Ruby: Collections

Juan “Harek” Urrios
@xharekx33

What are collections?

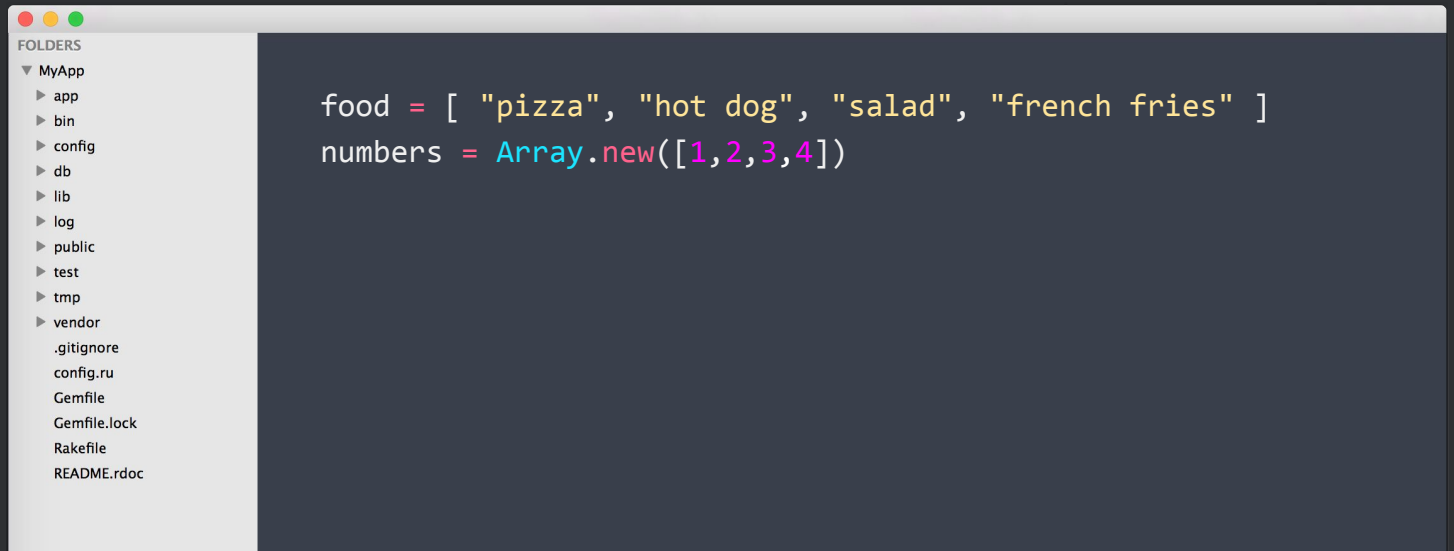
Often we need to store variables that hold more than a single value.

This lists of values are called Collections and allow for the organizing of large amounts of data.

The most common types are: `Arrays` and `Hashes`

Arrays

Arrays can be used to store many different kinds of data including strings, numbers, and almost any other kind of Ruby object.



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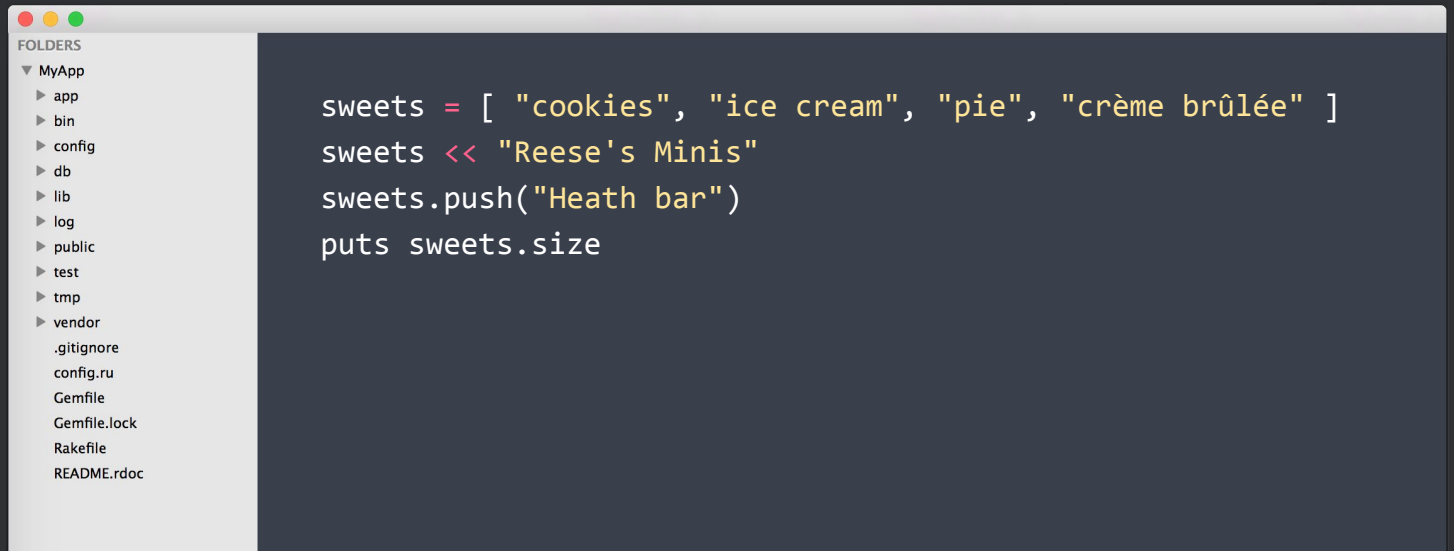
Arrays: Adding items

Arrays are dynamic, so it isn't necessary to preallocate space for them and you can add items after the fact with the push method or the << operator.



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Arrays: Accessing items

You can access elements in the array directly by their assigned number, also known as the index. The index starts at 0, but you can also start from the end of the array using negative numbers!

```
$ irb
2.2-head :001 > food = [ "pizza", "hot dog", "salad", "french
fries" ]
 => ["pizza", "hot dog", "salad", "french fries"]
2.2-head :002 > food[0]
 => "pizza"
2.2-head :003 > food[3]
 => "french fries"
2.2-head :003 > food[-1]
 => "french fries"
```

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Arrays: Accessing items

Be careful, nothing stops you from accessing an index that doesn't exist!

```
$ irb
2.2-head :001 > food = [ "pizza", "hot dog", "salad", "french
fries" ]
 => ["pizza", "hot dog", "salad", "french fries"]
2.2-head :002 > food[900]
 => nil
```

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Arrays: stacks and queues

You can use `pop` to get the last element from the array and remove it, using the Array as a stack. Or you can use `shift` to get the first element from the array and remove it, using the Array as a queue

```
$ irb
2.2-head :001 > food = [ "pizza", "hot dog", "salad", "french
fries" ]
 => ["pizza", "hot dog", "salad", "french fries"]
2.2-head :002 > food.pop
 => "french fries"
2.2-head :003 > food.shift
 => "pizza"
2.2-head :004 > food
 => ["hot dog", "salad"]
```

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Arrays: Deleting specific items

If you want to delete an item with a certain index instead of using `pop` or `shift`, you can use `delete_at` and specify an index

```
$ irb
2.2-head :001 > food = [ "pizza", "hot dog", "salad", "french
fries" ]
 => ["pizza", "hot dog", "salad", "french fries"]
2.2-head :002 > food.delete_at(1)
 => "hot dog"
2.2-head :003 > food.delete_at(-2)
 => "salad"
2.2-head :004 > food
 => ["pizza", "french fries"]
```

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Arrays: Finding items

If you want to find out whether an item is in an array or not you can use `include?` or you can use `index` to get the index of the first instance of that value

```
$ irb
2.2-head :001 > food = [ "pizza", "hot dog", "salad", "french
fries" ]
 => ["pizza", "hot dog", "salad", "french fries"]
2.2-head :002 > food.include?("salad")
 => true
2.2-head :003 > food.index("hot dog")
 => 1
2.2-head :003 > food.index("burger")
 => nil
```

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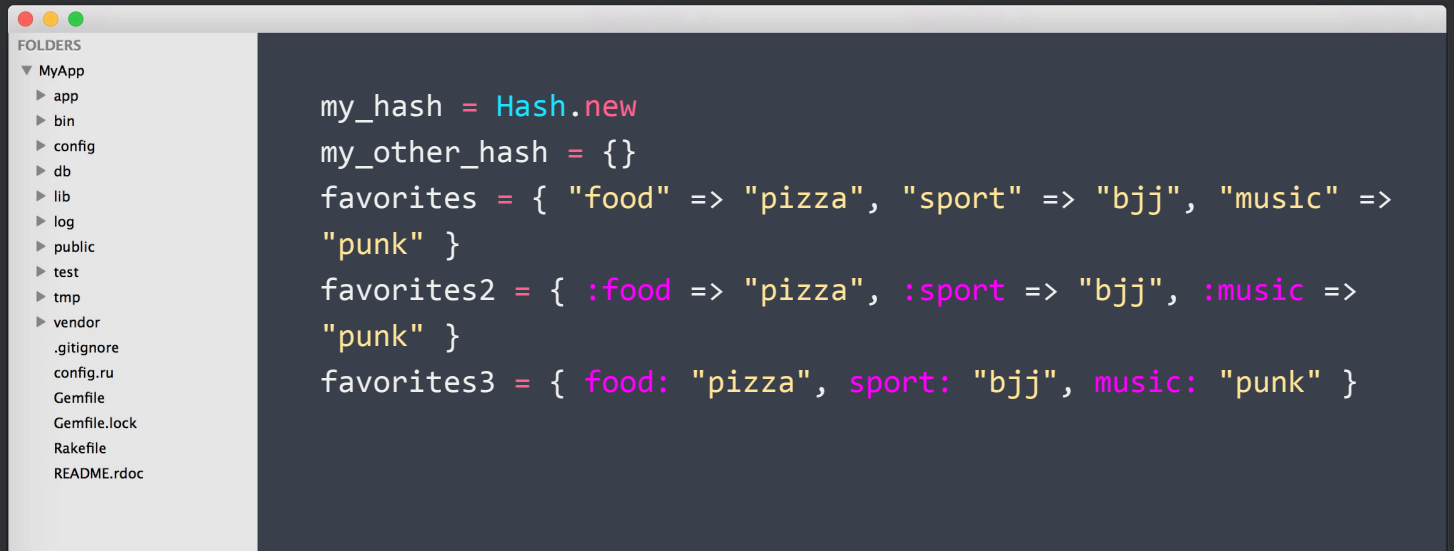
Arrays: Multidimensional

Arrays items do not need to be all of the same data type. They can be heterogeneous.This is rarely useful though.
What can actually be quite useful is to store an Array inside an Array!

```
$ irb
2.2-head :001 > random = [ "yolo", 45, "weird", 7.0, nil ]
 => [ "yolo", 45, "weird", 7.0, nil ]
2.2-head :002 > my_array1 = Array.new(5)
 =>  => [nil, nil, nil, nil, nil]
2.2-head :003 > matrix = Array.new(5, Array.new(2))
 => [[nil, nil], [nil, nil], [nil, nil], [nil, nil], [nil,
nil]]
```

Hashes

Hashes are also containers for data, like arrays, but instead of storing data based on numeric indices, you use "keys" which can be strings or symbols



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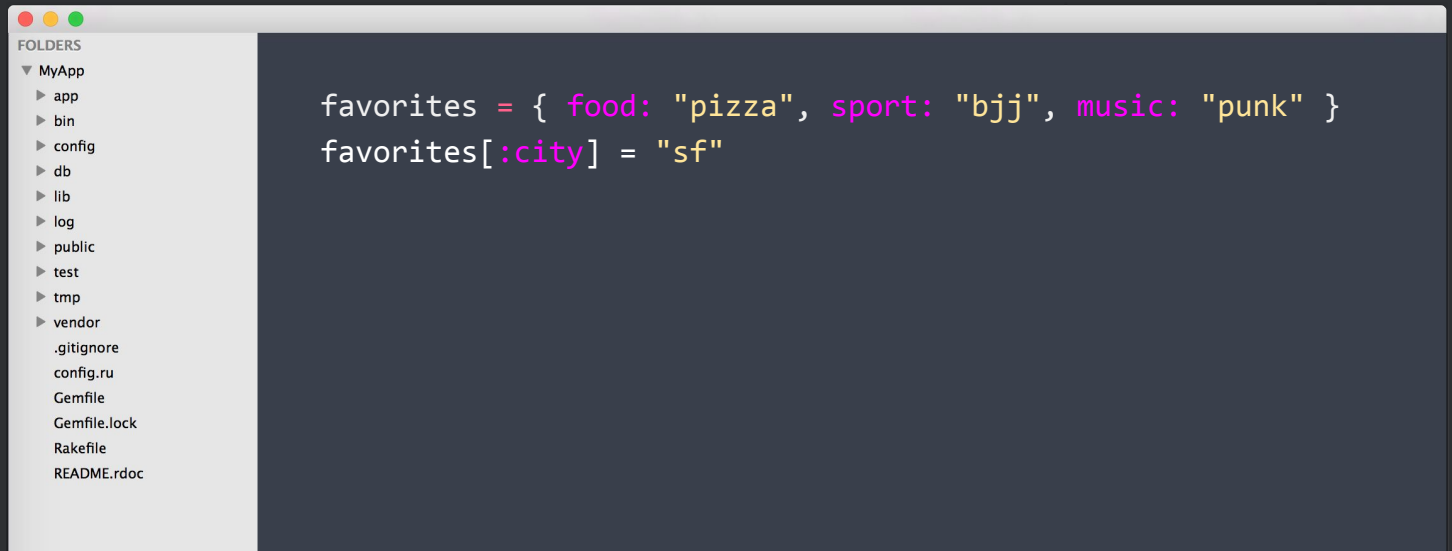
Hashes: Adding items

To add items to a hash you simply define a new key and assign a value.



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Hashes: Accessing items

You can access elements in a hash directly by their key. Don't try to use indexes as you would do with arrays.

```
$ irb
2.2-head :001 > favorites = { food: "pizza", sport: "bjj",
music: "punk" }
 => { food: "pizza", sport: "bjj", music: "punk" }
2.2-head :002 > favorites[:food]
 => "pizza"
2.2-head :003 > favorites[0]
 => nil
```

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Hashes: Deleting specific items

If you want to delete an item from the Hash simply use the `delete` method and specify the key that you want to delete from the hash

```
$ irb
2.2-head :001 > favorites = { food: "pizza", sport: "bjj",
music: "punk" }
 => { food: "pizza", sport: "bjj", music: "punk" }
2.2-head :002 > favorites.delete(:food)
 => "pizza"
2.2-head :003 > favorites
 => { sport: "bjj", music: "punk" }
```

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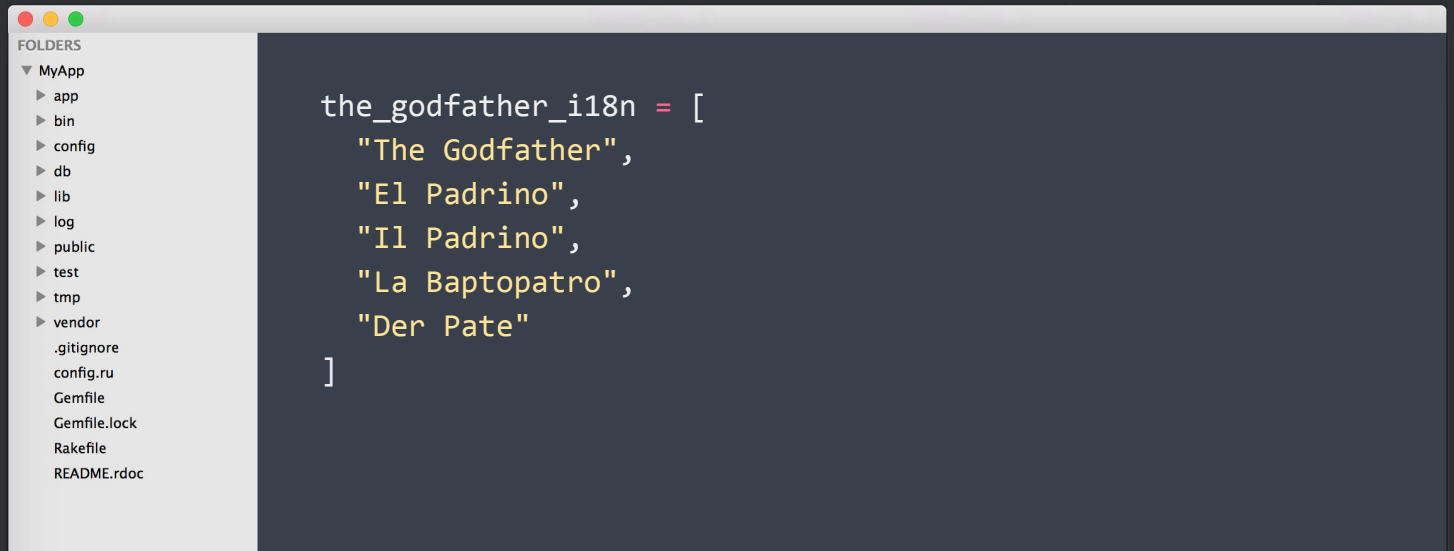
Why use hashes?

What if you're storing lists with no inherent order, but instead need some other property to make sense of the values?



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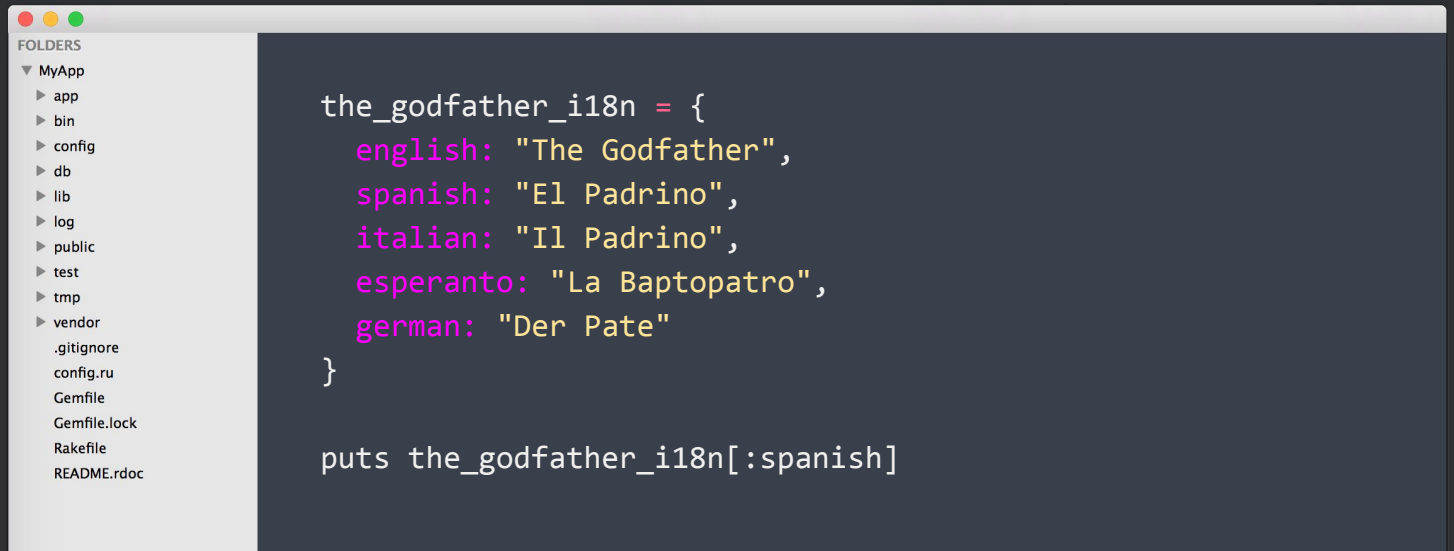
Why use hashes?

To know what translation matches what language using a hash is more convenient and intuitive that having to remember what numeric index corresponds to each language.



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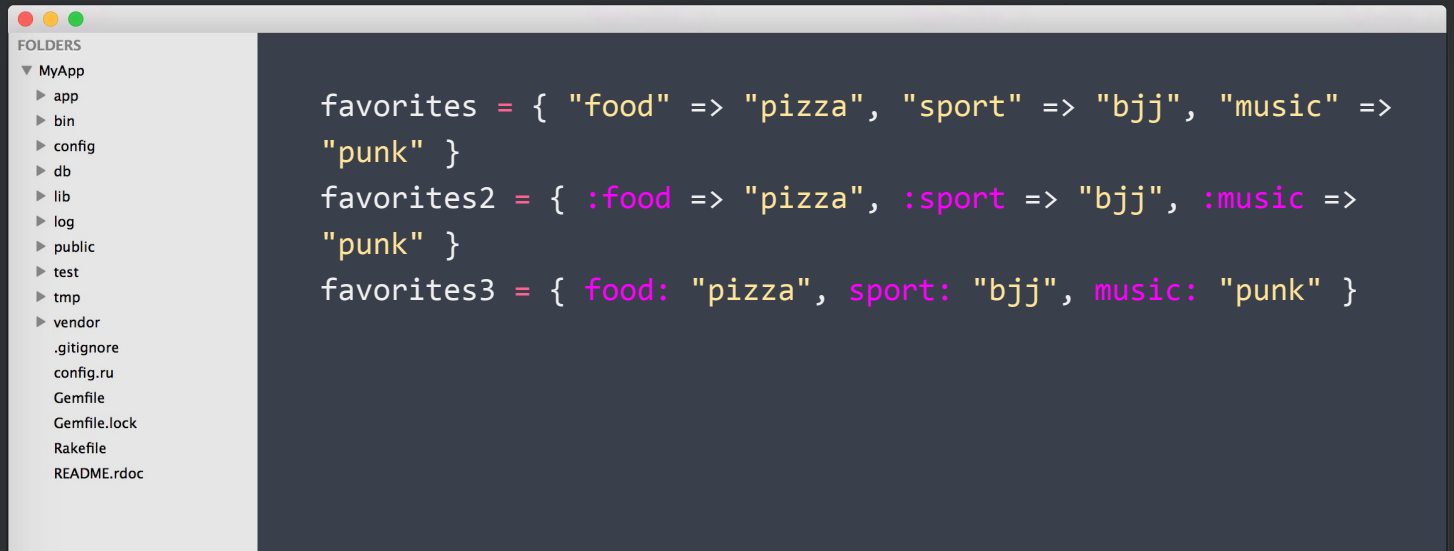
Symbols

There's no quick and easy definition for a symbol (here are 13 ways of looking at them: http://bit.ly/1LkJjbb) For now, let's just say that they are immutable identifiers, usually used as hash keys instead of strings.



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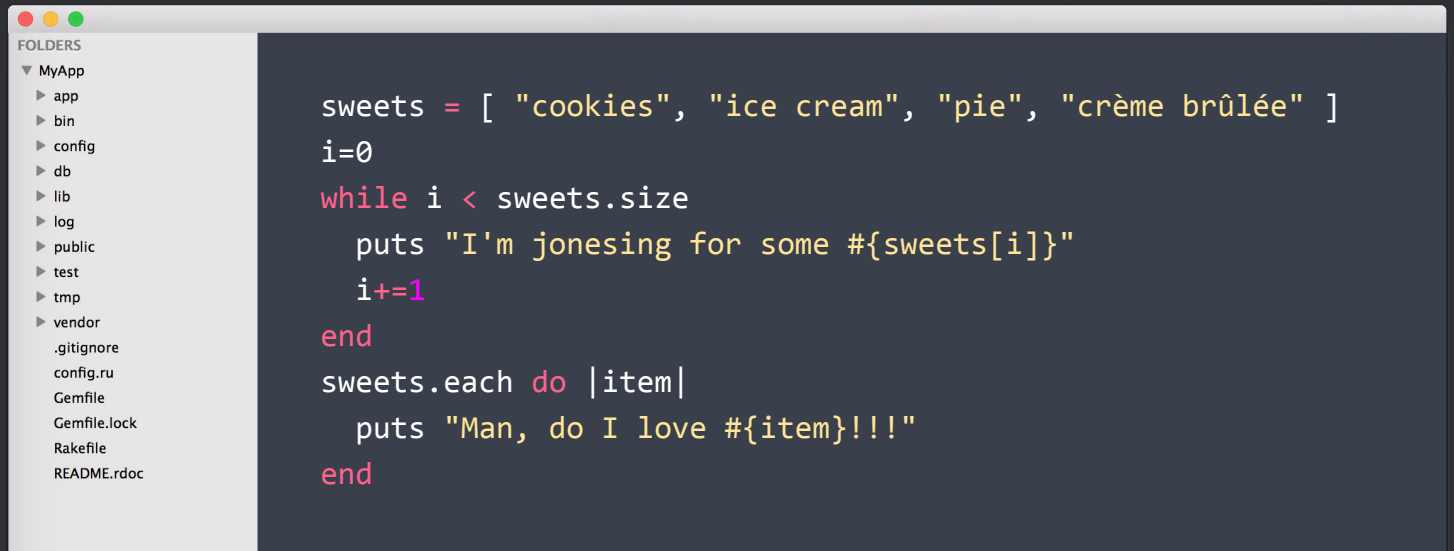
Iteration: each

To go over all the elements in an Array you could build a while loop... but it's cleaner and easier to use the `each` method, that will let you run some code for each item in the array.



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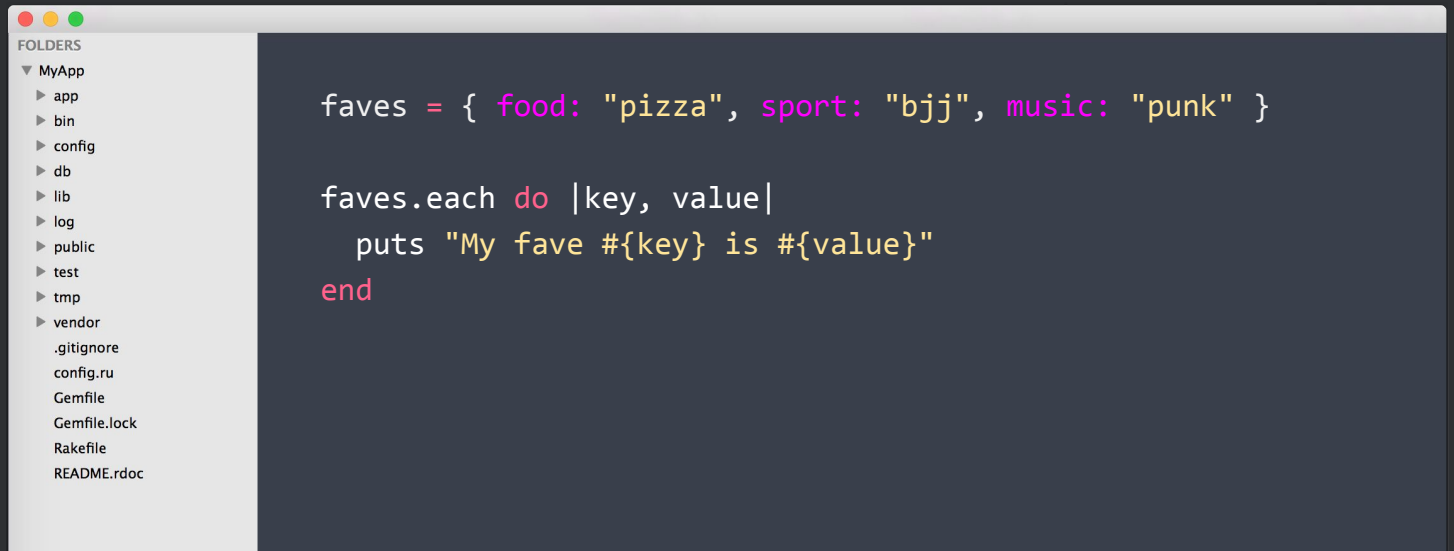
Iteration: each

You can also use `each` with Hashes and get the key, value pair. That's way more convenient that coming up with a regular loop that does the same thing!



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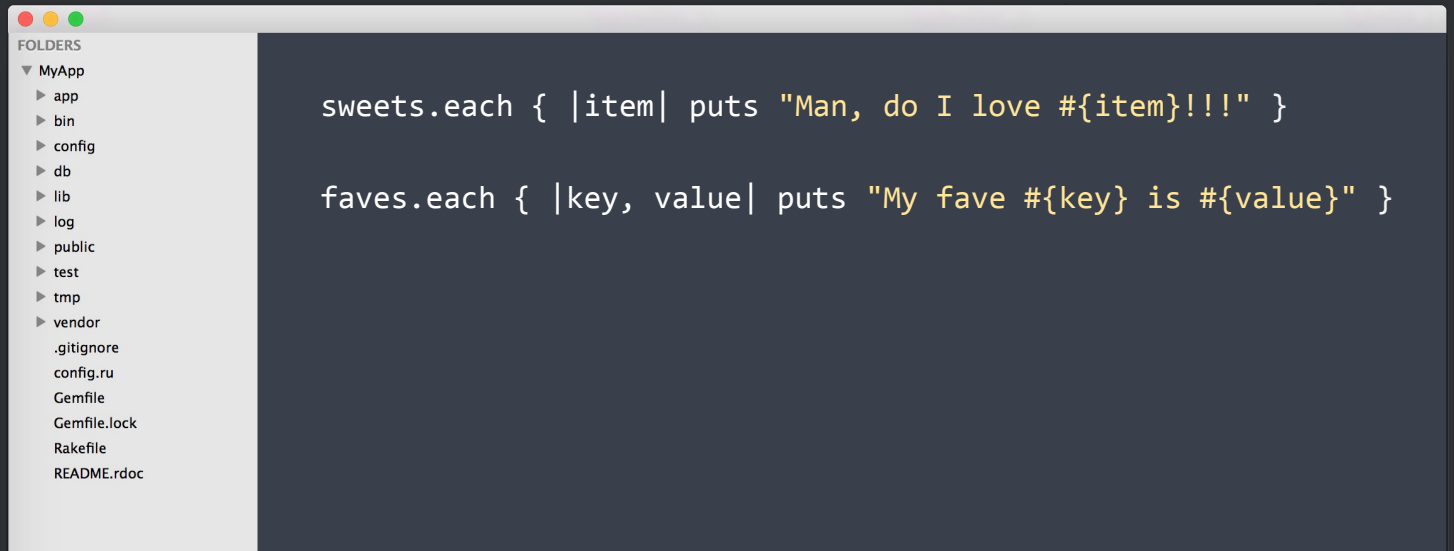
Iteration: each in a single line

Our previous calls to `each` can be written in a single line.



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Exercise: each

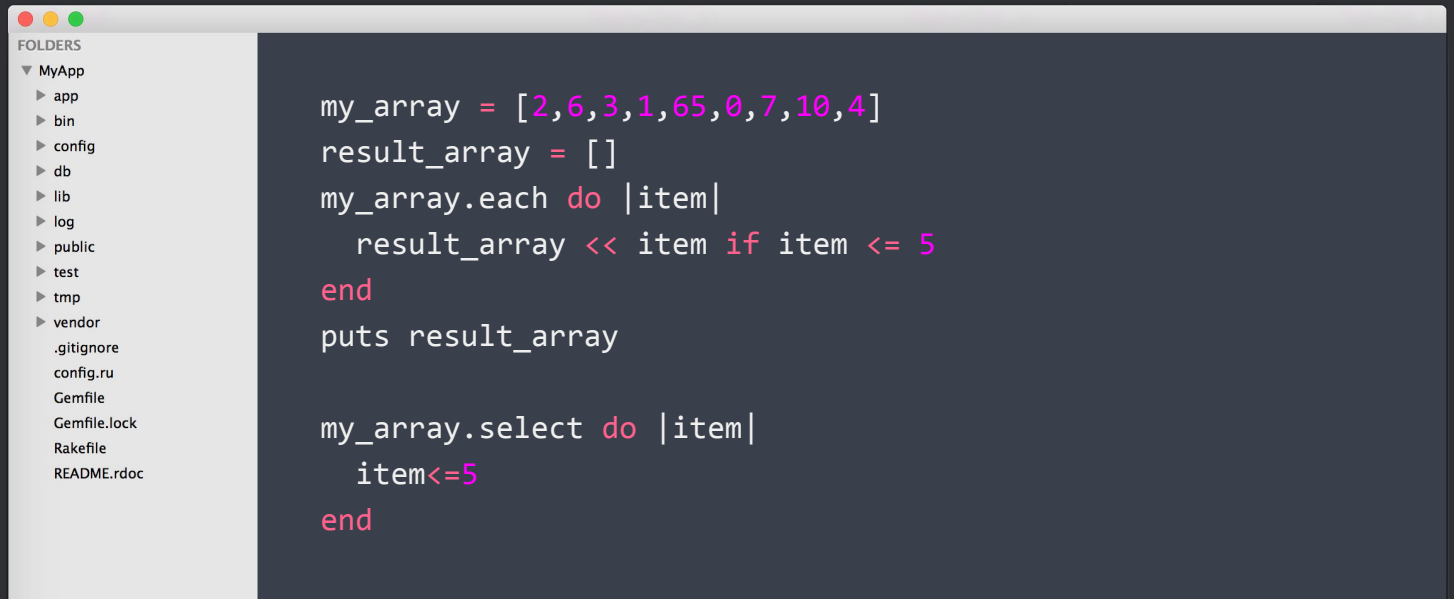
Given an array with all the names of the people in class, tell them "good morning"

Transforming collections

Next we will see other methods we can use to iterate over collections and transform them and how all these methods have `each` at the heart of their functionality.

Iteration: select

With `select` you can extract only the values you want from an Array and get a new array. The original is left untouched.



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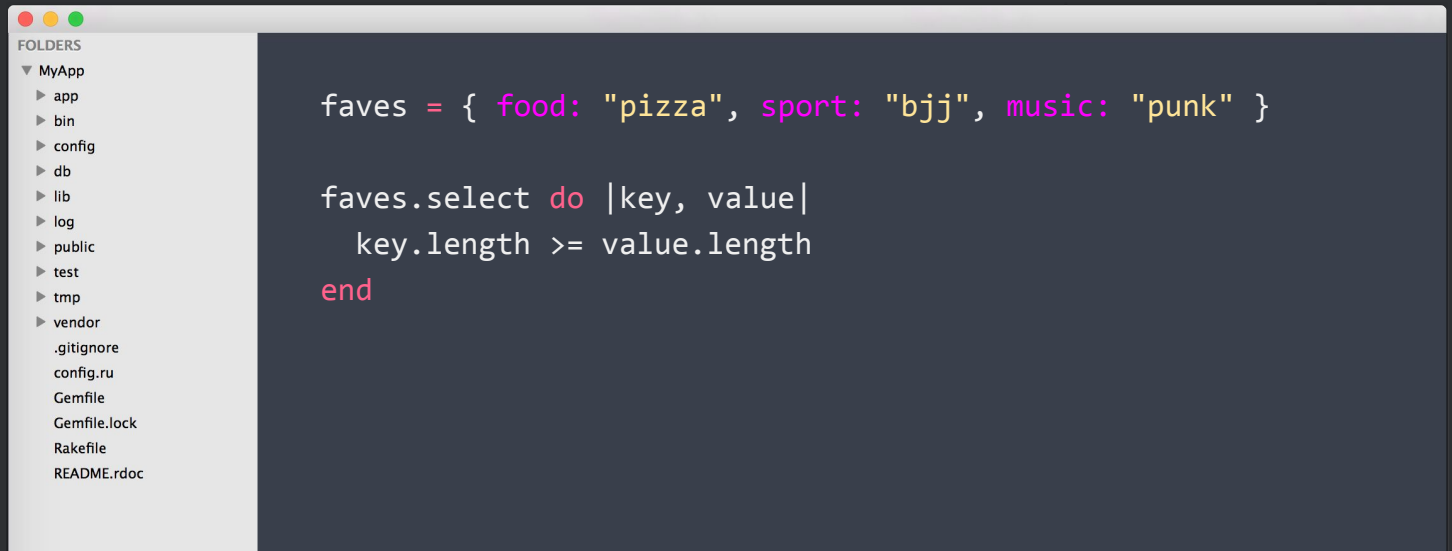
Iteration: select

`Select` can be used with hashes too



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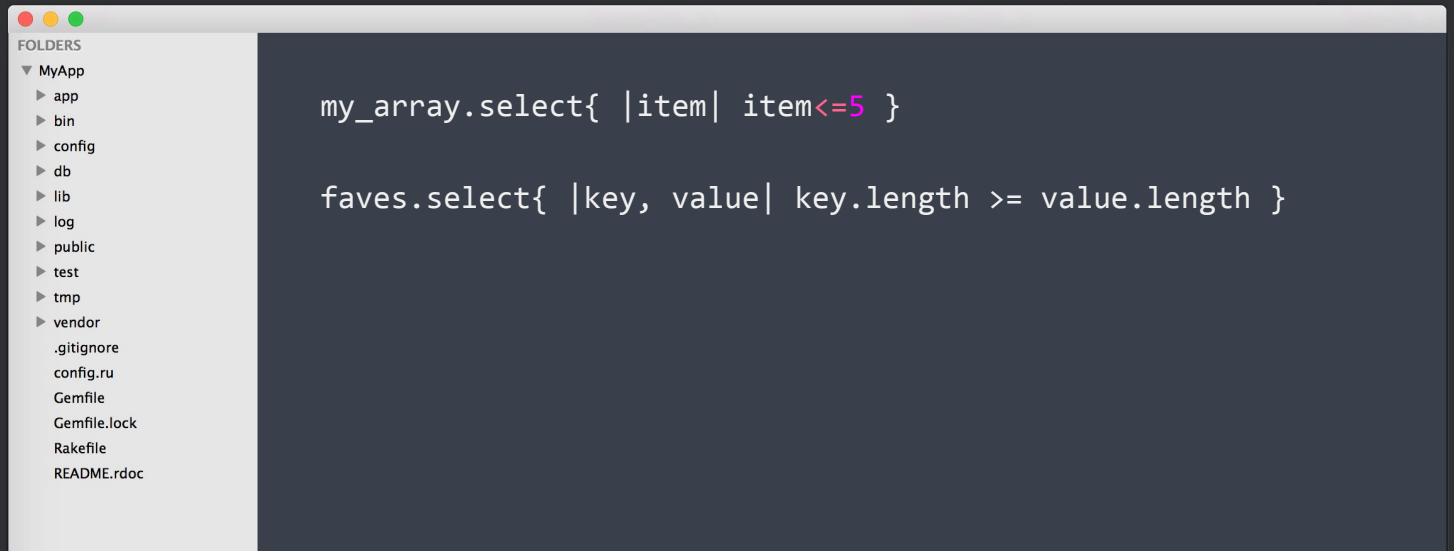
Iteration: select in a single line

Our previous `select` calls can be also written in a single line.



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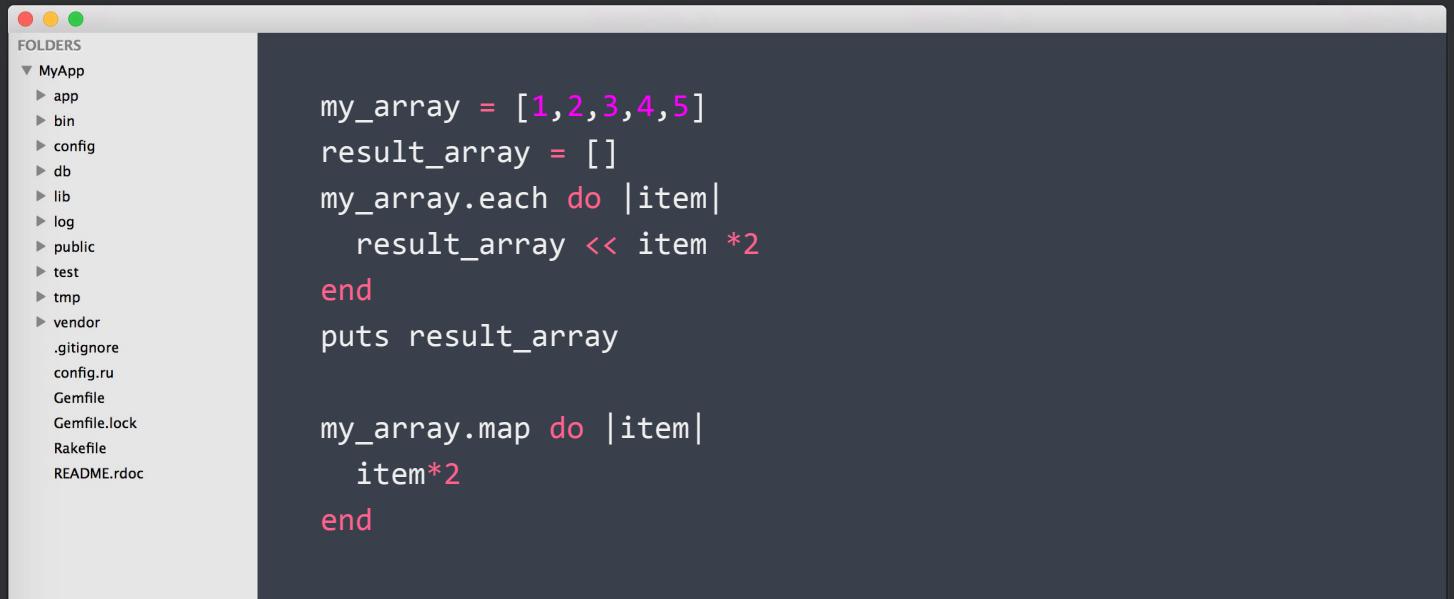
Exercise: select

Given a hash with all the names of the people in class and their ages, return those who are older than 25

Iteration: map

Map returns a new array with the results of running a block once for every element in enum. Again, the original is left untouched.



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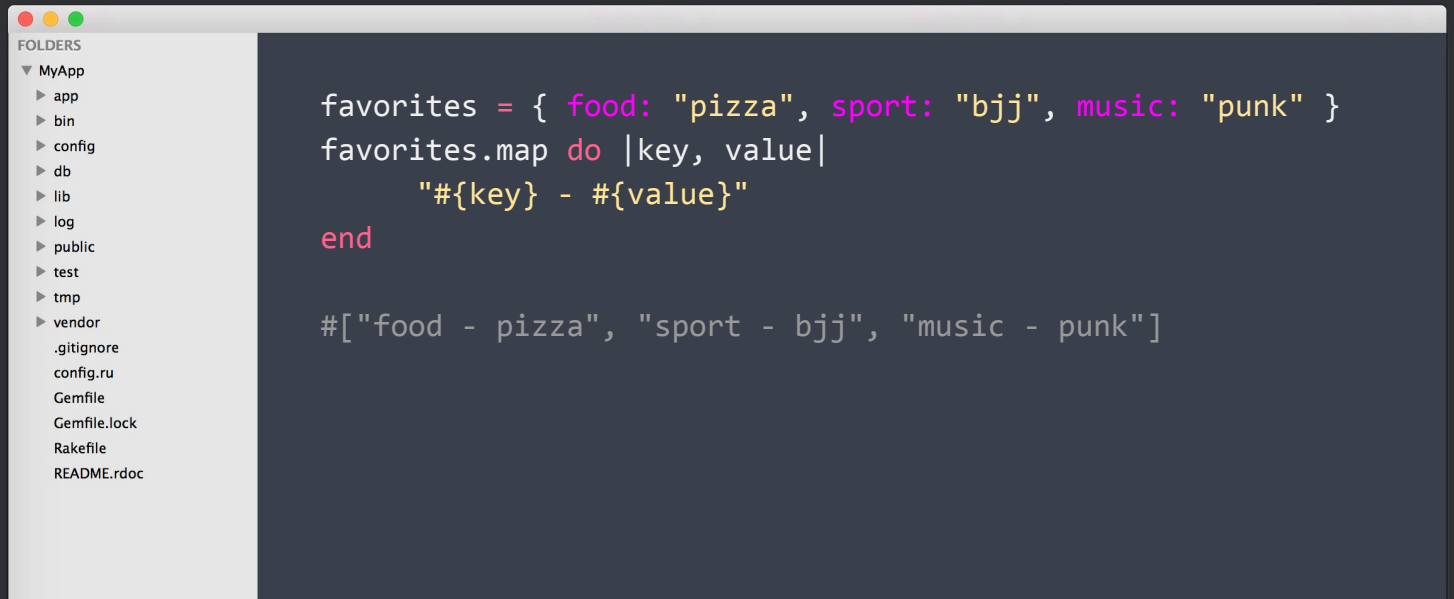
Iteration: map

You can use `Map` with Hashes too, but remember that it will return an Array!



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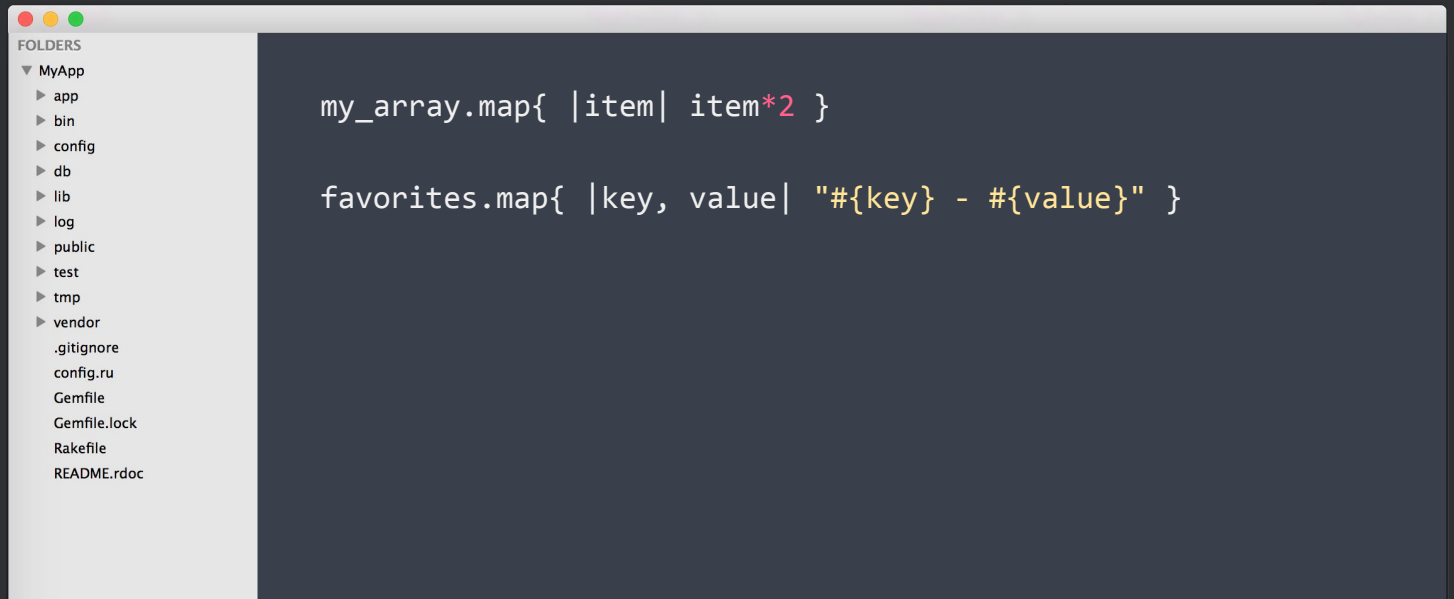
Iteration: map in a single line

Our previous `map` calls can be also written in a single line.



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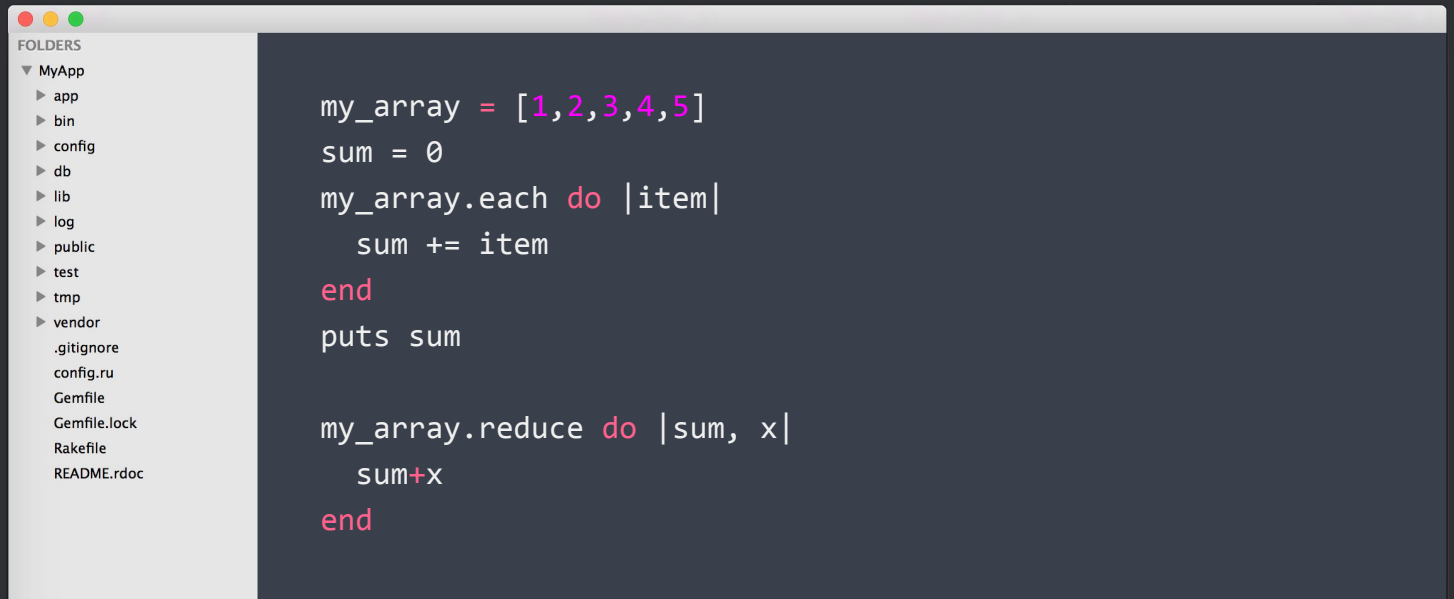
Exercise: map

Given an Array with city names all in downcase, return another with those city names properly capitalized.

Iteration: reduce

`Reduce` (aka "`inject`") transforms a Collection into a single value, resulting from applying a function recursively to each element in the collection.



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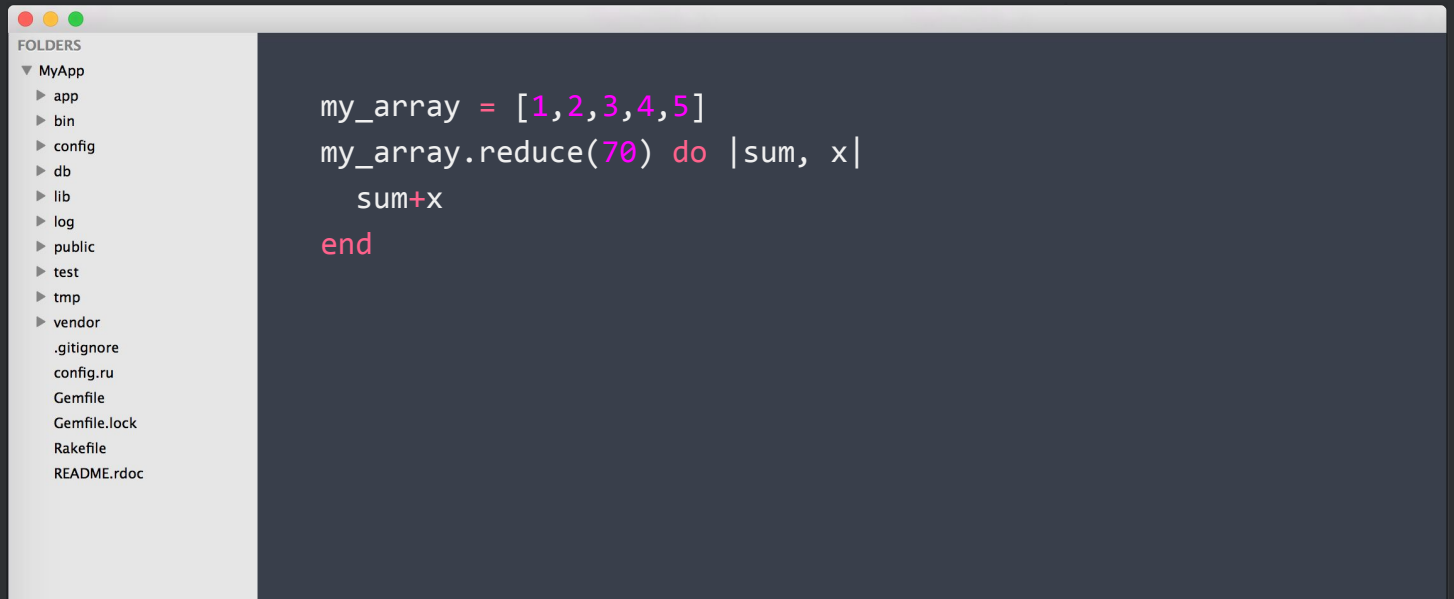
Iteration: reduce

You can initialize the acumulator ("memo") with any value you want. If you don't specify a initial value for it, then the first element of collection will be used.



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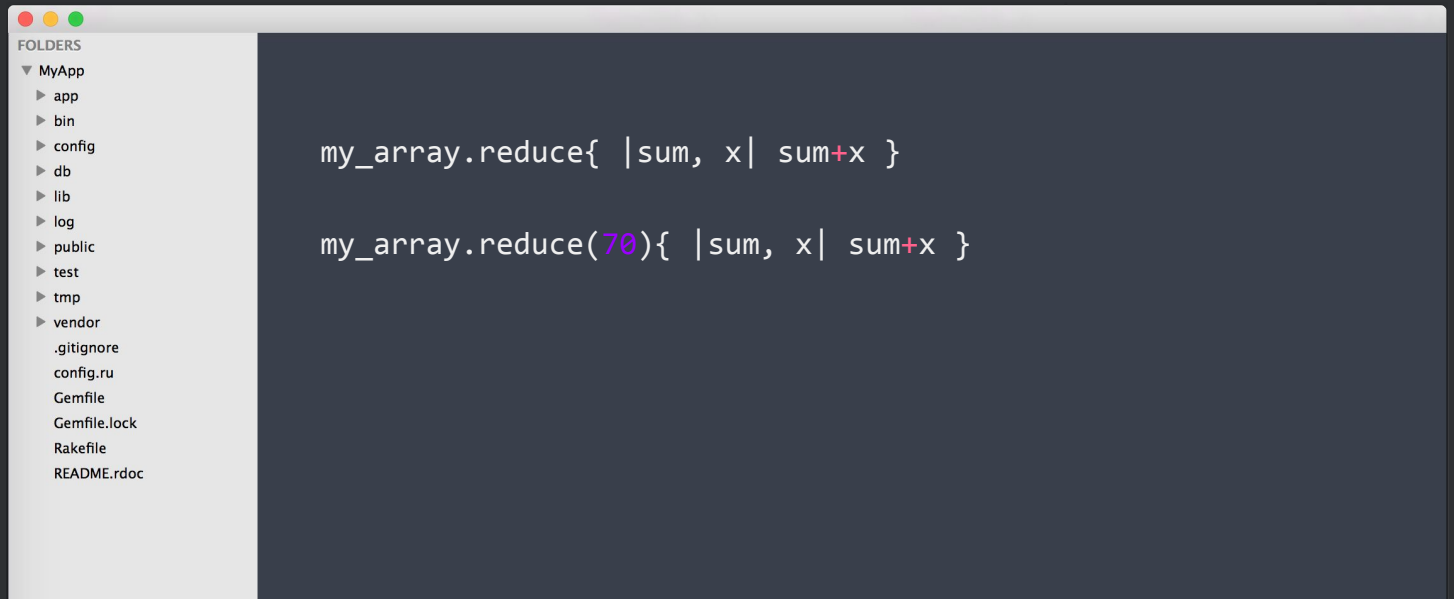
Iteration: reduce in a single line

Once again, our previous calls to `reduce` can be written in a single line



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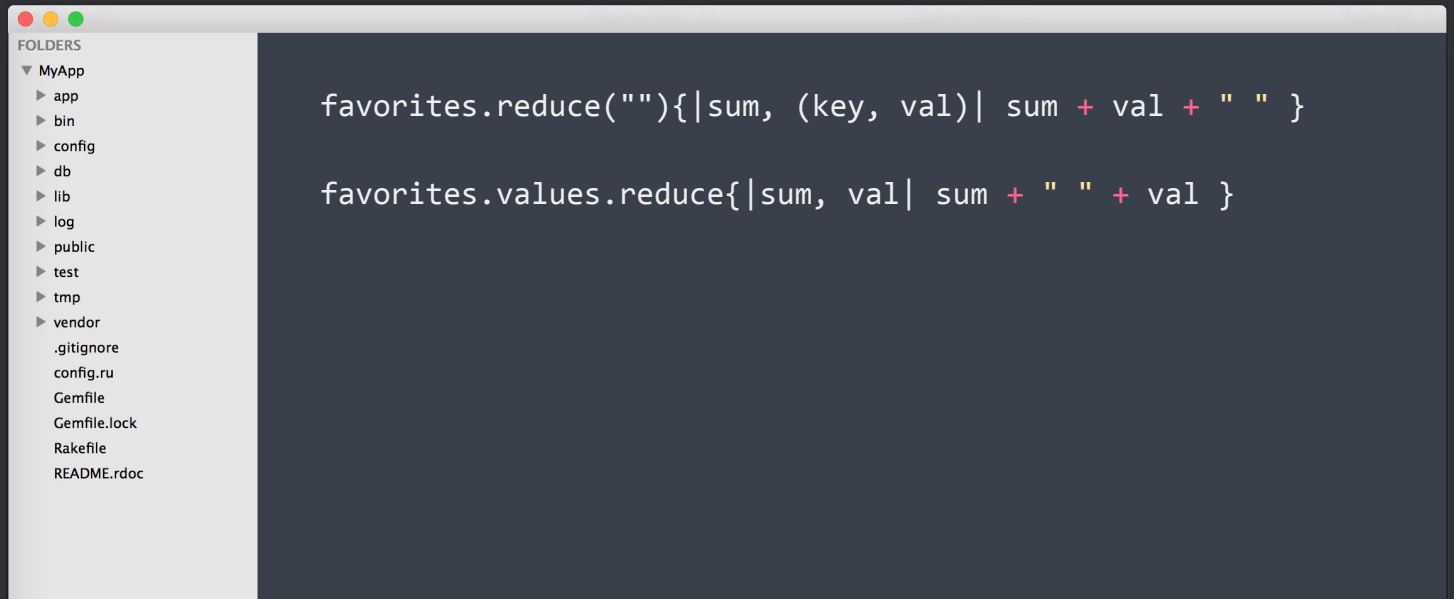
Iteration: reduce

You can use reduce with Hashes, but it's often just simpler to use the Hash `values` method instead and work with the Array it returns.



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Exercise: reduce

Given an Array with city names, return the longest.

Iteration methods quick summary

As a simple summary, so it's easy to remember what each method does:

- `each`: Traverse
- `select`: Filter
- `map`: Transform
- `reduce`: Accumulate

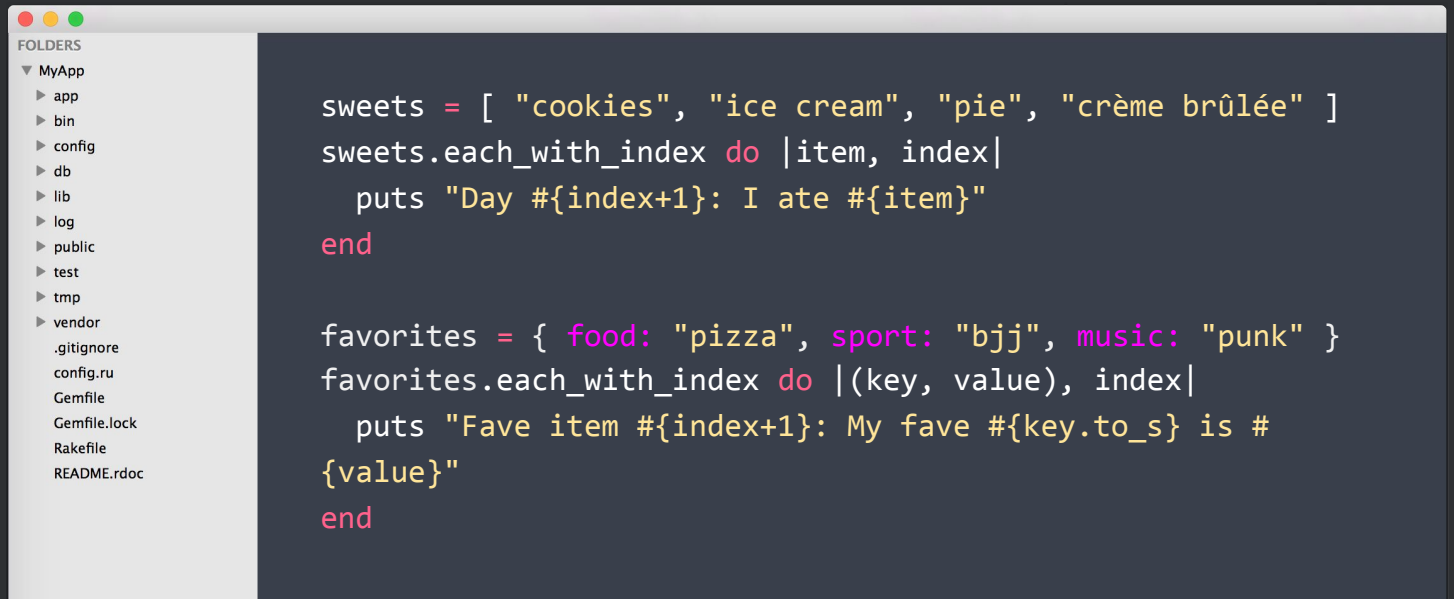
Enumerable

Collection classes implement an `each` method to get successive members of the collection. Because of it they can take advantage of the methods in `Enumerable`.

This module provides several traversing, searching and sorting methods that we can use with our Arrays and Hashes, and that are included by default.

More methods: each with index

If you want to use each, but you need the index along with the item you can use the `each_with_index` method




```ruby
sweets = [ "cookies", "ice cream", "pie", "crème brûlée" ]
sweets.each_with_index do |item, index|
  puts "Day #{index+1}: I ate #{item}"
end

favorites = { food: "pizza", sport: "bjj", music: "punk" }
favorites.each_with_index do |(key, value), index|
  puts "Fave item #{index+1}: My fave #{key.to_s} is #
{value}"
end
```

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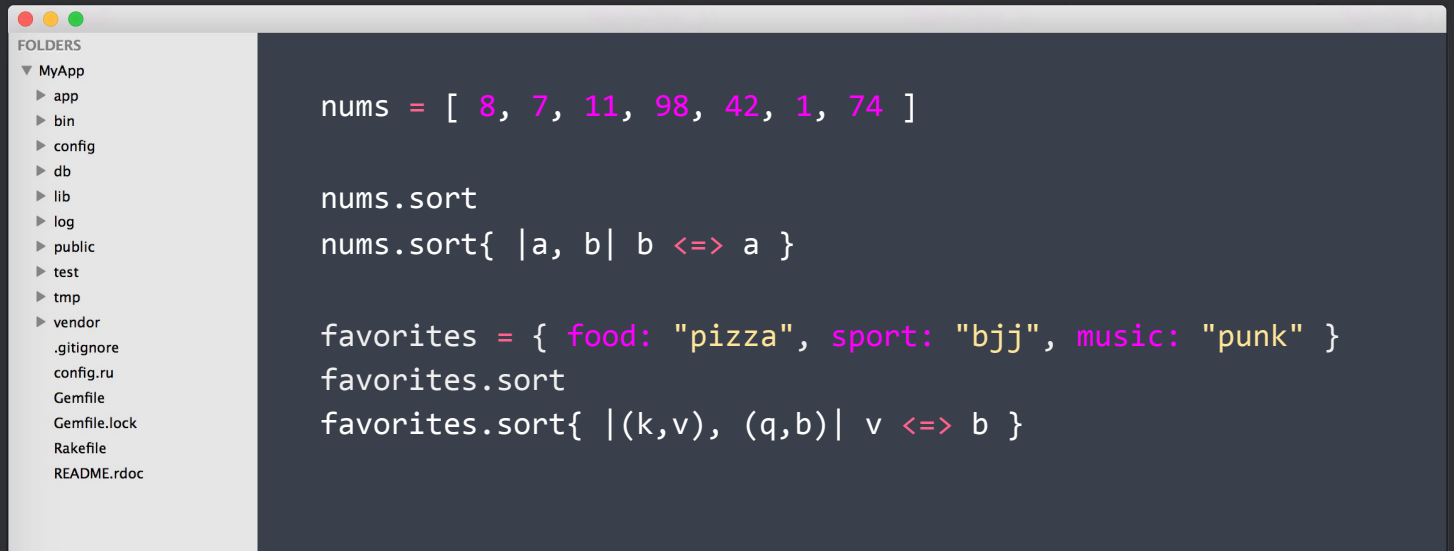
More methods: sort

To sort and array you can use `sort`, that will sort items either according to their own <=> method, or by using the results of the supplied block.



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