>>> Account.interest = 0.04
>>> tom_account.interest
20.0
```
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression:

- If the object is an instance, then assignment sets an instance attribute.
- If the object is a class, then assignment sets a class attribute.

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest
0.02
>>> Account.interest = 0.04
>>> tom_account.interest
0.04
```
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression

- If the object is an instance, then assignment sets an instance attribute
- If the object is a class, then assignment sets a class attribute

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest
0.02
>>> jim_account.interest
0.02
>>> Account.interest = 0.04
>>> tom_account.interest
0.04
```
Assignment Statements and Attributes

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• If the object is an instance, then assignment sets an instance attribute
• If the object is a class, then assignment sets a class attribute

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest
0.02
>>> jim_account.interest
0.02
>>> Account.interest = 0.04
>>> tom_account.interest
0.04
>>> jim_account.interest = 0.08
```
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression

- If the object is an instance, then assignment sets an instance attribute
- If the object is a class, then assignment sets a class attribute

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest
0.02
>>> jim_account.interest = 0.08
>>> jim_account.interest
0.08
```
Assignment Statements and Attributes

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>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest = 0.02
>>> jim_account.interest = 0.08
>>> jim_account.interest
0.08
>>> Account.interest = 0.04
>>> tom_account.interest
0.04
>>> Account.interest
0.04
```
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Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression

• If the object is an instance, then assignment sets an instance attribute
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```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest
0.02
>>> jim_account.interest = 0.08
>>> jim_account.interest
0.08
>>> tom_account.interest
0.04
>>> Account.interest = 0.04
>>> tom_account.interest
0.04
```
Assignment Statements and Attributes

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• If the object is an instance, then assignment sets an instance attribute
• If the object is a class, then assignment sets a class attribute

```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
0.02
>>> jim_account.interest = 0.02
0.02
>>> Account.interest = 0.04
>>> tom_account.interest
0.04
```
Assignment Statements and Attributes

Assignment statements with a dot expression on their left-hand side affect attributes for the object of that dot expression

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>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest = 0.02
>>> Account.interest = 0.04
>>> tom_account.interest = 0.04
>>> Account.interest = 0.05
```
Assignment Statements and Attributes

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- If the object is an instance, then assignment sets an instance attribute
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>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest = 0.02
>>> Account.interest = 0.04
>>> tom_account.interest = 0.04
>>> jim_account.interest = 0.08
>>> jim_account.interest
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>>> tom_account.interest
0.04
>>> Account.interest = 0.05
>>> tom_account.interest
0.05
```
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>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest = 0.02
>>> Account.interest = 0.04
>>> tom_account.interest = 0.04
>>> Account.interest = 0.05
>>> tom_account.interest = 0.05
```
Assignment Statements and Attributes

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```python
>>> jim_account = Account('Jim')
>>> tom_account = Account('Tom')
>>> tom_account.interest = 0.02
>>> jim_account.interest = 0.02
>>> Account.interest = 0.04
>>> tom_account.interest = 0.04
>>> Account.interest = 0.05
>>> jim_account.interest = 0.08
>>> Account.interest = 0.05
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```
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>>> Account.interest = 0.04
>>> tom_account.interest = 0.01
>>> Account.interest = 0.05
>>> tom_account.interest = 0.05
>>> jim_account.interest = 0.08
```