Objects

Announcements

Object-Oriented Programming

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Object-Oriented Programming

A method for organizing programs

Object-Oriented Programming

A method for organizing programs

- Data abstraction

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- Data abstraction

- Bundling together information and related behavior

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• Data abstraction

• Bundling together information and related behavior

A metaphor for computation using distributed state

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A metaphor for computation using distributed state

- Each object has its own local state

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•Bundling together information and related behavior

A metaphor for computation using distributed state

•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

- Each object also knows how to manage its own local state,
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- Method calls are messages passed between objects

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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

Object-Oriented Programming

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```
┌─────────────┐
│             │
│   John's    │
│   Account   │
│             │
└─────────────┘
```

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```
John's
Account
```
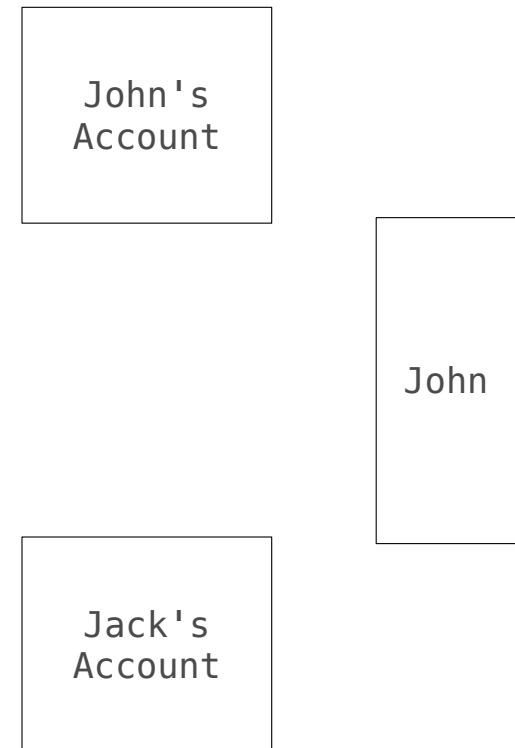
```
Jack's
Account
```

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Specialized syntax & vocabulary to support this metaphor

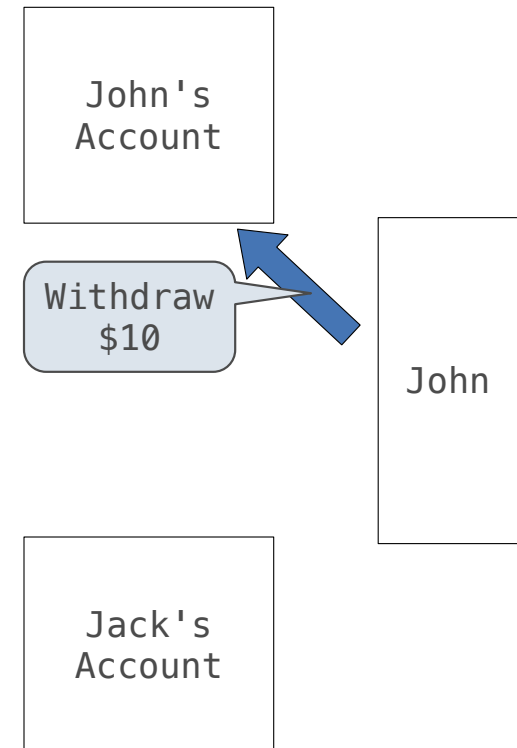John's Account

John

Jack's Account

Object-Oriented Programming

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John's Account

Withdraw $10

John

Jack's Account

Object-Oriented Programming

A method for organizing programs

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• Bundling together information and related behavior

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Object-Oriented Programming

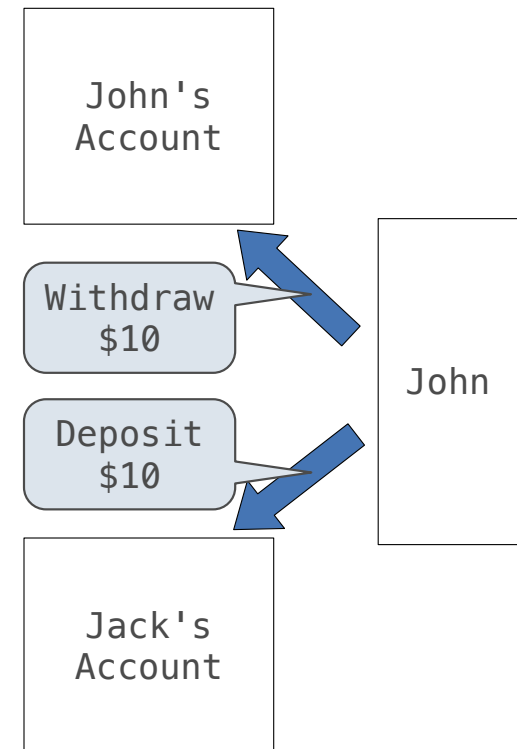A method for organizing programs

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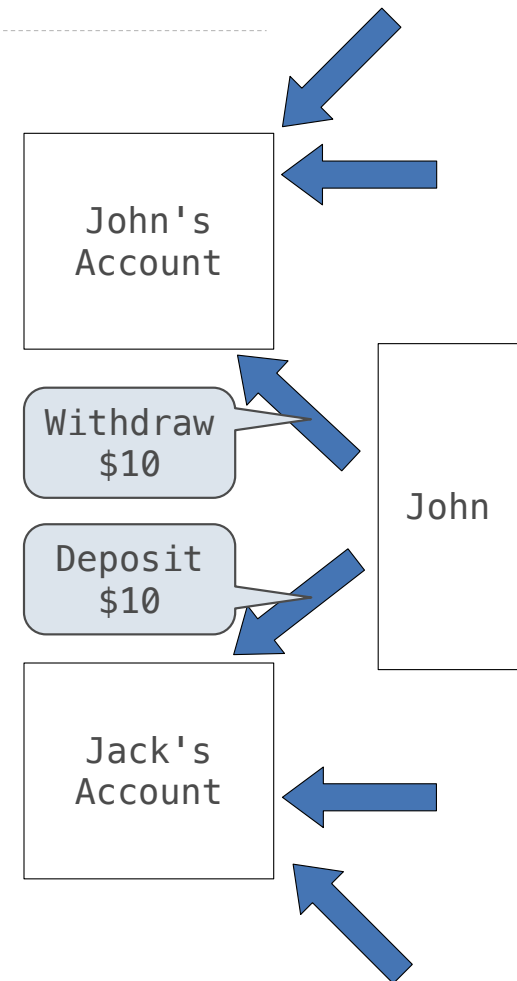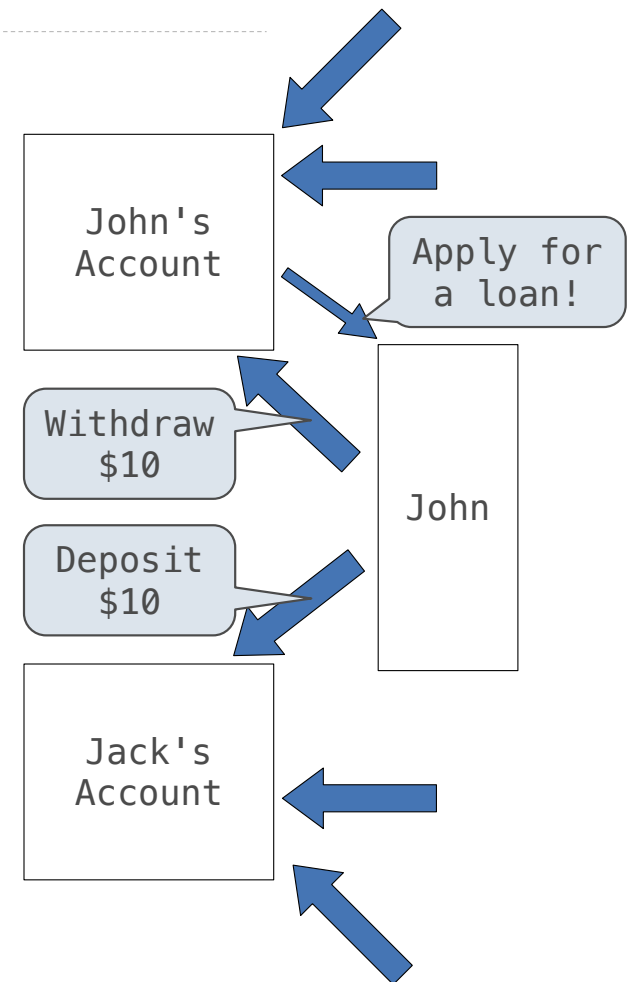A method for organizing programs

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Classes

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A class describes the general behavior of its instances

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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

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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

```
>>> a = Account('John')
>>> a.holder
'John'
```

Classes

A class describes the general behavior of 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('John')
>>> a.holder
'John'
>>> a.balance
0
```

Classes

A class describes the general behavior of 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('John')
>>> a.holder
'John'
>>> a.balance
0
```

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

Classes

A class describes the general behavior of 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('John')
>>> a.holder
'John'
>>> a.balance
0

>>> a.deposit(15)
15
```

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

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A class describes the general behavior of 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('John')
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'John'
>>> a.balance
0
```

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

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

Classes

A class describes the general behavior of 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

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

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>>> a = Account('John')
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'John'
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Classes

A class describes the general behavior of 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('John')
>>> a.holder
'John'
>>> a.balance
0

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

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Classes

A class describes the general behavior of 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

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

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

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

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

Class Statements

The Class Statement

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```
class <name>:
    <suite>
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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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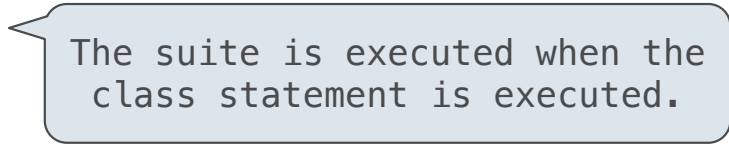
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The Class Statement

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

The Class Statement

```
class <name>:
    <suite>
```

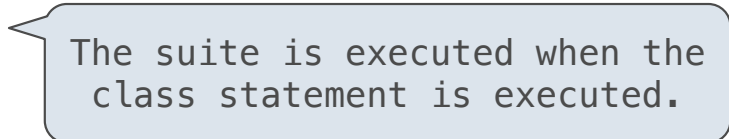> The suite is executed when the class statement is executed.

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>>> Clown.nose
'big and red'
```

The Class Statement

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'big and red'
>>> Clown.dance()
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>>> class Clown:
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<class '__main__.Clown'>
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Object Construction

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Idea: All bank accounts have a **balance** and an account **holder**;
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class Account:
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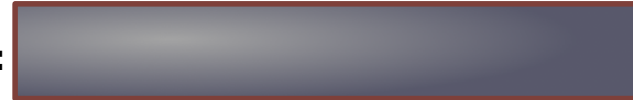
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class Account:
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__init__ is called a constructor

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>>> a = Account('Jim')
>>> a.holder
'Jim'
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When a class is called:

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Object Identity

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>>> b = Account('Jack')
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Every call to Account creates a new Account instance. There is only one Account class.

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

Object Identity

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

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

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

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

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```
>>> a is a
True
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True
```

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

```
>>> c = a
>>> c is a
True
```

Methods

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Methods are functions defined in the suite of a class statement

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```
class Account:
```

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

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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 should always be bound to an instance of the Account class

Methods

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

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

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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
```

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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):
```

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class Account:
    def __init__(self, account_holder):
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        return self.balance
    def withdraw(self, amount):
        if amount > self.balance:
```

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```python
class Account:
    def __init__(self, account_holder):
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        self.balance = self.balance + amount
        return self.balance
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        if amount > self.balance:
            return 'Insufficient funds'
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class Account:
    def __init__(self, account_holder):
        self.balance = 0
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    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
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class Account:
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        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
```

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Methods are functions defined in the suite of a class statement

```python
class Account:
    def __init__(self, account_holder):
        self.balance = 0
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    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
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> self should always be bound to an instance of the Account class

These def statements create function objects as always,
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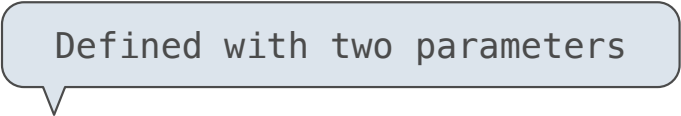
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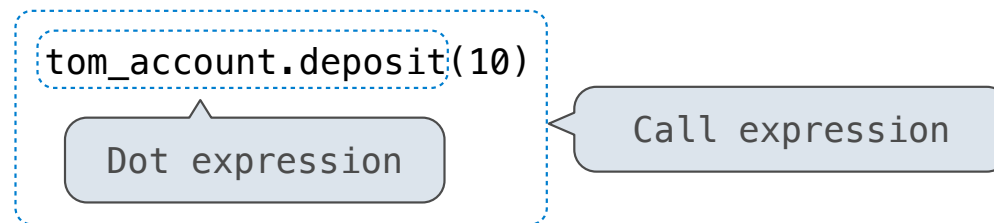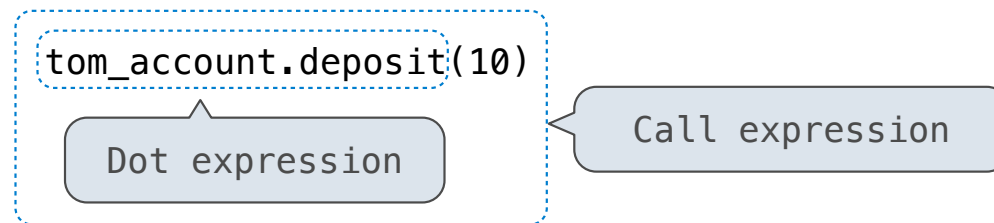Dot notation accesses attributes of the instance or its class

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(Demo)

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Methods and Functions

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1011
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Function: all arguments within parentheses

Method: One object before the dot and other arguments within parentheses

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4. That value is returned unless it is a function, in which case a bound method is returned instead

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