CSC 581: Mobile App Development

Spring 2019

Unit 2: More Swift & UIKit

- computed properties/fields
- classes & inheritance
- collections:
  - arrays, dictionaries
- UIKit
  - UIView subclasses: UILabel, UIImageView, …
  - UIControl subclasses: UIButton, UISwitch, …
- Appicon

RouletteWheel struct

consider a struct for simulating a roulette wheel

- American roulette wheels contain 00,0,1…34
- to differentiate between 0 and 00, spin method will return a String

- `numSpins` field seems redundant – the private die field already keeps track of the # of rolls

```
struct RouletteWheel {
    private var die = Die(withSides: 36)
    private(set) var numSpins = 0

    mutating func spin() -> String {
        let dieRoll = self.die.roll()
        self.numSpins += 1

        if dieRoll == 36 {
            return "00"
        }
        else if dieRoll == 35 {
            return "0"
        }
        else {
            return String(dieRoll)
        }
    }
}

var wheel = RouletteWheel()
for _ in 1...10 {
    print(wheel.spin())
}

print(wheel.numSpins)
```

Avoiding redundant counters

we could get rid of the `numSpins` field

- instead have a method for determining the number of spins
- this avoids the redundant counter, but many feel that a field is more natural

```
struct RouletteWheel {
    private var die = Die(withSides: 36)

    mutating func spin() -> String {
        let dieRoll = self.die.roll()
        if dieRoll == 36 {
            return "00"
        }
        else if dieRoll == 35 {
            return "0"
        }
        else {
            return String(dieRoll)
        }
    }

    func numSpins() -> Int {
        return die.numRolls
    }
}

var wheel = RouletteWheel()
for _ in 1...10 {
    print(wheel.spin())
}

print(wheel.numSpins())
```

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Computed properties/fields

it is possible to make the method look like a field

a *computed property/field* is declared and accessed like a field, but its value is computed whenever it is accessed

- after the field declaration, specify code in { } that computes & returns the value
- don't specify protection, but implicitly `private(set)`
- essentially, it acts like an accessor method but looks like a `private(set)` field

```
struct RouletteWheel {
    private var die = Die(withSides: 36)
    var numSpins: Int {
        return die.numRolls
    }

    mutating func spin() -> String {
        let dieRoll = self.die.roll()
        if dieRoll == 36 {
            return "00"
        }
        else if dieRoll == 35 {
            return "0"
        }
        else {
            return String(dieRoll)
        }
    }
}

var wheel = RouletteWheel()
for _ in 1...10 {
    print(wheel.spin())
}

print(wheel.numSpins)
```

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Classes

in addition to structs, Swift supports classes for defining new types

- can define just like in Java
- private fields
- init (constructor)
- accessor & mutator methods

note: unlike structs, you do not declare methods mutating

classes are typically more work & less natural than structs

- used in Swift mainly when you want to utilize inheritance

```
class Die {
    private var numRolls: Int
    private var numSides: Int

    init(withSides sides: Int = 6) {
        self.numSides = sides
        self.numRolls = 0
    }

    func roll() -> Int {
        self.numRolls += 1
        return Int.random(in: 1...self.numSides)
    }

    func numberOfRolls() -> Int {
        return self.numRolls
    }

    func numberOfSides() -> Int {
        return self.numSides
    }
}

var d = Die()
for _ in 1...10 {
    print(d.roll())
}

print(d.numberOfRolls())
```

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Inheritance

to inherit from an existing class:

- specify the parent class in the header
- all fields & methods of the parent class are inherited
- call `super.init` AT THE END of the `init`
- if overriding a method, must declare as `override`

- as in Java, private fields from parent class are not accessible (can allow access by declaring as `internal`)

```
class ColoredDie: Die {
    private var color: String

    init(withColor color: String,
              withSides sides: Int = 6) {
        self.color = color
        super.init(withSides: sides)
    }

    override func roll() -> Int {
        if self.color == "red" {
            return 1
        }
        else {
            return super.roll()
        }
    }

    func dieColor() -> String {
        return self.color
    }
}

var d = ColoredDie(withColor: "white")
print(d.roll())
print(d.dieColor())

var poly: Die = ColoredDie(withColor: "red")
print(poly.roll())
```

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Values vs. references

structs are value types (as in Python)

- when you assign a *struct* object to a variable or pass it as a parameter, a *copy* of that object is assigned

```
var me = Name(first: "David", middle: "W", last: "Reed")
var copy = me

me.first = "Dave"

me.first        →       "Dave"
copy.first      →       "David"
```

classes are reference types (as in Java)

- when you assign a *class* object to a variable or pass it as a parameter, a *reference* to that object is assigned

```
var die1 = ColoredDie(withColor: "green")
var die2 = die1

die1.roll()

die1.numberOfRolls()   → 1
die2.numberOfRolls()   → 1
```

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Collections

Swift provides three different collection structs for storing values

- array: an indexed list
- dictionary: a list of key-value pairs
- set: a non-index list of unique items (*we will ignore for now*)

note: all three are homogeneous (items must all be of the same type)

arrays

```
var example: Array<String>        // declares an array of Strings
var example: [String]             // same thing, but cleaner

var empty: Array<String>()        // declares & inits to be empty
var empty: [String]()             // same thing
var empty: [String] = []          // same thing

var words = ["foo", "bar"]        // declares & initializes
```

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Array properties & methods

```
var words = ["foo", "bar"]

words.count                    → 2

words.append("biz")
words                          → ["foo", "bar", "biz"]

words += ["baz", "boo"]
words                          → ["foo", "bar", "biz", "baz", "boo"]

words[0]                       → "foo"
words[words.count-1]           → "boo"

for str in words {             // displays all five words
    print(str)
}

for i in 0..<words.count {     // also displays all five words
    print(words[i])
}

words.remove(at: 2)
words                          → ["foo", "bar", "baz", "boo"]

words.insert("zoo", at: 1)
words                          → ["foo", "zoo", "bar", "baz", "boo"]
```

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Decision Maker

for HW2, you separated the Model & Controller in your Decision Maker app

- could have taken the HW1 code as is and placed it in a struct with no fields

this is not ideal

- hardcoded to those three answers
- adding more answers is tedious
- impossible to have different Deciders with different options

better solution:

- when a Decider is created, pass in a list of the options
- store that list as a private field
- can then randomly choose an option from the list

```
struct Decider {
    func getAnswer() -> String {
        let randomNum = Int.random(in: 1...3)
        if randomNum == 1 {
            return "YES"
        }
        else if randomNum == 2 {
            return "NO"
        }
        else {
            return "MAYBE"
        }
    }
}


var chooser = Decider()


print(chooser.getAnswer())
```

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Better Decider

```
struct Decider {
    private let options: [String]

    init(between options: [String]) {
        self.options = options
    }

    func getAnswer() -> String {
        return self.options[Int.random(in: 0..<options.count)]
    }
}


var chooser = Decider(between: ["yes", "no", "maybe"])

print(chooser.getAnswer())


var dinnerOptions = ["Pizza", "Sushi", "Burger",
                     "Tacos", "Pancakes", "Salad"]

var foodPicker = Decider(between: dinnerOptions)

print(foodPicker.getAnswer())
```

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Dictionaries (a.k.a. Maps)

suppose you wanted to store people and their ages

- e.g., Pat is 18, Chris is 20, …
- once stored, could look up a person to get their age

a dictionary is a collection of key:value pairs

```
var ages = ["Pat": 18, "Chris": 20, "Kelly": 19]
```

- can add pairs simply by assigning a value to a key

```
ages["Jan"] = 21   // adds "Jan": 21 to the dictionary
```

- can access the value by indexing with the key
- note: indexing returns an Optional (`nil` if key is not stored in the dictionary)

```
ages["Chris"]      → Optional(20)

if let age = ages["Chris"] {
    print(age)
}
```

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Dictionary properties & methods

```
var example = Dictionary<String, Int>  // declares Dictionary of
var example = [String: Int]            //   String:Int pairs

var example: Dictionary<String: Int>() // declares and initializes as
var example: [String: Int]()           //   empty
var example: [String: Int] = [:]       //


var ages = ["Pat": 18, "Chris": 20, "Kelly": 19]

for (name, age) in ages {
    print("\(name) is \(age) years old.")
}

ages["Pat"] = 19                       // updates "Pat"'s value

ages["Sean"] = 22                      // adds "Sean":22 to end

for name in ages.keys {                // adds 1 to each age
    if let age = ages[name] {
        ages[name] = age+1
    }
}

print(ages.values.max()!)              // prints 22
```

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Copy care

arrays and dictionaries, like other built-in Swift types, are structs

- that means that assigning an array/dictionary or passing it as a parameter to a function makes a copy

```
var nums = [3, 6, 1, 7]

var copy = nums

nums += [10, 20, 30]

nums.count                → 7

copy.count                → 4


func zeroOut(numList: [Int]) {
    for index in 0..<numList.count {
        numList[index] = 0
    }
}

zeroOut(numList: nums)

nums                      → [3, 6, 1, 7, 10, 20, 30]
```

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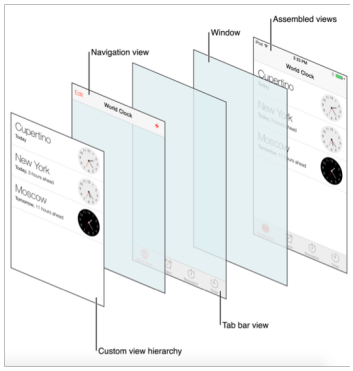
UIKit

the UIKit is a code framework for building mobile apps

- the foundational class for all visual elements in the UIKit is the UIView (or just *view*)
- a view is a clear rectangular shape that is customized to display things on the screen
- UIView subclasses:
  - ✓ UILabel – for displaying text
  - ✓ UIImageView – for displaying images
  - ✓ UIScrollView – for scrollable content
- most app screens consist of many views



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UIView subclasses (so far)

✓ UILabel

- for displaying text
- access/change label: `labelOutlet.text`
- access/change text color: `labelOutlet.textColor`
- access/change background color: `labelOutlet.backgroundColor`

The volume of the ringer and alerts can be adjusted using the volume buttons.

✓ UIImageView

- for displaying images
- access/change image: `imgOutlet.image`

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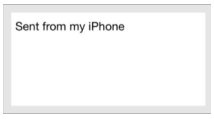
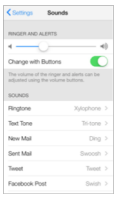
Other UIView subclasses

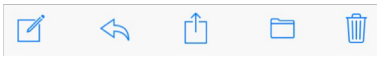


- ✓ UITextView
  - for entering and displaying multiline text

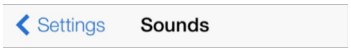
- ✓ UIScrollView
  - for scrollable content



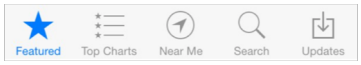
- ✓ UITableView
  - for displaying data in a scrollable column of rows and sections
- ✓ UIToolbar
  - for displaying a toolbar of buttons
  - usually at the bottom of the screen



- ✓ UINavigationBar
  - for displaying main navigational controls
  - usually at the top of the screen



- ✓ UITabBar
  - for displaying options for actions



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UIControl subclasses (so far)

- ✓ UIButton
  - can be clicked

  - change label text: `buttonOutlet.setTitle("???", for: .normal)`
  - change label color: `buttonOutlet.setTitleColor(???, for: .normal)`
  - change background color: `buttonOutlet.backgroundColor`
  - change image: `buttonOutput.setImage(named: ???, for: .normal)`

- ✓ UISwitch
  - can turn on or off

  - determine its position: `switchOutlet.isOn`

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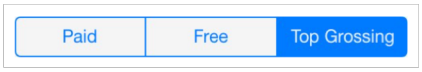
Other UIControl subclasses

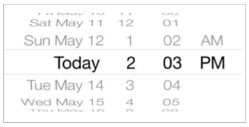
- ✓ UISegmentedControl
  - can select from visible options



- ✓ UITextField
  - can enter text

- ✓ UISlider
  - can select from a range

- ✓ UIDatePicker
  - can select a date



- ✓ UIStepper
  - can increment/decrement a counter

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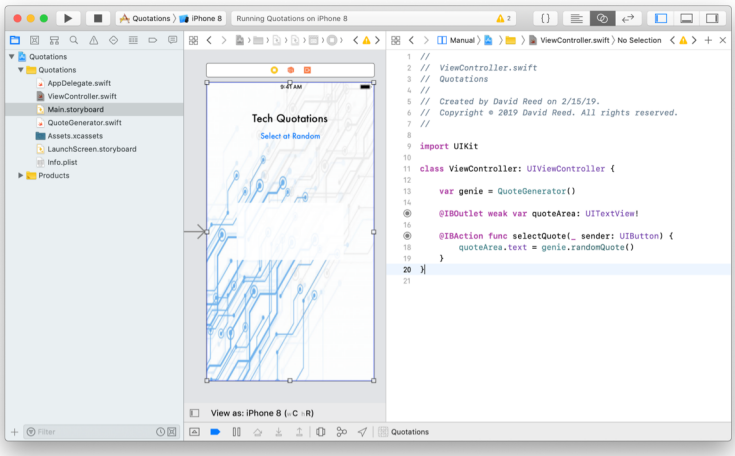
Example: text view

UITextView can display multiline text in an editable, scrollable rectangle

- here, a random quotation is selected and displayed in the text view
- a UIImageView provides the background
- setting the UITextView's alpha to 0.9 make it semi-transparent



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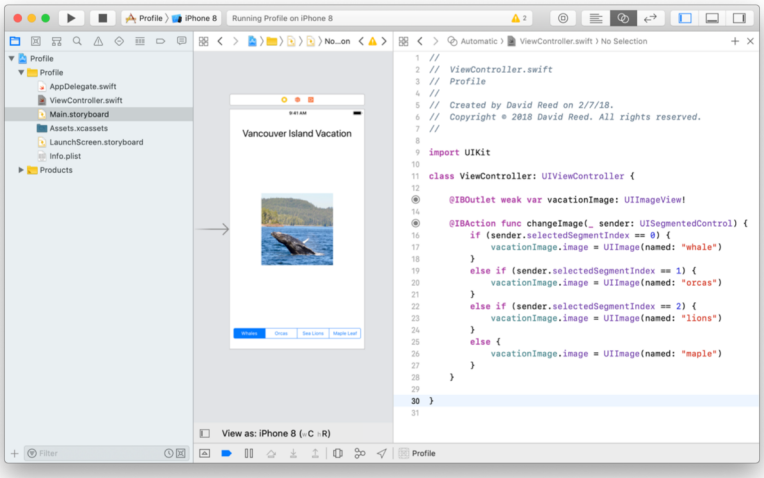
Example: segmented control

UISegmentedControl provides a series of clickable segments

- here, a different image is displayed when a segment is selected



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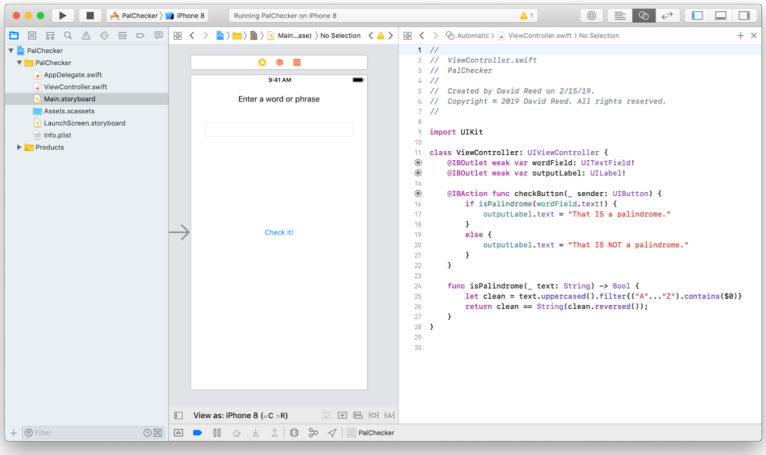
Example: text field

UITextField allows the user to enter text, which can be accessed

- here, the user enters a word or phrase in the text field
- a message identifying whether it is a palindrome or not is displayed in a label



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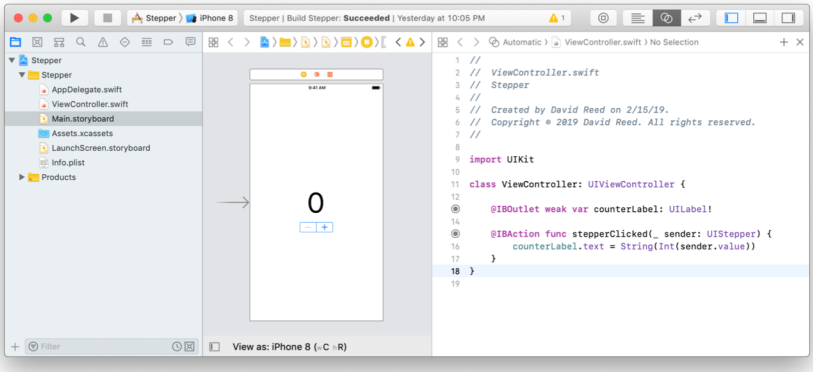
Example: stepper

UIStepper allows simple increment/decrement of a counter

- here, the user clicks +/– to increment/decrement



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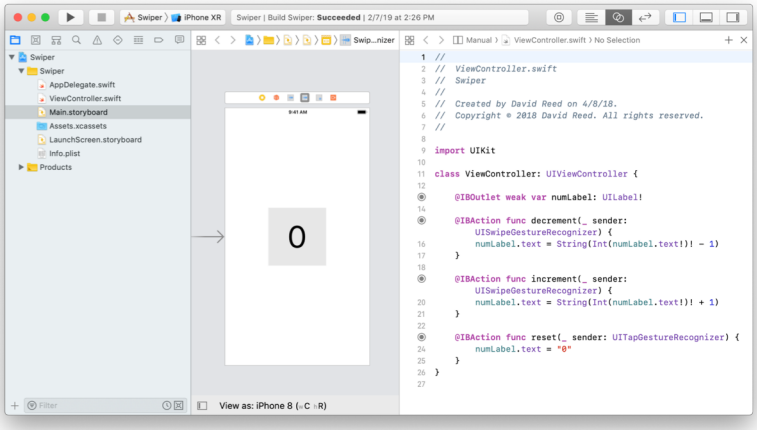
Example: swipe gesture recognizers

similar to the earlier Tap Gesture Recognizer example, we can add Swipe Gesture Recognizers to the main View

- here, swipe right increments, swipe left decrements, tap resets



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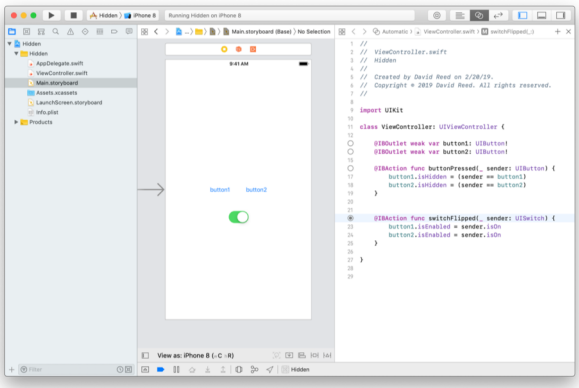
Example: isHidden & isEnabled

can hide views or even disable controls

- every UIView element has an isHidden field
- every UIControl (which inherits from UIView) also has an isEnabled field

- here, one button is visible, clicking on it hides it and makes the other visible
- if the switch is turned off, all the buttons are disabled



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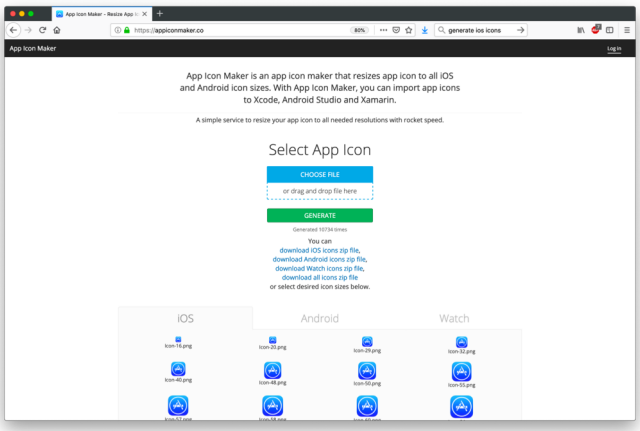
Adding an app icon

adding an icon to your app is simple but tedious

1. download or create an icon image (it should be square)
2. go to a site (many free ones exist) that will generate all of the required resolutions
3. drag your image there, then download a zip file of images



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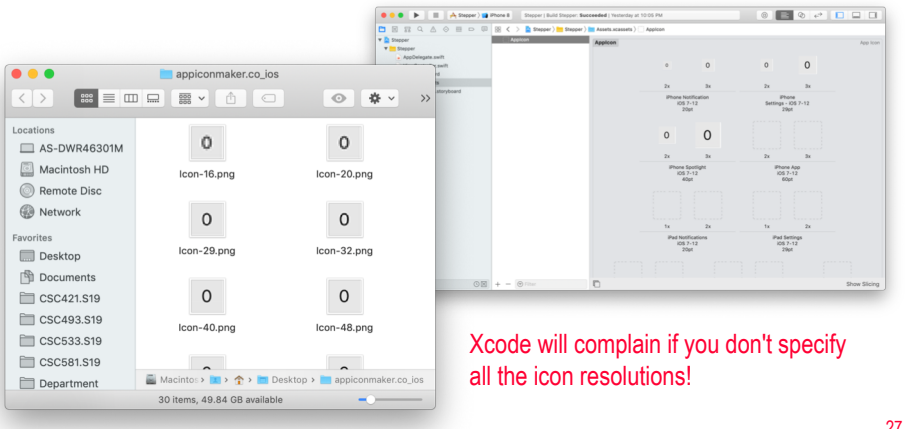
Adding an app icon

4. open the Assets folder in your project and select Appicon
5. drag the corresponding icon image to each slot

   2x specifies twice the resolution; 3x specifies three times

   e.g., 20 pt 2x → drag in Icon-40.png



Xcode will complain if you don't specify all the icon resolutions!

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