Nested Data Structures

Arrays and Hashes

Phase 1: Day 3

Lecture Topics

- Examples
- Accessing values through method chaining
- Creating the desired structure
- Ambiguity in complex array structures

Why we care.

- Big Data is a HUGE part of Web Development
- Ability to navigate them easily is crucial
- API consumption is dependent on nested data

Everything is an Object

- Everything in Ruby is an Object
- Arrays && Hashes are just Object containers
- So you can fill them however you like

```
object_array = [true, "string", 1024, ahash: {topher: "awesome"}]

object_hash = { bool: true, string: "strings", array: [1,2,3], integer: 88 }
```

Example of a Nested Array

- Grids with rows and columns

```
row_1 = [ "-", "-", "X"]
row_2 = [ "-", "O", "X"]
row_3 = [ "-", "-", "O"]
```

```
tic_tac_toe = [ [ "-", "-", "X"],
                [ "-", "O", "X"],
                [ "-", "-", "O"] ]
```

Example of a Nested Hash

- Hierarchy with named attributes

```
freda = { age: 27 }
fred  = { age: 25 }
```

Example of a Nested Hash

- Hierarchy with named attributes

```
foxes = { freda: { age: 27 },
          fred:  { age: 25 } }
```

Example of a Nested Hash

- Hierarchy with named attributes

```
cohorts = {  foxes: { freda:  { age: 27 },
                      fred:   { age: 25 } },
            otters: { olivia: { age: 24 },
                      oliver: { age: 29 } } }
```

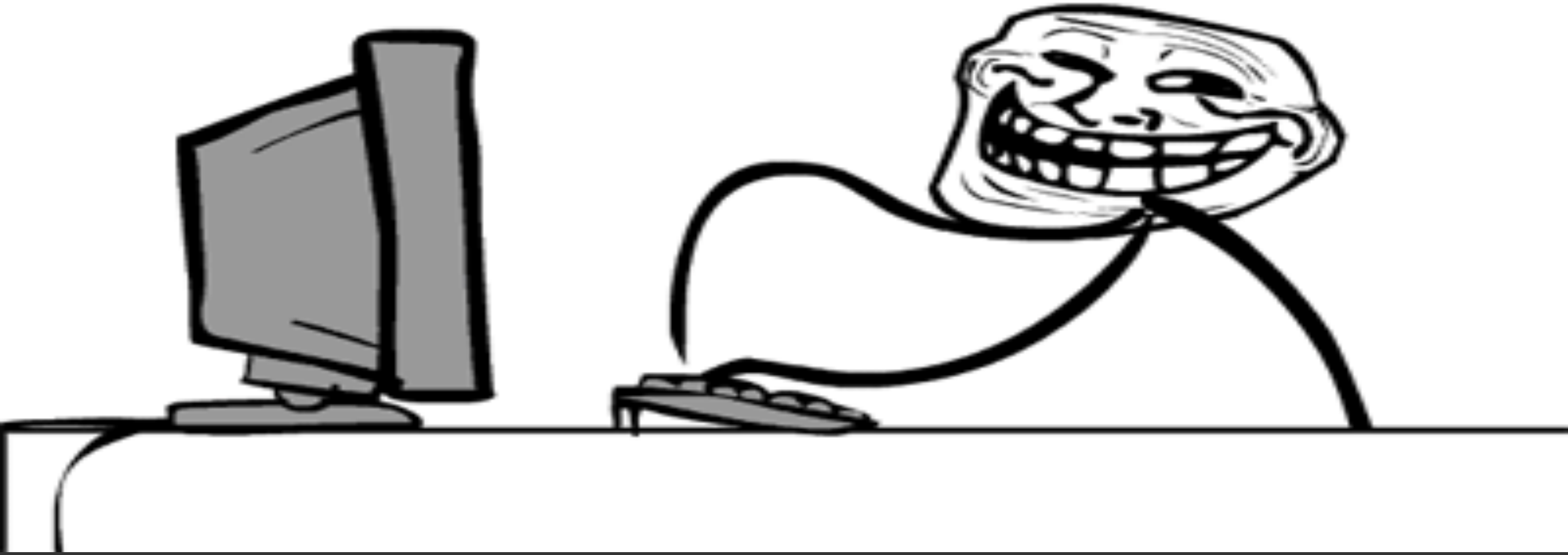
Mixing Arrays and Hashes

- Anything object can be inside the collections

```
cohorts = {
  foxes: {
    students: [ { name: ”freda”, age: 27 },
                { name: ”fred”,   age: 25 } ]
  },
  otters: {
    students: [ { name: ”olivia”, age: 24 },
                { name: ”oliver”, age: 29 } ]
  }
}
```

Accessing Values

- How do we dive into these structures?



Method Chaining

```
“WARD”.downcase.reverse.capitalize
# => “Draw”
```

Method Chaining

```
“WARD”.downcase.reverse.capitalize

“WARD”.downcase   # => “ward”
```

Method Chaining

```
“WARD”.downcase.reverse.capitalize

“WARD”.downcase   # => “ward”
“ward”.reverse    # => “draw”
```

Method Chaining

```
“WARD”.downcase.reverse.capitalize

“WARD”.downcase   # => “ward”
“ward”.reverse    # => “draw”
“draw”.capitalize # => “Draw”
```

Access Values in a Nested Array

- Find an element in tic-tac-toe board

Access Values in a Nested Array

```
tic_tac_toe =
[ [ “-“, “-”, “X”],
  [ “-“, “O”, “X”],
  [ “-“, “-“, “O”]]
```

```
tic_tac_toe.at(1).at(2)
```

Access Values in a Nested Array

```
tic_tac_toe =
[ [ “-“, “-”, “X”],
  [ “-“, “O”, “X”],
  [ “-“, “-“, “O”]]
```

```
tic_tac_toe.at(1).at(2)
#=> “X”
```

Access Values in a Nested Array

```
tic_tac_toe =
[ [ “-“, “-”, “X”],
  [ “-“, “O”, “X”],
  [ “-“, “-“, “O”]]
```

```
tic_tac_toe.at(1).at(2)
#=> “X”
```

Access Values in a Nested Array

```
tic_tac_toe =
[ [ “-“, “-”, “X”],
  [ “-“, “O”, “X”],
  [ “-“, “-“, “O”]]
```

```
tic_tac_toe.at(1).at(2)
#=> “X”
```

Access Values in a Nested Array

```
tic_tac_toe =
[ [ “-“, “-”, “X”],
  [ “-“, “O”, “X”],
  [ “-“, “-“, “O”]]
```

```
tic_tac_toe[1][2]
#=> “X”
```

Access Values in a Nested Array

```
tic_tac_toe =
[ [ “-“, “-”, “X”],
  [ “-“, “O”, “X”],
  [ “-“, “-“, “O”]]
```

```
tic_tac_toe[1][2]
#=> “X”
```

Access Values in a Nested Array

```
tic_tac_toe =
[ [ “-“, “-”, “X”],
  [ “-“, “O”, “X”],
  [ “-“, “-“, “O”]]
```

```
tic_tac_toe[1][2]
#=> “X”
```

Access Values in a Nested Hash

- The age of a student in a cohort

```
cohorts = {  foxes: { freda:  { age: 27 },
                      fred:   { age: 25 } },
            otters: { olivia: { age: 24 },
                      oliver: { age: 29 } } }
```

Access Values in a Nested Hash

```
cohorts = {
  foxes:  { freda:  { age: 27 },
             fred:   { age: 25 } },
  otters: { olivia: { age: 24 },
            oliver: { age: 29 } }
}

cohorts.fetch(:foxes).fetch(:freda).fetch(:age)
#=> 27
```

Access Values in a Nested Hash

```
cohorts = {
  foxes:  { freda:  { age: 27 },
             fred:   { age: 25 } },
  otters: { olivia: { age: 24 },
            oliver: { age: 29 } }
}

cohorts.fetch(:foxes).fetch(:freda).fetch(:age)
#=> 27
```

Access Values in a Nested Hash

```
cohorts = {
  foxes:  { freda:  { age: 27 },
             fred:   { age: 25 } },
  otters: { olivia: { age: 24 },
            oliver: { age: 29 } }
}

cohorts.fetch(:foxes).fetch(:freda).fetch(:age)
#=> 27
```

Access Values in a Nested Hash

```
cohorts = {
  foxes:  { freda:  { age: 27 },
             fred:   { age: 25 } },
  otters: { olivia: { age: 24 },
            oliver: { age: 29 } }
}

cohorts.fetch(:foxes).fetch(:freda).fetch(:age)
#=> 27
```

Access Values in a Nested Hash

```
cohorts = {
  foxes:  { freda:  { age: 27 },
             fred:   { age: 25 } },
  otters: { olivia: { age: 24 },
            oliver: { age: 29 } }
}

cohorts[:foxes][:freda][:age]
#=> 27
```

Access Values in a Nested Hash

```
cohorts = {
  foxes:  { freda:  { age: 27 },
             fred:   { age: 25 } },
  otters: { olivia: { age: 24 },
            oliver: { age: 29 } }
}

cohorts[:foxes][:freda][:age]
#=> 27
```

Access Values in a Nested Hash

```
cohorts = {
  foxes:  { freda:   { age: 27 },
             fred:    { age: 25 } },
  otters: { olivia: { age: 24 },
            oliver: { age: 29 } }
}

cohorts[:foxes][:freda][:age]
#=> 27
```

Access Values in a Nested Hash

```
cohorts = {
  foxes:   { freda:   { age: 27 },
             fred:    { age: 25 } },
  otters: { olivia: { age: 24 },
            oliver: { age: 29 } }
}

cohorts[:foxes][:freda][:age]
#=> 27
```

Creating the Structure

- How to populate a desired structure with the right values?

3x3 array with Sample values from a 3x9 array

```
provided =

[ [:a, :b, :c],
  [:d, :e, :f],
  [:g, :h, :i],
  [:j, :k, :l],
  [:m, :n, :o],
  [:p, :q, :r],
  [:s, :t, :u],
  [:v, :w, :x],
  [:y, :z, :A] ]
```

```
desired =

[ [:a, :e, :g],
  [:l, :n, :q],
  [:t, :w, :z] ]
```

Creating the Structure

```
provided =

[ [:a, :b, :c],
  [:d, :e, :f],
  [:g, :h, :i],
  [:j, :k, :l],
  [:m, :n, :o],
  [:p, :q, :r],
  [:s, :t, :u],
  [:v, :w, :x],
  [:y, :z, :A] ]
```

Creating the Structure

```
provided =

[ [:a, :b, :c],
  [:d, :e, :f],
  [:g, :h, :i],
  [:j, :k, :l],
  [:m, :n, :o],
  [:p, :q, :r],
  [:s, :t, :u],
  [:v, :w, :x],
  [:y, :z, :A] ]
```

```
desired =

[ [nil, nil, nil],
  [nil, nil, nil],
  [nil, nil, nil] ]
```

Creating the Structure

```
provided =

[ [:a, :b, :c],
  [:d, :e, :f],
  [:g, :h, :i],
  [:j, :k, :l],
  [:m, :n, :o],
  [:p, :q, :r],
  [:s, :t, :u],
  [:v, :w, :x],
  [:y, :z, :A] ]
```

```
desired =

[ [:a, :e, :g],
  [:l, :n, :q],
  [:t, :w, :z] ]
```

Creating the Structure

- Create and populate the desired structure
- Manipulate the input

Creating the Structure

- Create and populate the desired structure

```
desired = Array.new(3) { Array.new(3) }
```

Creating the Structure

- Create and populate the desired structure

```
desired = Array.new(3) { Array.new(3) }

desired.map!.with_index do |row, row_index|
  row.map!.with_index do |column, column_index|
    provided.each_slice(3).to_a[row_index][column_index].sample
  end
end
```

Creating the Structure

- Manipulate the input

Creating the Structure

- Manipulate the input

```
desired = provided.map(&:sample).each_slice(3).to_a
```

Ambiguity in Complex Arrays

- How do you access elements in an array?

Ambiguity in Complex Arrays

- How do you access elements in an array?

by index

Ambiguity in Complex Arrays

- Indexes are like poorly named variables

Ambiguity in Complex Arrays

team			
number	name	position	points per game
12	Joe Schmo	Center	[14, 32, 7, 0, 23]
9	Ms. Buckets	Point Guard	[19, 0, 11, 22, 0]
31	Harvey Kay	Shooting Guard	[0, 30, 16, 0, 25]
18	Sally Talls	Power Forward	[18, 29, 26, 31, 19]
22	MK DiBoux	Small Forward	[11, 0, 23, 17, 0]

Ambiguity in Complex Arrays

```
team = [["number", "name", "position", "points per game"],
        [12, "Joe Schmo", "Center", [14, 32, 7, 0, 23]],
        [9, "Ms. Buckets", "Point Guard", [19, 0, 11, 22, 0]],
        [31, "Harvey Kay", "Shooting Guard", [0, 30, 16, 0, 25]],
        [18, "Sally Talls", "Power Forward", [18, 29, 26, 31, 19]],
        [22, "MK DiBoux", "Small Forward", [11, 0, 23, 17, 0]]]
```

Ambiguity in Complex Arrays

- How do I get the data for Sally Talls?

Ambiguity in Complex Arrays

```
team = [["number", "name", "position", "points per game"],
        [12, "Joe Schmo", "Center", [14, 32, 7, 0, 23]],
        [9, "Ms. Buckets", "Point Guard", [19, 0, 11, 22, 0]],
        [31, "Harvey Kay", "Shooting Guard", [0, 30, 16, 0, 25]],
        [18, "Sally Talls", "Power Forward", [18, 29, 26, 31, 19]],
        [22, "MK DiBoux", "Small Forward", [11, 0, 23, 17, 0]]]

sally_talls = team[4]
```

Ambiguity in Complex Arrays

```
team = [["number", "name", "position", "points per game"],
        [12, "Joe Schmo", "Center", [14, 32, 7, 0, 23]],
        [9, "Ms. Buckets", "Point Guard", [19, 0, 11, 22, 0]],
        [31, "Harvey Kay", "Shooting Guard", [0, 30, 16, 0, 25]],
        [18, "Sally Talls", "Power Forward", [18, 29, 26, 31, 19]],
        [22, "MK DiBoux", "Small Forward", [11, 0, 23, 17, 0]]]

sally_talls = team.find { |player| player[1] = “Sally Talls” }
```

Ambiguity in Complex Arrays

```
team = [["number", "name", "position", "points per game"],
        [12, "Joe Schmo", "Center", [14, 32, 7, 0, 23]],
        [9, "Ms. Buckets", "Point Guard", [19, 0, 11, 22, 0]],
        [31, "Harvey Kay", "Shooting Guard", [0, 30, 16, 0, 25]],
        [18, "Sally Talls", "Power Forward", [18, 29, 26, 31, 19]],
        [22, "MK DiBoux", "Small Forward", [11, 0, 23, 17, 0]]]
```

Ambiguity in Complex Arrays

- What position does Ms. Buckets play?
- What number does Harvey Kay wear?
- How many points did Joe Schmo score in Game 3?

Ambiguity in Complex Arrays

- What values do these return?

```
team[2][0]
team[5][3][0]
team[3][2]
```

Hashes Provide Informative Labels

```
hash_team = {
             "Joe Schmo" => { number: 12, position: "center",
                              "points per game" => [14,32,7,0,23]},

             "Ms. Buckets" => { number: 9, position: "Point Guard",
                              "points per game" => [19,0,11,22,0]},

             "Harvey Kay" => {number: 31, position: "Shooting Guard",
                              "points per game" => [0,30,16,0,25]},

             "Sally Talls" => {number: 18, position: "Power Forward",
                              "points per game" => [18,29,26,31,19]},

             "MK DiBoux" => {number: 22, position: "Small Forward",
                              "points per game" => [11,0,23,17,0]}
            }
```

Hashes Provide Informative Labels

- Which is more comprehensible?

```
team[2][0]
team[“Ms. Buckets”][“number”]
```

Optimal Solution – Array of Hashes

```
team = [
             {"Joe Schmo" => { number: 12, position: "center",
                              "points per game" => [14,32,7,0,23]}},

             {"Ms. Buckets" => { number: 9, position: "Point Guard",
                              "points per game" => [19,0,11,22,0]}},

             {"Harvey Kay" => {number: 31, position: "Shooting Guard",
                              "points per game" => [0,30,16,0,25]}},

             {"Sally Talls" => {number: 18, position: "Power Forward",
                              "points per game" => [18,29,26,31,19]}},

             {"MK DiBoux" => {number: 22, position: "Small Forward",
                              "points per game" => [11,0,23,17,0]}}
        ]
```

Data Structs Wrapup

Questions