GENERAL ASSEMBLY

MOBILE DEVELOPMENT

SWIFT DATA STRUCTURES

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LEARNING OBJECTIVES

- Create, modify, and iterate over arrays.
- Identify and use array methods and properties.
- Create, modify, and iterate over dictionaries.
- Identify and use dictionary methods and properties.
- Compare and contrast arrays and dictionaries.
- Deploy arrays in UITableViews to hold app data.

REVIEW OF IBOUTLETS AND IBACTIONS

EXERCISE: DISMISS A MODAL

DATA STRUCTURES

WHAT IS A DATA STRUCTURE?

- A data structure is a type that manages potentially large amounts of data.
- What are data?

WHAT ARE DATA?

- Data are pieces of information devoid of meaning.
- e.g. What do these numbers mean?
  - 83, 80, 82, 87, 86, 88, 78, 87, 88, 89, 85, 85, 88, 81, 83, 87, 90, 88, 95, 88, 96, 94, 93, 92, 89, 92, 86, 88, 97, 92, 89

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- Hint: We don’t know.

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- Hint: We don't know.
- But when I tell you that they're the record high temperatures for NYC in May collected in Central Park, then they *mean* something. They're promoted to *information*.

ARRAYS

WHAT IS AN ARRAY?

- An array is a type (implemented as a “struct”) in Swift
  - Since arrays are structs, they are passed by **value.**
- It contains a one-dimensional list of things (instances of classes or structs).
- It can be added to and removed from (if not a constant).
- Just like everything else in Swift, it is “typed” (i.e. has a specific type).
  - e.g. `var strings: [String] = []`

ARRAYS

- Arrays have a few interesting properties.
  - They contain objects. (We'll call them **elements**.)
  - Arrays can also be empty.
  - Each element has an **index.** *(Indexes start at 0.)*
  - The array has a **count** of elements.
- Arrays have order and can be iterated over in order.
- Arrays can change their order by reversing or sorting their elements.
- Arrays elements can change by adding, removing, or filtering them.

SYNTAX: ARRAYS

Creating an array:

```
// Type is inferred (implicit) if the array is populated with elements of
the same type.
var arr = [1, 2, 3]


// Must declare type explicitly if array is empty, ...
var arr: [Int] = []


// ... or instantiate the type itself:
var arr = [Int]()
```

SYNTAX: MANIPULATING ARRAYS

Adding elements to an array (adds an element to the end of the array):

```
arr.append(4)
```

Change an element in an array:

```
arr[0] = 12
```

Insert or remove an element wherever you want, as long as the index is in the array's "bounds":

```
arr.insert(7, atIndex:0)
arr.removeAtIndex(0)
```

Concatenating two arrays (produces a new array with the elements from both in order):

```
arr + [4, 5, 6]
```

SYNTAX: ARRAY ELEMENTS

Accessing elements in an array:

```
// We can access elements by index using this syntax
let firstElement = arr[0]


for el in [2, 4, 6] {
    // This loops three times. el is first 2, then 4, then 6.
}
for (index, element) in enumerate([“hi”, “there”, “class!”]) {
    // Loops three times...
    // index is 0, 1 then 2. element is “hi”, “there” then “class!”
}
```

SYNTAX: REMOVING AND COUNTING ELEMENTS

```
// Remove an element from an array like this:
var words = ["hello", "doctor", "name", "continue", "yesterday", "tomorrow"]
words.removeAtIndex(3)
words

// Count elements in an array by using the function “count”:
count(words)
```

SORTING ARRAYS

Sorting elements in an array.

```
// Sort an array of basic types like this. Note the &.
sort(&arr)

// Sort arrays of more complex types by providing a “comparator”:
func sortByName(a:Dog, b:Dog) -> Bool {
    return a.name < b.name
}
dogs.sort(sortByName)
```

FILTERING ARRAYS

Filter elements in an array.

```
// Filter arrays by providing a filter function:
func isMale(dog:Dog) -> Bool {
    return dog.gender == “m”
}
let maleDogs = dogs.filter(sortByName)
maleDogs
```

ARRAY DEMO & EXERCISE

ARRAY EXERCISE

- Create a class called Dog.
- Create a class called DogCollection.
- Give DogCollection the ability to do the following:
  - Hold a collection of dogs (perhaps, an Array property called … “dogs”?)
  - Add a single dog to the collection.
  - Sort the dogs by name.
  - Return the current number of dogs.
  - Return a dog given its name. (Hint: What happens if no dog of that name lives in the collection?)
  - Return a dog given an index.
  - Remove a dog given an index.
- Create an instance myFamilysDogs and add some dogs to it.

DICTIONARIES

WHAT IS A DICTIONARY?

- A dictionary is a “mapping” from one set of unique things (like phone numbers) to another set of things (like people).
- It’s like a language “dictionary;” each entry (word) is unique, and each has one definition. Some words can mean the same thing.
- Or, it’s like an array, but instead of using indices (0, 1, 2, 3, … count - 1), we are given the ability to define our own indices, called “keys.”
- Also, they don’t hold order like Arrays.
  - i.e. We don’t know what order the keys and values will come in.

WHAT IS A DICTIONARY?

- A dictionary has a set of unique **keys**. *i.e.* Each of those keys is only found once in the dictionary.
- Each key points to a **value**, which can be easily referenced if you have the **key.**
  - Values need not be unique in the Dictionary.
- Also referred to in other contexts as "**maps**."

SYNTAX: DICTIONARIES

Creating a Dictionary:

```
// Type is [String: Double]. String = type for the keys, Dog for the values.
// [:] means an “empty” Dictionary.
var constants : [String: Double] = [:]

// Can implicitly set a type for a Dictionary by giving it the first pair:
var constants = [“e”: 2.71828]

// or by instantiating the empty type:
var constants = [String: Double]()
```

SYNTAX: MANIPULATING DICTIONARIES

```
var constants = [“e”: 2.71828]

// Add another key-value pair:
constants[“pi”] = 3.14159

// Look up a value in the dictionary.
constants[“e”]

// But if that key doesn’t exist, you get nil!
constants[“c”]    // OOPS!
```

SYNTAX: MANIPULATING DICTIONARIES

```
// Remove a key-value pair given a key.
constants.removeValueForKey(“e”)

// Iterate over the key-value pairs in the Dictionary.
for (constant, value) in constants {
    // constant will be “e”, “pi”, etc.
    // value will be 2.71828, 3.14159, etc.
}
```

SYNTAX: DEALING WITH ABSENT KEYS

```
// Declare a dictionary with multiple key-value pairs from the start:
var constants = [“e”: 2.71828, “pi”: 3.14159]

if let c = constants[“c”] {
    // Does this look familiar?
} else {

}
```

MORE ABOUT DICTIONARIES

- We use dictionaries when there is an association between
  - a set of *unique* identifying things, and
  - another set of things to be identified (not necessarily unique).
- Examples:
  - SSN → person
  - word → definition
  - registration number → dog
- You *really should* query a dictionary for a value first when you have a key. Don't assume it has a value or the key!

DICTIONARY DEMO & EXERCISE

DICTIONARY EXERCISE

- Make a new DogCollection class that uses a Dictionary as its data store instead of an Array.
- Remove the sort methods.

TABLE VIEWS

TABLE VIEWS

- Table views display a one-dimensional list of cells.
  - Section: All table views contain multiple sections.
  - Row: Every section has a number of rows, which are entries in that section.
  - NSIndexPath: The combination of a section and row that is a unique entry in a table view.
  - Cell: The view that is displayed for an NSIndexPath (class UITableViewCell, which is a subclass of UIView).

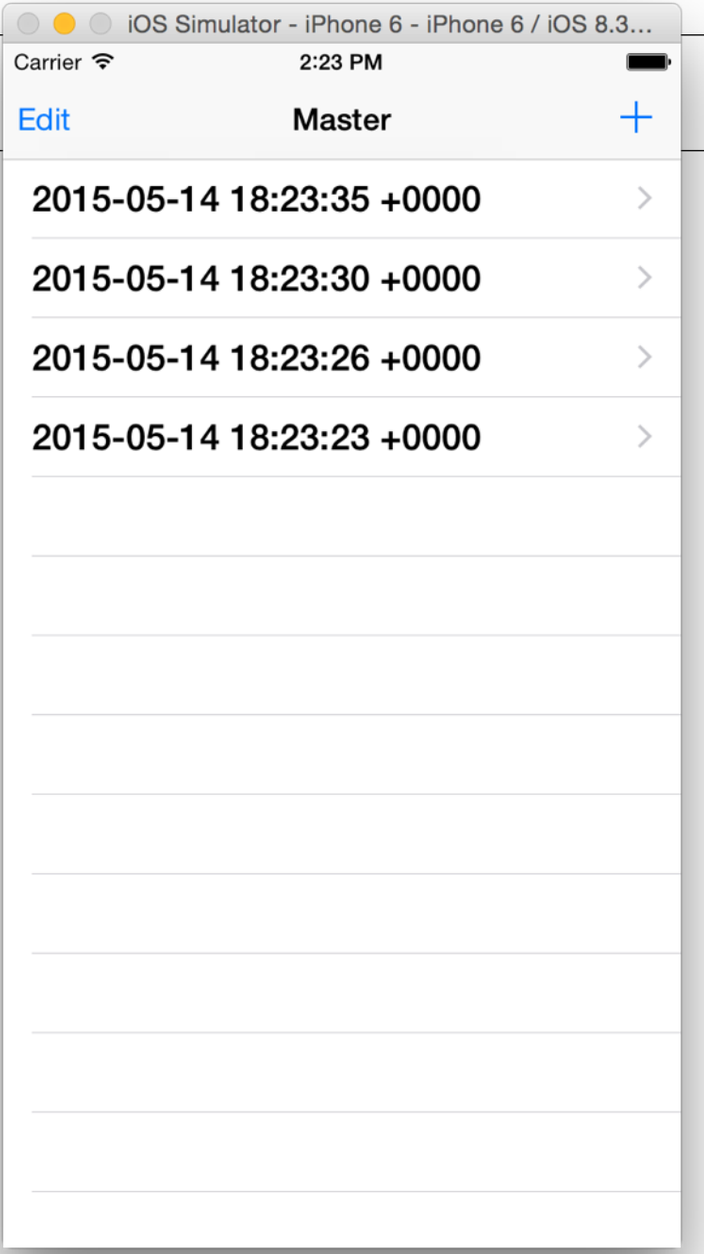


TABLE VIEWS

- Table View Controllers provide:
  - the number of sections (think the mini letter headings in the Contacts app),
  - the number of cells in each section, and
  - (optionally) the cells themselves.
- Table views also can have a data source and a delegate.
  - Data source: Provides cells, number of cells, and sections.
  - Delegate: Gets called when things happen to the table view, provides some views (e.g. header and footer).

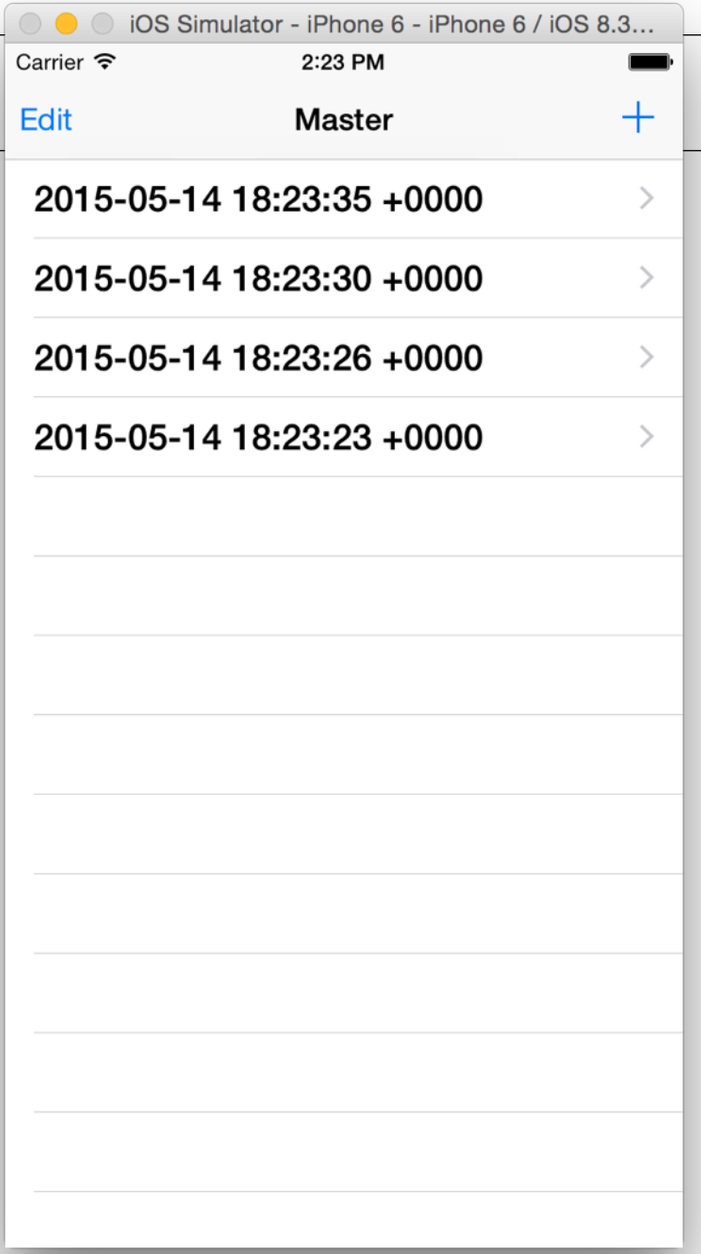
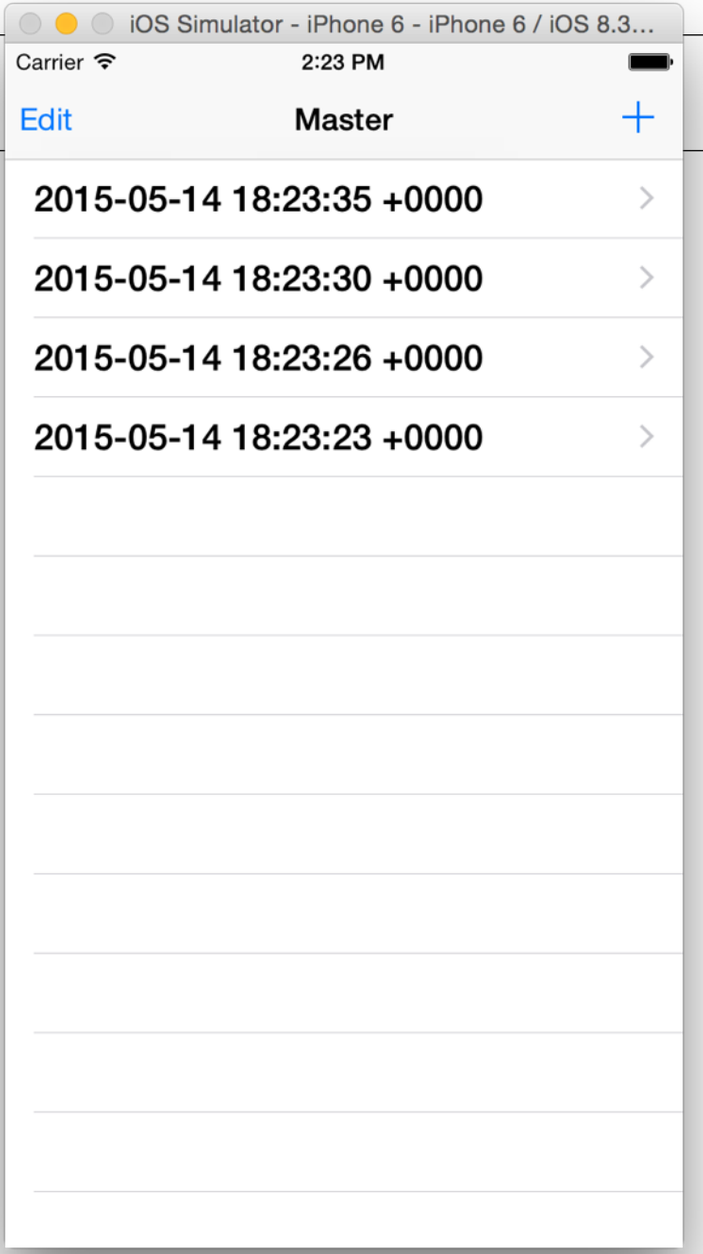


TABLE VIEWS

- How do we achieve this?
  - Extend a UIViewController.
  - Override methods that return these values (e.g. number of sections, etc.)
- Recommend using the Master-Detail template to start learning with a new app.



PUTTING IT ALL TOGETHER

DATA STRUCTURES EXERCISE

- Create a new app from the Master-Detail Application template. *Wait to get a tour.*
- The Table View should display the list of dogs' names.
- Use the Dog and DogCollection classes you've already created. Put them in a separate Swift file.
- Then, place an "Add" button as a "Bar Button Item" in the upper right. When tapped, it should display a "Add another dog" form via a modal Segue.
- That modal dialog should ask the user for a dog's name (Bonus: And other info, too!). When the user taps an "Add" button, create a new Dog, add it to the collection, then dismiss the modal. The new dog should be in the table.
- Bonus: Add a button called 'sort', which should sort the dogs alphabetically by name.
- Bonus: Add two buttons to the navigation controller on the main page, when tapped, it should make the table view only display dogs that are male or female.
- Bonus: Implement deleting an item from the table view.