Developer Tools

#WWDC16

Getting Started with Swift

Session 404

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The Basics

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Constants

```
let language: String = "Swift"
```

Constants

```
let language: String = "Swift"
```

Constants

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```

Constants

```
let language: String = "Swift"
```

Constants

```
let language: String = "Swift"
```

Constants

```
let language: String = "Swift"
```

Constants

```
let language: String = "Swift"
let introduced: Int = 2014
```

Constants

```
let language: String = "Swift"
let introduced: Int = 2014
let isAwesome: Bool = true
```

Constants

```
let language: String = "Swift"
let introduced: Int = 2014
let isAwesome: Bool = true
```

Naming

```
let language: String = "Swift"
let introduced: Int = 2014
let isAwesome: Bool = true
```

Naming

```
let language: String = "Swift"
let introduced: Int = 2014
let isAwesome: Bool = true
```

Type Inference

```
let language: String = "Swift"
let introduced: Int = 2014
let isAwesome: Bool = true
```

Type Inference

```
let language = "Swift"
let introduced = 2014
let isAwesome = true
```

Type Inference

```
let language = "Swift"          // Inferred as String
let introduced = 2014           // Inferred as Int
let isAwesome = true            // Inferred as Bool
```

Variables

```
let language = "Swift"
let introduced = 2014
let isAwesome = true
var version = 1
```

Variables

```
let language = "Swift"
let introduced = 2014
let isAwesome = true
var version = 1
```

Variables

```
let language = "Swift"
let introduced = 2014
let isAwesome = true
var version = 1
version = 3
```

Variables

```
let language = "Swift"
let introduced = 2014
let isAwesome = true
var version = 1

version = 3

isAwesome = false
```

Variables

```
let language = "Swift"
let introduced = 2014
let isAwesome = true
var version = 1

version = 3

isAwesome = false                    Error
```

Building Strings

```
let conference = "WWDC"

let message = "Hello, " + conference + "!"
// "Hello, WWDC!"
```

String Interpolation

```
let conference = "WWDC"

let message = "Hello, \(conference)!"
// "Hello, WWDC!"
```

String Interpolation

```
let conference = "WWDC"
let year = 2016
let message = "Hello, \(conference) \(year)!"
// "Hello, WWDC 2016!"
```

String Interpolation

```
let conference = "WWDC"
let year = 2016
let message = "Hello, \(conference) \(year + 1)!"
// "Hello, WWDC 2017!"
```

Unicode

```
let instruction = "Beware of the 🐶🐮"
```

Unicode

```
let instruction = "Beware of the 🐶🐮"
let internationalHarmony = "🇬🇧🇺🇸😍"
```

Unicode

```
let instruction = "Beware of the 🐶🐮"
let internationalHarmony = "🇬🇧🇺🇸😍"

let π = 3.1415927
let 鼠标 = "🐭"
```

Characters

```
let dogString = "Dog?!🐶"
```

Characters

```
let dogString = "Dog?!🐶"
```

Characters

```
let dogString = "Dog?!🐶"
print("\(dogString) is \(dogString.characters.count) characters long")
```

Characters

```
let dogString = "Dog?!🐶"
print("\(dogString) is \(dogString.characters.count) characters long")
```

```
Dog?!🐶 is 5 characters long.
```

Characters

```
let dogString = "Dog?!🐶"
for character in dogString.characters {
   print(character)
}
```

Characters

```
let dogString = "Dog?!🐶"
for character in dogString.characters {
   print(character)
}
```

```
D
o
g
?!
🐶
```

Array and Dictionary

Array and Dictionary

```
let names = ["Lily", "Santiago", "Justyn", "Aadya"]
```

Array and Dictionary

```
let names = ["Lily", "Santiago", "Justyn", "Aadya"]



let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Array and Dictionary

```
let names = ["Lily", "Santiago", "Justyn", "Aadya"]


let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Array and Dictionary

```
let names = ["Lily", "Santiago", "Justyn", "Aadya", 42]



let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Array and Dictionary

```
let names = ["Lily", "Santiago", "Justyn", "Aadya", true]



let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Array and Dictionary

```
let names = ["Lily", "Santiago", "Justyn", "Aadya", Bicycle()]



let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Array and Dictionary

```
let names = ["Lily", "Santiago", "Justyn", "Aadya"]



let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Array and Dictionary

```
let names: [String] = ["Lily", "Santiago", "Justyn", "Aadya"]



let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Type Inference

```
let names = ["Lily", "Santiago", "Justyn", "Aadya"]
// an array of String values

let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Type Inference

```
let names = ["Lily", "Santiago", "Justyn", "Aadya"]
// an array of String values

let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
// a dictionary with String keys and Int values
```

Loops

While and Repeat-While

```
while !endOfFile {
    readLine()
}
```

```
repeat {
    performTask()
} while tasksRemaining > 0
```

For-In Loop

Characters

```
let dogString = "Dog?!🐶"
for character in dogString.characters {
   print(character)
}
```

For-In Loop

Characters

```
let dogString = "Dog?!🐶"
for character in dogString.characters {
   print(character)
}
```

```
D
o
g
?!
🐶
```

For-In Loop

Closed Ranges

```
for number in 1...5 {
   print("\(number) times 4 is \(number * 4)")
}
```

For-In Loop

Closed Ranges

```
for number in 1...5 {
   print("\(number) times 4 is \(number * 4)")
}
```

```
1 times 4 is 4
2 times 4 is 8
3 times 4 is 12
4 times 4 is 16
5 times 4 is 20
```

For-In Loop

Closed Ranges

```
for number in 1...5 {
    print("\(number) times 4 is \(number * 4)")
}
```

```
1 times 4 is 4
2 times 4 is 8
3 times 4 is 12
4 times 4 is 16
5 times 4 is 20
```

For-In Loop

Half-Closed Ranges

```
let results = [7, 52, 9, 33, 6, 12, 86, 4, 22, 18, 3]
let maxResultCount = 5
for index in 0..<maxResultCount {
   print("Result \(index) is \(results[index])")
}
```

For-In Loop

Half-Closed Ranges

```
let results = [7, 52, 9, 33, 6, 12, 86, 4, 22, 18, 3]
let maxResultCount = 5
for index in 0..<maxResultCount {
   print("Result \(index) is \(results[index])")
}
```

```
Result 0 is 7
Result 1 is 52
Result 2 is 9
Result 3 is 33
Result 4 is 6
```

For-In Loop

Half-Closed Ranges

```
let results = [7, 52, 9, 33, 6, 12, 86, 4, 22, 18, 3]
let maxResultCount = 5
for index in 0..<maxResultCount {
   print("Result \(index) is \(results[index])")
}
```

```
Result 0 is 7
Result 1 is 52
Result 2 is 9
Result 3 is 33
Result 4 is 6
```

For-In Loop

Arrays

```
for name in ["Lily", "Santiago", "Justyn", "Aadya"] {
   print("Hello, \(name)!")
}
```

For-In Loop

Arrays

```
for name in ["Lily", "Santiago", "Justyn", "Aadya"] {
   print("Hello, \(name)!")
}
```

```
Hello, Lily!
Hello, Santiago!
Hello, Justyn!
Hello, Aadya!
```

For-In Loop

Dictionaries

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
for (name, age) in ages {
   print("\(name) is \(age) years old")
}
```

For-In Loop

Dictionaries

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
for (name, age) in ages {
   print("\(name) is \(age) years old")
}
```

```
Mohsen is 17 years old
Amy is 40 years old
Graham is 5 years old
```

For-In Loop

Dictionaries

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
for (name, age) in ages {
   print("\(name) is \(age) years old")
}
```

```
Mohsen is 17 years old
Amy is 40 years old
Graham is 5 years old
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
```

```
["Socks", "Shoes"]
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
```

```
"Socks"
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
packingList.append("Trousers")
```

```
["Socks", "Shoes", "Trousers"]
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
packingList.append("Trousers")
```

```
["Socks", "Shoes", "Trousers"]
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
packingList.append("Trousers")
packingList[2] = "Jeans"
```

```
["Socks", "Shoes", "Jeans"]
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
packingList.append("Trousers")
packingList[2] = "Jeans"
```

```
["Socks", "Shoes", "Jeans"]
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
packingList.append("Trousers")
packingList[2] = "Jeans"
packingList.append(contentsOf: ["Shorts", "Sandals", "Sunblock"])
```

```
["Socks", "Shoes", "Jeans", "Shorts", "Sandals", "Sunblock"]
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
packingList.append("Trousers")
packingList[2] = "Jeans"
packingList.append(contentsOf: ["Shorts", "Sandals", "Sunblock"])
```

```
["Socks", "Shoes", "Jeans", "Shorts", "Sandals", "Sunblock"]
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
packingList.append("Trousers")
packingList[2] = "Jeans"
packingList.append(contentsOf: ["Shorts", "Sandals", "Sunblock"])
packingList[3...5] = ["Hoodie", "Scarf"]
```

```
["Socks", "Shoes", "Jeans", "Hoodie", "Scarf"]
```

Modifying an Array

Packing for WWDC

```
var packingList = ["Socks", "Shoes"]
print(packingList[0])
packingList.append("Trousers")
packingList[2] = "Jeans"
packingList.append(contentsOf: ["Shorts", "Sandals", "Sunblock"])
packingList[3...5] = ["Hoodie", "Scarf"]
```

```
["Socks", "Shoes", "Jeans", "Hoodie", "Scarf"]
```

Modifying a Dictionary

```
var ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

```
["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Modifying a Dictionary

```
var ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
ages["Justyn"] = 67     // Adds a new value for "Justyn"
```

```
["Mohsen": 17, "Amy": 40, "Graham": 5, "Justyn": 67]
```

Modifying a Dictionary

```
var ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
ages["Justyn"] = 67     // Adds a new value for "Justyn"
ages["Justyn"] = 68     // Changes the value for "Justyn"
```

```
["Mohsen": 17, "Amy": 40, "Graham": 5, "Justyn": 68]
```

Retrieving a Value from a Dictionary

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
```

Retrieving a Value from a Dictionary

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
// Devon?
```

Retrieving a Value from a Dictionary

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
// Devon?
// Daryl?
```

Retrieving a Value from a Dictionary

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]
// Devon?
// Daryl?
// Daniel?
```

Optionals

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge = ages["Amy"]
```

Optionals

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge = ages["Amy"]
```

A value of 40, perhaps?

Optionals

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge = ages["Daryl"]
```

Optionals

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

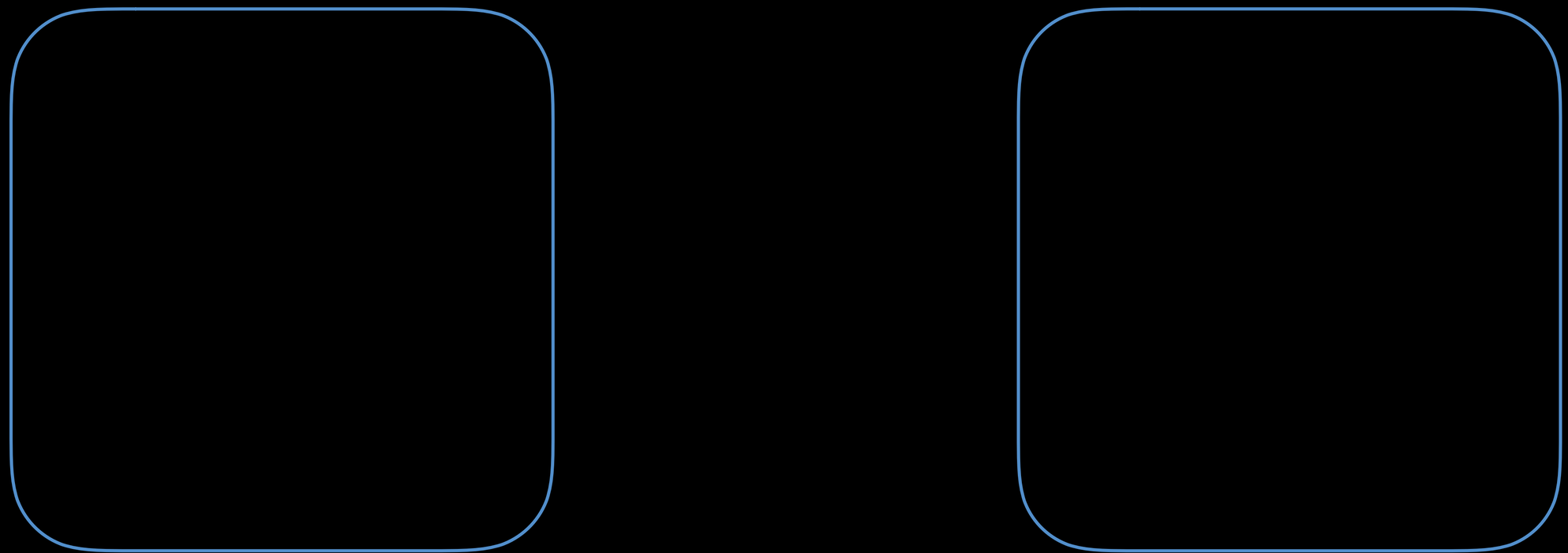
let possibleAge = ages["Daryl"]
```

```
?????
```

Optionals

`ages["Amy"]`

`ages["Daryl"]`



Optionals

```
ages["Amy"]
```

40

Int

```
ages["Daryl"]
```

Optionals

`ages["Amy"]`

40

Int

`ages["Daryl"]`

No Value

No Int

Optionals

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge: Int? = ages["Daryl"]
```

Optionals

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge: Int? = ages["Daryl"]
```

Checking for an Optional Value

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge: Int? = ages["Daryl"]

if possibleAge == nil {
    print("Age not found.")
}
```

Checking for an Optional Value

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge: Int? = ages["Daryl"]

if possibleAge == nil {
    print("Age not found.")
}
```

Checking for an Optional Value

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge: Int? = ages["Daryl"]

if possibleAge == nil {
    print("Age not found.")
}
```

```
Age not found.
```

Checking for an Optional Value

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

let possibleAge: Int? = ages["Amy"]

if possibleAge == nil {
    print("Age not found.")
}
```

If-Let Statement

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

if let age = ages["Amy"] {
   print("An age of \(age) was found.")
}
```

If-Let Statement

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

if let age = ages["Amy"] {
   print("An age of \(age) was found.")
}
```

If-Let Statement

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

if let age = ages["Amy"] {
   print("An age of \(age) was found.")
}
```

If-Let Statement

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

if let age = ages["Amy"] {
   print("An age of \(age) was found.")
}
```

If-Let Statement

```
let ages = ["Mohsen": 17, "Amy": 40, "Graham": 5]

if let age = ages["Amy"] {
   print("An age of \(age) was found.")
}
```

```
An age of 40 was found.
```

If Statement

```
let age = 32

if age == 1 {
   print("Happy first birthday!")
} else if age == 40 {
   print("Happy 40th birthday!")
} else {
   print("Happy plain old boring birthday.")
}
```

If Statement

```
let age = 32

if age == 1 {
   print("Happy first birthday!")
} else if age == 40 {
   print("Happy 40th birthday!")
} else {
   print("Happy plain old boring birthday.")
}
```

If Statement

```
let age = 32

if age == 1 {
    print("Happy first birthday!")
} else if age == 40 {
    print("Happy 40th birthday!")
} else {
    print("Happy plain old boring birthday.")
}
```

Switch Statement

```
let age = 1
switch age {




}
```

Switch Statement

```
let age = 1
switch age {




}
```

Switch Statement

```
let age = 1
switch age {
case 1:
   print("Happy first birthday!")




}
```

Switch Statement

```
let age = 15
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")



}
```

Switch Statement

```
let age = 40
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")


}
```

Switch Statement

```
let age = 40
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")



}
```

Switch Statement

```
let age = 40
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")


}
```

Switch Statement

```
let age = 40
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")


}
```

Switch Statement

```
let age = 40
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")


}
```

Switch Statement

```
let age = 41
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")


}
```

Switch Statement

```
let age = 97
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")


}
```

Switch Statement

```
let age = 56
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")


}
```

Switch Statement

```
let age = 32
switch age {
case 1:
   print("Happy first birthday!")
case 13...19:
   print("Happy birthday, teenager!")
case let decade where decade % 10 == 0:
   print("Happy significant \(decade)th birthday!")
default:
   print("Happy plain old boring birthday.")
}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {



}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
    print("Welcome back, administrator!")




}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")


}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")


}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "admin"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

```
Welcome back, administrator!
```

Switch Statement

```
let userName = "guest"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "guest"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

```
Guests are not allowed in this restricted area.
```

Switch Statement

```
let userName = "bob"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "bob"
let passwordIsValid = true
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

```
Welcome to the restricted area!
```

Switch Statement

```
let userName = "bob"
let passwordIsValid = false
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "bob"
let passwordIsValid = false
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

```
ACCESS DENIED.
```

Switch Statement

```
let userName = "bob"
let passwordIsValid = false
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Switch Statement

```
let userName = "bob"
let passwordIsValid = false
switch (userName, passwordIsValid) {
case ("admin", true):
   print("Welcome back, administrator!")
case ("guest", _):
   print("Guests are not allowed in this restricted area.")
case (_, let isValid):
   print(isValid ? "Welcome to the restricted area!" : "ACCESS DENIED.")
}
```

Functions and Closures

Brian Lanier Swift Documentation Team Manager

Functions

```
func sendMessage() {
    let message = "Hey there!"
    print(message)
}
```

Functions

```
func sendMessage() {
    let message = "Hey there!"
    print(message)
}
sendMessage()
```

Functions

```
func sendMessage() {
    let message = "Hey there!"
    print(message)
}
sendMessage()
```

```
Hey there!
```

Parameters

```
func sendMessage(shouting: Bool) {
    var message = "Hey there!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
```

Parameters

```
func sendMessage(shouting: Bool) {
    var message = "Hey there!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
```

Argument Labels

```
func sendMessage(shouting: Bool) {
    var message = "Hey there!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(shouting: true)
```

Argument Labels

```
func sendMessage(shouting: Bool) {
   var message = "Hey there!"
   if shouting {
      message = message.uppercased()
   }
   print(message)
}
sendMessage(shouting: true)
```

```
HEY THERE!
```

Multiple Parameters

```
func sendMessage(recipient: String, shouting: Bool) {
    var message = "Hey there, \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
```

Multiple Parameters

```
func sendMessage(recipient: String, shouting: Bool) {
    var message = "Hey there, \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(recipient: "Morgan", shouting: false)
```

Multiple Parameters

```
func sendMessage(recipient: String, shouting: Bool) {
    var message = "Hey there, \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(recipient: "Morgan", shouting: false)
```

```
Hey there, Morgan!
```

Multiple Parameters

```
func sendMessage(recipient: String, shouting: Bool) {
    var message = "Hey there, \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(recipient: "Morgan", shouting: false)
```

Multiple Parameters

```
func sendMessage(to: String, shouting: Bool) {
   var message = "Hey there, \(to)!"
   if shouting {
      message = message.uppercased()
   }
   print(message)
}
sendMessage(to: "Morgan", shouting: false)
```

Multiple Parameters

```
func sendMessage(to: String, shouting: Bool) {
    var message = "Hey there, \(to)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(to: "Morgan", shouting: false)
```

Multiple Parameters

```
func sendMessage(to: String, shouting: Bool) {
   var message = "Hey there, \(to)!"
   if shouting {
      message = message.uppercased()
   }
   print(message)
}
sendMessage(to: "Morgan", shouting: false)
```

Multiple Parameters

```
func sendMessage(to: String, shouting: Bool) {
    var message = "Hey there, \(to)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(to: "Morgan", shouting: false)
```

Explicit Argument Labels

```
func sendMessage(to recipient: String, shouting: Bool) {
    var message = "Hey there, \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(to: "Morgan", shouting: false)
```

Explicit Argument Labels

```
func sendMessage(to recipient: String, shouting: Bool) {
    var message = "Hey there, \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(to: "Morgan", shouting: false)
```

Explicit Argument Labels

```
func sendMessage(to recipient: String, shouting: Bool) {
    var message = "Hey there, \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(to: "Morgan", shouting: false)
```

Argument Labels

```
func sendMessage(message: String, to recipient: String, shouting: Bool) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
```

Argument Labels

```
func sendMessage(message: String, to recipient: String, shouting: Bool) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(message: "See you at the Bash", to: "Morgan", shouting: false)
```

Argument Labels

```
func sendMessage(message: String, to recipient: String, shouting: Bool) {
   var message = "\(message), \(recipient)!"
   if shouting {
      message = message.uppercased()
   }
   print(message)
}
sendMessage(message: "See you at the Bash", to: "Morgan", shouting: false)
```

```
See you at the Bash, Morgan!
```

Argument Labels

```
func sendMessage(message: String, to recipient: String, shouting: Bool) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage(message: "See you at the Bash", to: "Morgan", shouting: false)
```

Omitting Argument Labels

```
func sendMessage(_ message: String, to recipient: String, shouting: Bool) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
```

Omitting Argument Labels

```
func sendMessage(_ message: String, to recipient: String, shouting: Bool) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage("See you at the Bash", to: "Morgan", shouting: false)
```

Parameters with Default Values

```
func sendMessage(_ message: String, to recipient: String, shouting: Bool = false) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
```

Parameters with Default Values

```
func sendMessage(_ message: String, to recipient: String, shouting: Bool = false) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage("See you at the Bash", to: "Morgan")
```

Parameters with Default Values

```
func sendMessage(_ message: String, to recipient: String, shouting: Bool = false) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage("See you at the Bash", to: "Morgan")
```

```
See you at the Bash, Morgan!
```

Parameters with Default Values

```
func sendMessage(_ message: String, to recipient: String, shouting: Bool = false) {
    var message = "\(message), \(recipient)!"
    if shouting {
        message = message.uppercased()
    }
    print(message)
}
sendMessage("See you at the Bash", to: "Morgan")
```

Swift API Design Guidelines	Presidio	Tuesday 10:00AM

Function Return Values

Function Return Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String {…}
```

Function Return Values

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func firstString(havingPrefix prefix: String, in strings: [String]) -> String {…}
```

Function Return Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String {…}
```

Function Return Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String {…}
```

Function Return Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String {
    for string in strings {



    }

}
```

Function Return Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String {
    for string in strings {
        if string.hasPrefix(prefix) {
        }
    }

}
```

Function Return Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String {
    for string in strings {
        if string.hasPrefix(prefix) {
            return string
        }
    }

}
```

Function Return Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String {
    for string in strings {
        if string.hasPrefix(prefix) {
            return string
        }
    }
    return
}
```

Function Return Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String {
    for string in strings {
        if string.hasPrefix(prefix) {
            return string
        }
    }
    return ""
}
```

Returning Optional Values

```
func firstString(havingPrefix prefix: String, in strings: [String]) -> String? {
    for string in strings {
        if string.hasPrefix(prefix) {
            return string
        }
    }
    return nil
}
```

Returning Optional Values

```
var guests = ["Jack", "Kumar", "Anita", "Anna"]

if let guest = firstString(havingPrefix: "A", in: guests) {
   print("See you at the party, \(guest)!")
} else {
   print("Invite must be in the mail.")
}
```

Returning Optional Values

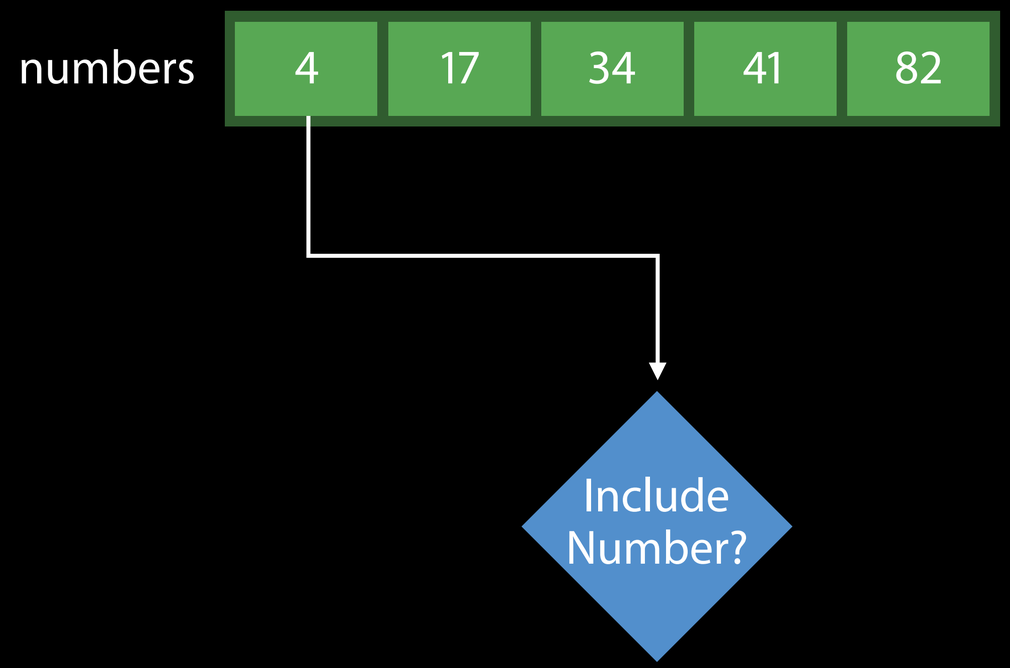
```
var guests = ["Jack", "Kumar", "Anita", "Anna"]

if let guest = firstString(havingPrefix: "A", in: guests) {
   print("See you at the party, \(guest)!")
} else {
   print("Invite must be in the mail.")
}
```

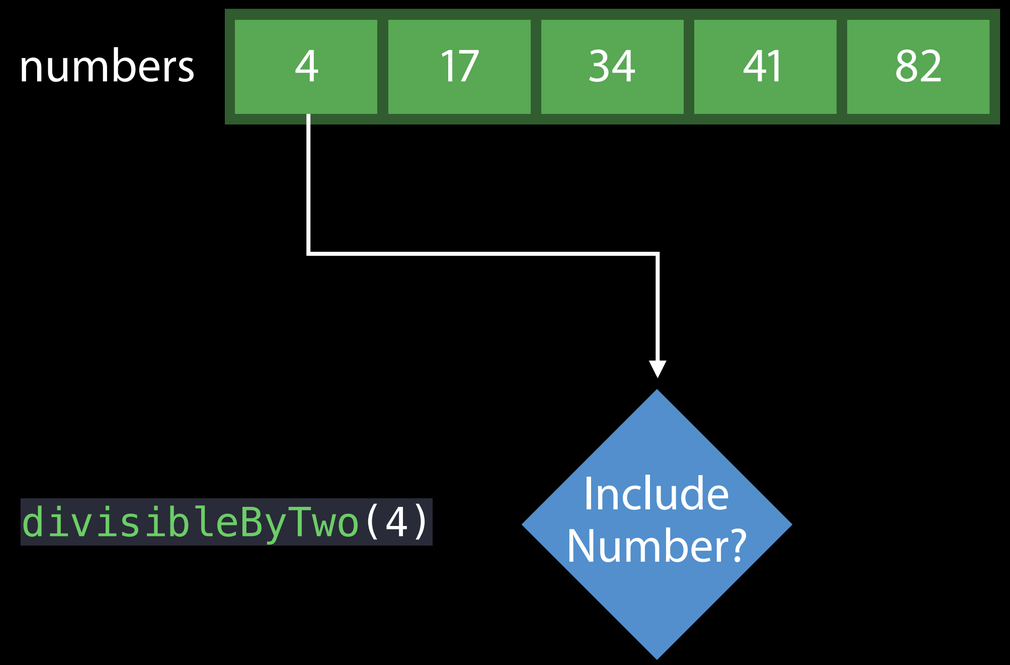
```
See you at the party, Anita!
```

Filtering Numbers

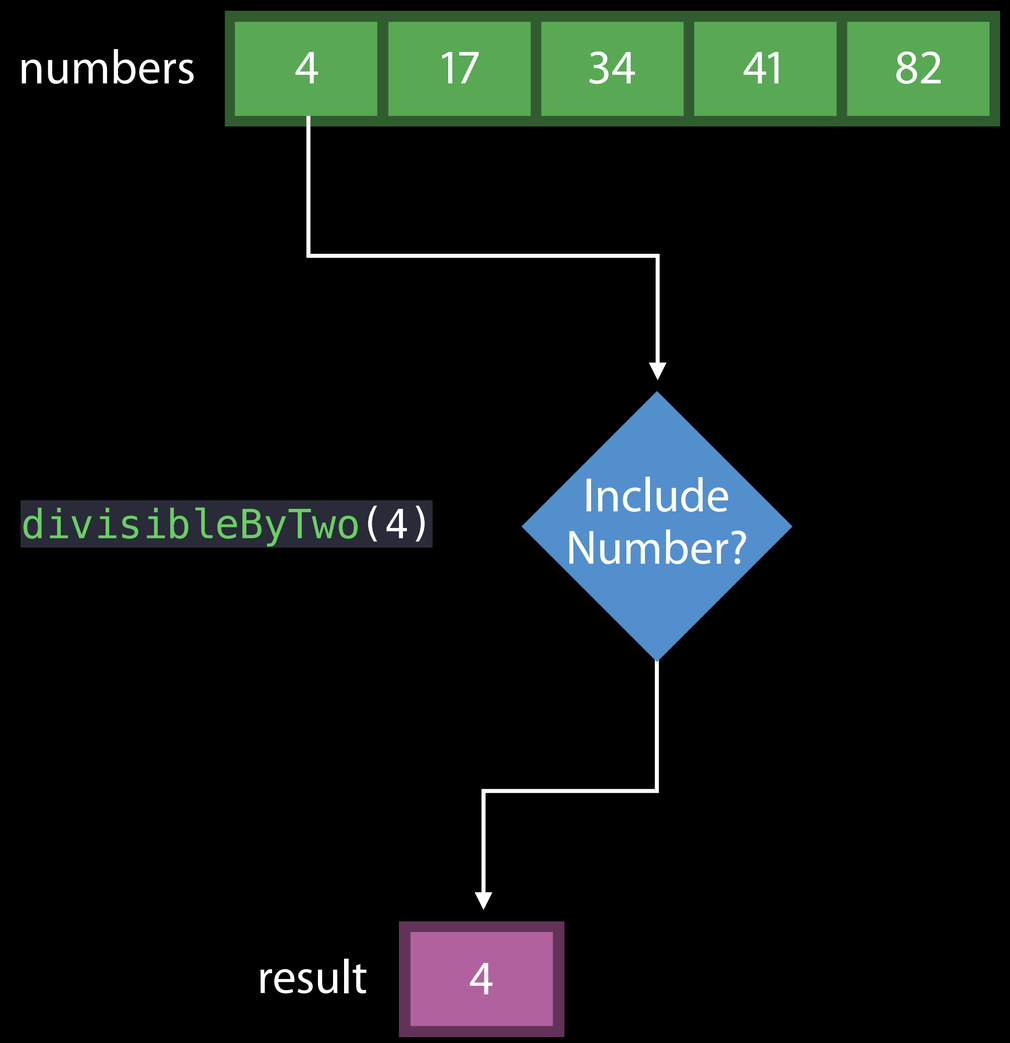
Filtering Numbers



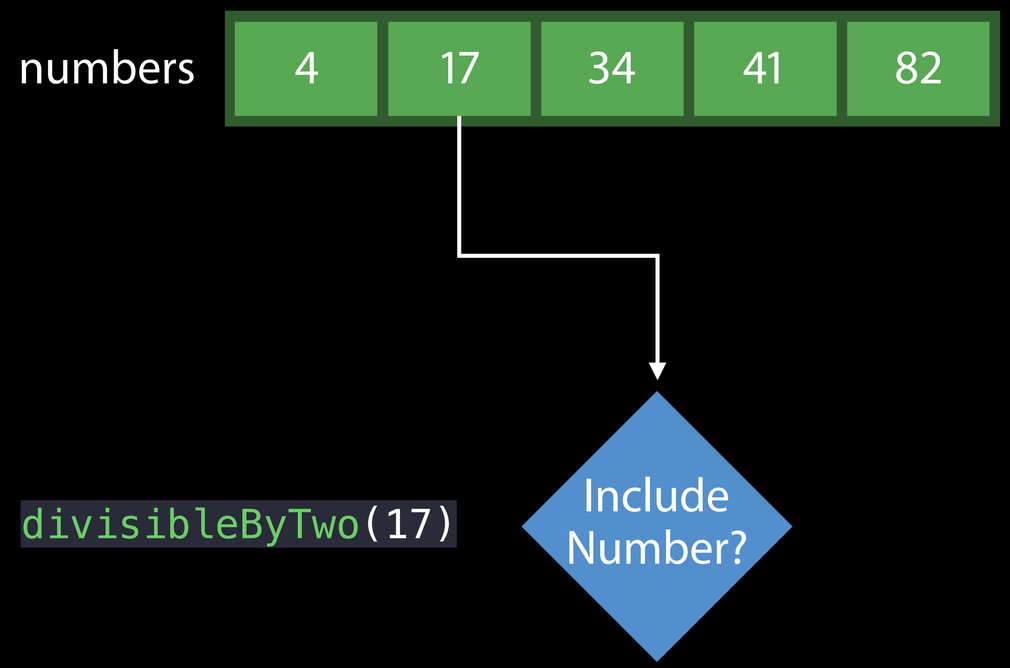
Filtering Numbers



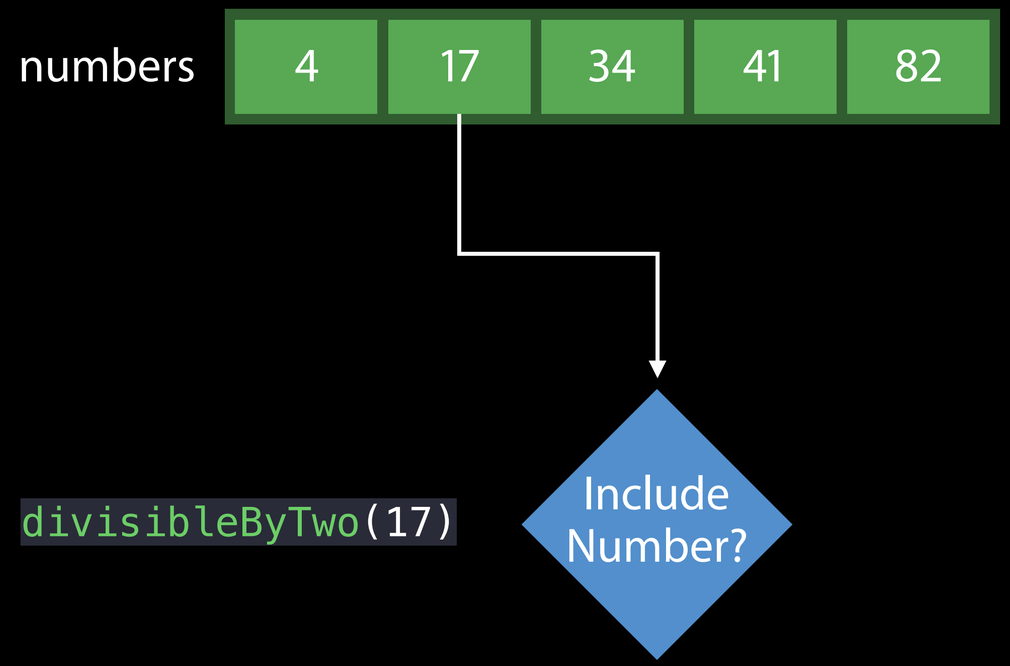
Filtering Numbers



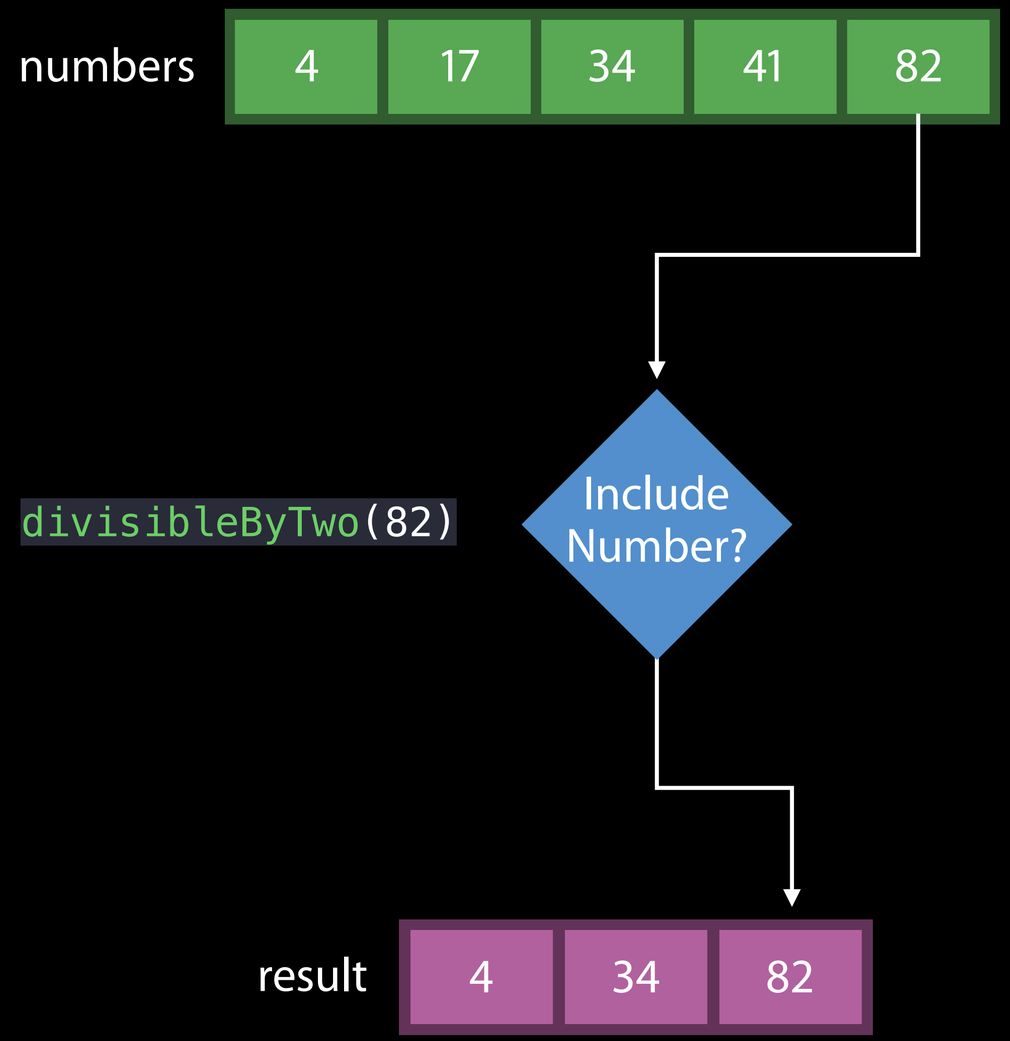
Filtering Numbers



Filtering Numbers



Filtering Numbers



Filtering Numbers

```
func filterInts(_ numbers: [Int], _ includeNumber: type) -> [Int] {…}
```

Function Types

```
(parameter types) -> return type
```

Function Types

```
(parameter types) -> return type

func sendMessage() {…}
```

Function Types

```
(parameter types) -> return type

func sendMessage() {…}
```

```
() -> Void
```

Function Types

```
(parameter types) -> return type

func firstString(havingPrefix prefix: String, in strings: [String]) -> String? {…}
```

Function Types

```
(parameter types) -> return type

func firstString(havingPrefix prefix: String, in strings: [String]) -> String? {…}
```

```
(String, [String]) -> String?
```

Functions as Parameters

```
func filterInts(_ numbers: [Int], _ includeNumber: type) -> [Int] {…}
```

Functions as Parameters

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {



}
```

Functions as Parameters

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {
    var result: [Int] = []
    for number in numbers {


    }
    return result
}
```

Functions as Parameters

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {
    var result: [Int] = []
    for number in numbers {
        if includeNumber(number) {
            result.append(number)
        }
    }
    return result
}
```

Functions as Parameters

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {
    var result: [Int] = []
    for number in numbers {
        if includeNumber(number) {
            result.append(number)
        }
    }
    return result
}
```

Functions as Arguments

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return n % 2 == 0
}
```

Functions as Arguments

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}
```

(Int) -> Bool

Functions as Arguments

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, divisibleByTwo)
```

Functions as Arguments

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, divisibleByTwo)
print(evenNumbers)
```

```
[4, 34, 82]
```

Functions as Arguments

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, divisibleByTwo)
print(evenNumbers)
```

```
[4, 34, 82]
```

Functions as Arguments

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts([4, 17, 34, 41, 82], divisibleByTwo)
print(evenNumbers)
```

```
[4, 34, 82]
```

Functions as Arguments

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, divisibleByTwo)
print(evenNumbers)
```

```
[4, 34, 82]
```

Functions as Arguments

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, divisibleByTwo)
print(evenNumbers)
```

```
[4, 34, 82]
```

Closure Expressions

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, divisibleByTwo)
print(evenNumbers)
```

```
[4, 34, 82]
```

Closure Expressions

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, { (number: Int) -> Bool     return number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Closure Expressions

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, { (number: Int) -> Bool in return number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Closure Expressions

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let numbers = [4, 17, 34, 41, 82]
func divisibleByTwo(_ number: Int) -> Bool {
    return number % 2 == 0
}

let evenNumbers = filterInts(numbers, { (number: Int) -> Bool in return number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Type Inference in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { (number: Int) -> Bool in return number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Type Inference in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { (number: Int) -> Bool in return number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Type Inference in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { number in return number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Type Inference in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { number in return number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Type Inference in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { number in number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Implicit Arguments in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { number in number % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Implicit Arguments in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { $0 % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Implicit Arguments in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { $0 % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Implicit Arguments in Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { $0 % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Trailing Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers, { $0 % 2 == 0 })
print(evenNumbers)
```

```
[4, 34, 82]
```

Trailing Closures

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {…}

let evenNumbers = filterInts(numbers) { $0 % 2 == 0 }
print(evenNumbers)
```

```
[4, 34, 82]
```

Trailing Closures

```
let evenDigitSums = filterInts(numbers) { number in
   var sum = 0, number = number
   while number > 0 {
      //... calculate sum of digits
      //... 82 is 8 + 2 = 10, which is even
   }
   return sum % 2 == 0
}
```

Trailing Closures

```
let evenDigitSums = filterInts(numbers) { number in
   var sum = 0, number = number
   while number > 0 {
      //... calculate sum of digits
      //... 82 is 8 + 2 = 10, which is even
   }
   return sum % 2 == 0
}
print(evenDigitSums)
```

```
[4, 82]
```

Filtering Strings?

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna"]

let shortNames = filterStrings(names) { name in
   name.characters.count < 5
}
```

Filtering Strings?

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna"]

let shortNames = filterStrings(names) { name in
   name.characters.count < 5
}
print(shortNames)
```

```
[Lily, Jack, Anna]
```

Filtering Numbers

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {
    var result: [Int] = []
    for number in numbers {
        if includeNumber(number) {
            result.append(number)
        }
    }
    return result
}
```

Filtering Numbers

```
func filterInts(_ numbers: [Int], _ includeNumber: (Int) -> Bool) -> [Int] {
    var result: [Int] = []
    for number in numbers {
        if includeNumber(number) {
            result.append(number)
        }
    }
    return result
}
```

Filtering Numbers

```
func filterStrings(_ strings: [Int], _ includeString: (Int) -> Bool) -> [Int] {
    var result: [Int] = []
    for string in strings {
        if includeString(string) {
            result.append(string)
        }
    }
    return result
}
```

Filtering Numbers

```
func filterStrings(_ strings: [Int], _ includeString: (Int) -> Bool) -> [Int] {
    var result: [Int] = []
    for string in strings {
        if includeString(string) {
            result.append(string)
        }
    }
    return result
}
```

Filtering Strings

```
func filterStrings(_ strings: [String], _ includeString: (String) -> Bool) -> [String] {
    var result: [String] = []
    for string in strings {
        if includeString(string) {
            result.append(string)
        }
    }
    return result
}
```

Filtering Strings

```
func filterStrings(_ strings: [String], _ includeString: (String) -> Bool) -> [String] {
    var result: [String] = []
    for string in strings {
        if includeString(string) {
            result.append(string)
        }
    }
    return result
}
```

Generic Filtering

```
func filter(_ source: [Element], _ includeElement: (Element) -> Bool) -> [Element] {
    var result: [Element] = []
    for element in source {
        if includeElement(element) {
            result.append(element)
        }
    }
    return result
}
```

Generic Type Parameters

```
func filter<Element>(_ source: [Element], _ includeElement: (Element) -> Bool) -> [Element] {
    var result: [Element] = []
    for element in source {
        if includeElement(element) {
            result.append(element)
        }
    }
    return result
}
```

Generic Type Parameters

```
func filter<Element>(_ source: [Element], _ includeElement: (Element) -> Bool) -> [Element] {
    var result: [Element] = []
    for element in source {
        if includeElement(element) {
            result.append(element)
        }
    }
    return result
}
```

Calling Generic Functions

```
func filter<Element>(_ source: [Element], _ includeElement: (Element) -> Bool) -> [Element] {
    var result: [Element] = []
    for element in source {
        if includeElement(element) {
            result.append(element)
        }
    }
    return result
}
```

Calling Generic Functions

```
func filter<Element>(_ source: [Element], _ includeElement: (Element) -> Bool) -> [Element] {
    var result: [Element] = []
    for element in source {
        if includeElement(element) {
            result.append(element)
        }
    }
    return result
}

let evenNumbers = filter(numbers) { $0 % 2 == 0 }
let shortNames = filter(names) { name in name.characters.count < 5 }
```

Filter and Map Methods

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna", "Andrés"]

let shortNames = names.filter { name in name.characters.count < 5 }
```

Filter and Map Methods

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna", "Andrés"]

let shortNames = names.filter { name in name.characters.count < 5 }
print(shortNames)
```

```
[Lily, Jack, Anna]
```

Filter and Map Methods

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna", "Andrés"]

let shortNames = names.filter { name in name.characters.count < 5 }
print(shortNames)

let capitalizedShortNames = shortNames.map { name in name.uppercased() }
```

```
[Lily, Jack, Anna]
```

Filter and Map Methods

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna", "Andrés"]

let shortNames = names.filter { name in name.characters.count < 5 }
print(shortNames)

let capitalizedShortNames = shortNames.map { name in name.uppercased() }
print(capitalizedShortNames)
```

```
[Lily, Jack, Anna]
[LILY, JACK, ANNA]
```

Filter and Map Methods

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna", "Andrés"]

let capitalizedShortNames = names.filter { name in name.characters.count < 5 }
                                 .map { name in name.uppercased() }
```

Filter and Map Methods

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna", "Andrés"]

let capitalizedShortNames = names.filter { name in name.characters.count < 5 }
                                 .map { name in name.uppercased() }
```

Filter and Map Methods

```
let names = ["Lily", "Santiago", "Aadya", "Jack", "Anna", "Andrés"]

let capitalizedShortNames = names.filter { name in name.characters.count < 5 }
                                 .map { name in name.uppercased() }

print(capitalizedShortNames)
```

```
[LILY, JACK, ANNA]
```

Custom Types

Alex Martini Swift Documentation Engineer

Structures

```
struct Rectangle {
    var width = 12
    var height = 10
}

var rectangle = Rectangle()
rectangle.height = 4
```

Structures

```
struct Rectangle {
    var width = 12
    var height = 10
}

var rectangle = Rectangle()
rectangle.height = 4
```

Structures

```
struct Rectangle {
   var width = 12
   var height = 10
}

var rectangle = Rectangle()
rectangle.height = 4
```

Structures

```
struct Rectangle {
   var width = 12
   var height = 10
}

var rectangle = Rectangle()
rectangle.height = 4
```

Structures

```
struct Rectangle {
    var width: Int
    var height: Int
}

var rectangle = Rectangle(width: 4, height: 5)
```

Structures

```
struct Rectangle {
    var width: Int
    var height: Int
}

var rectangle = Rectangle(width: 4, height: 5)
```

Properties

```
struct Rectangle {
    var width: Int
    var height: Int
    var area: Int
}
```

Computed Properties

```
struct Rectangle {
    var width: Int
    var height: Int
    var area: Int {
        return width * height
    }
}
```

Computed Properties

```
struct Rectangle {
    var width: Int
    var height: Int
    var area: Int {
        return width * height
    }
}
let rectangle = Rectangle(width: 4, height: 5)
print("Width is \(rectangle.width) and area is \(rectangle.area).")
```

Computed Properties

```
struct Rectangle {
    var width: Int
    var height: Int
    var area: Int {
        return width * height
    }
}
let rectangle = Rectangle(width: 4, height: 5)
print("Width is \(rectangle.width) and area is \(rectangle.area).")
```

```
Width is 4 and area is 20.
```

Computed Properties

```
struct Rectangle {
    var width: Int
    var height: Int
    var area: Int {
        return width * height
    }
}
let rectangle = Rectangle(width: 4, height: 5)
print("Width is \(rectangle.width) and area is \(rectangle.area).")
```

```
Width is 4 and area is 20.
```

The Swift Programming Language > Properties

Computed Properties

```
struct Rectangle {
    var width: Int
    var height: Int
}
```

Methods

```
struct Rectangle {
    var width: Int
    var height: Int

    func fitsInside(_ other: Rectangle) -> Bool {
        return (width < other.width) && (height < other.height)
    }
}
```

Methods

```
struct Rectangle {
    var width: Int
    var height: Int

    func fitsInside(_ other: Rectangle) -> Bool {
        return (width < other.width) && (height < other.height)
    }
}

let small = Rectangle(width: 1, height: 2)
let large = Rectangle(width: 5, height: 5)
small.fitsInside(large)  // Returns true
```

Methods

```
struct Rectangle {
    var width: Int
    var height: Int

    func fitsInside(_ other: Rectangle) -> Bool {
        return (width < other.width) && (height < other.height)
    }
}

let small = Rectangle(width: 1, height: 2)
let large = Rectangle(width: 5, height: 5)
small.fitsInside(large)  // Returns true
```

Creating a Rectangle

```
struct Rectangle {
    var width: Int
    var height: Int
}

var rectangle = Rectangle(width: 4, height: 5)
```

Initializers

```
struct Rectangle {
    var width: Int
    var height: Int

    init(width: Int, height: Int) {
        self.width = width
        self.height = height
    }
}

var rectangle = Rectangle(width: 4, height: 5)
```

Initializers

```
struct Rectangle {
    var width: Int
    var height: Int

    init(width: Int, height: Int) {
        self.width = width
        self.height = height
    }
}

var rectangle = Rectangle(width: 4, height: 5)
```

Organizing Your Code

```
struct Rectangle {
    var width: Int
    var height: Int

    func fitsInside(_ other: Rectangle) -> Bool {
        return (width < other.width) && (height < other.height)
    }

    var area: Int {
        return width * height
    }
}
```

Extensions

```
struct Rectangle {
    var width: Int
    var height: Int
}

extension Rectangle {
    func fitsInside(_ other: Rectangle) -> Bool {…}
    var area {…}
}
```

Extensions

```
struct Rectangle {
    var width: Int
    var height: Int
}
```

```
extension Rectangle {
    func fitsInside(_ other: Rectangle) -> Bool {…}
    var area {…}
}
```

Extensions

```
struct Rectangle {
    var width: Int
    var height: Int
}
```

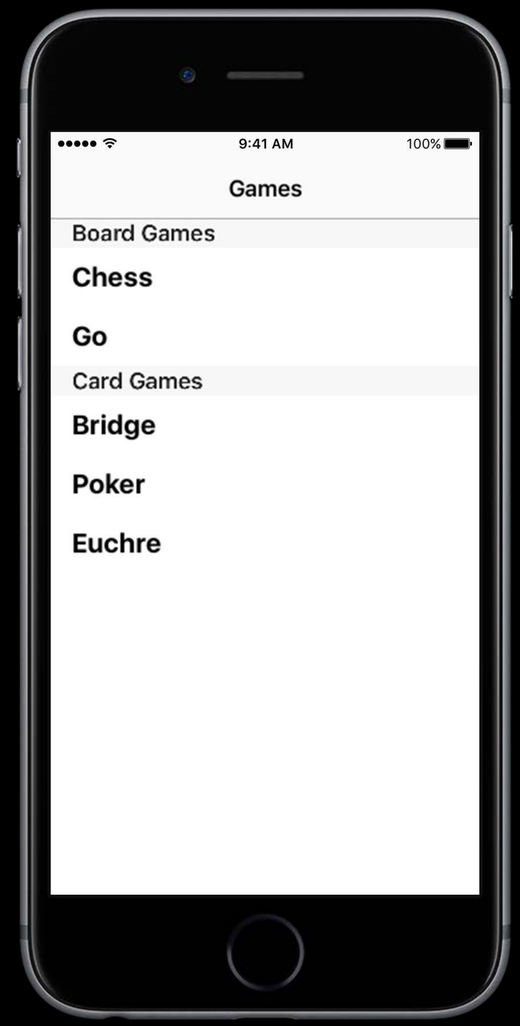
```
extension Rectangle {
    func fitsInside(_ other: Rectangle) -> Bool {…}
    var area {…}
}
```

Generic Types

```
struct NamedArray<Element> {
    var name: String
    var items: [Element]
}
```

Generic Types

```
struct NamedArray<Element> {
    var name: String
    var items: [Element]
}
```



Generic Types

```
struct NamedArray<Element> {
   var name: String
   var items: [Element]
}

let boardGames: NamedArray<String> = NamedArray(name: "Board Games", items: ["Chess", "Go"])
let primes: NamedArray<Int> = NamedArray(name: "Primes", items: [1, 3, 5, 7, 13])
```

Generic Types

```
struct NamedArray<Element> {
   var name: String
   var items: [Element]
}

let boardGames: NamedArray<String> = NamedArray(name: "Board Games", items: ["Chess", "Go"])
let primes: NamedArray<Int> = NamedArray(name: "Primes", items: [1, 3, 5, 7, 13])
```

Generic Types

```
struct NamedArray<Element> {
    var name: String
    var items: [Element]
}

let boardGames                  = NamedArray(name: "Board Games", items: ["Chess", "Go"])
let primes                    = NamedArray(name: "Primes", items: [1, 3, 5, 7, 13])
```

Generic Types

```
struct NamedArray<Element> {
   var name: String
   var items: [Element]
}

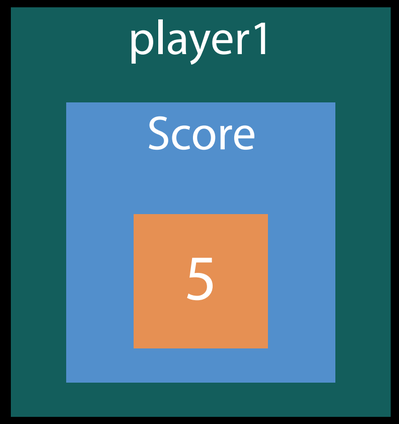
let boardGames = NamedArray(name: "Board Games", items: ["Chess", "Go"])
let primes = NamedArray(name: "Primes", items: [1, 3, 5, 7, 13])
```

Classes

```
class ScoreLogFile {
    var highScores: [Score]
    func record(score: Score, for player: Player) -> Void {…}
}
```

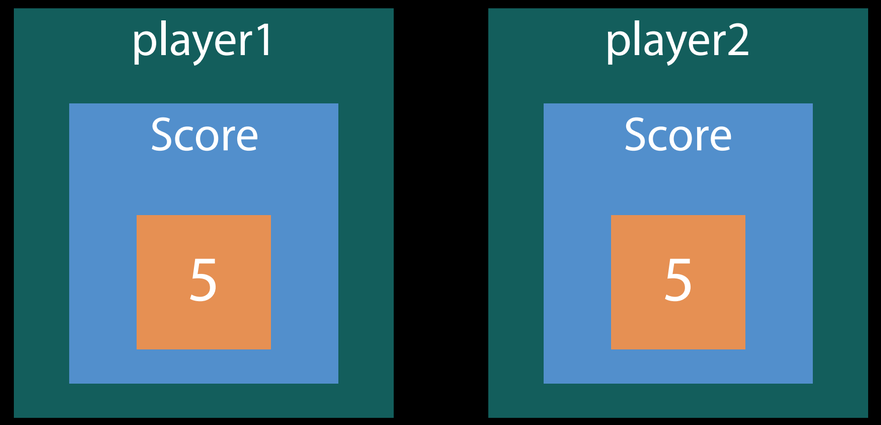
Values and References

```
struct Score { var value: Int }
player1.score = Score(value: 5)
```



Values and References

```
struct Score { var value: Int }
player1.score = Score(value: 5)
player2.score = player1.score
```



Values and References

```
struct Score { var value: Int }
player1.score = Score(value: 5)
player2.score = player1.score
player2.score.value = 99
```

Values and References

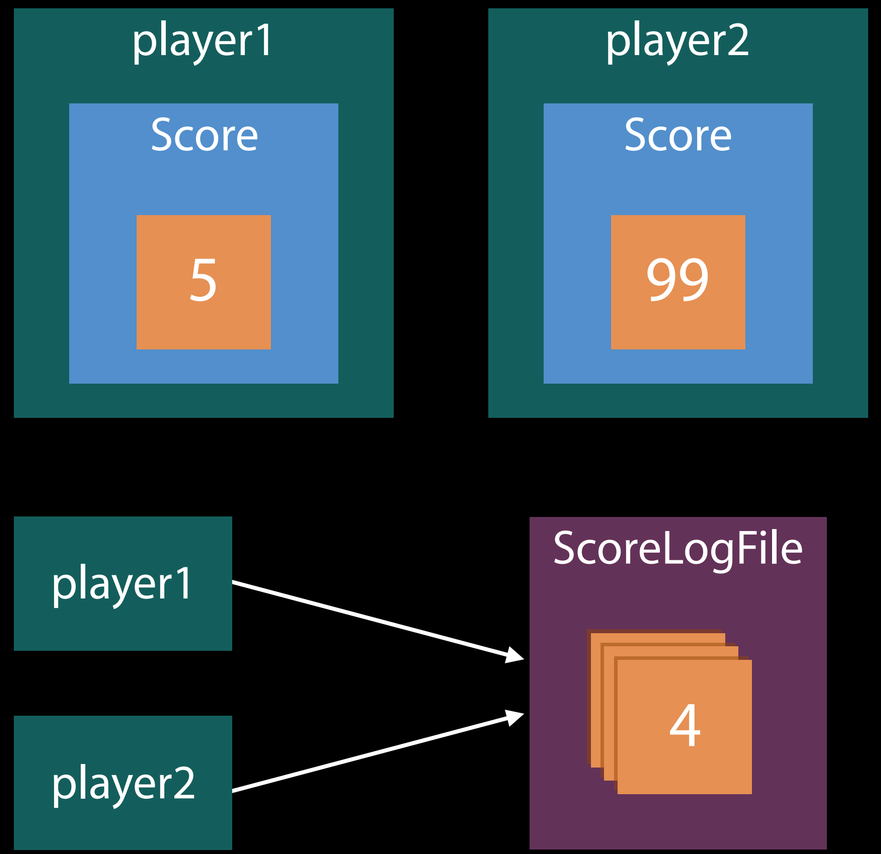
```
struct Score { var value: Int }
player1.score = Score(value: 5)
player2.score = player1.score
player2.score.value = 99

class ScoreLogFile {…}
let scoreLog = ScoreLogFile()
```

Values and References

```
struct Score { var value: Int }
player1.score = Score(value: 5)
player2.score = player1.score
player2.score.value = 99

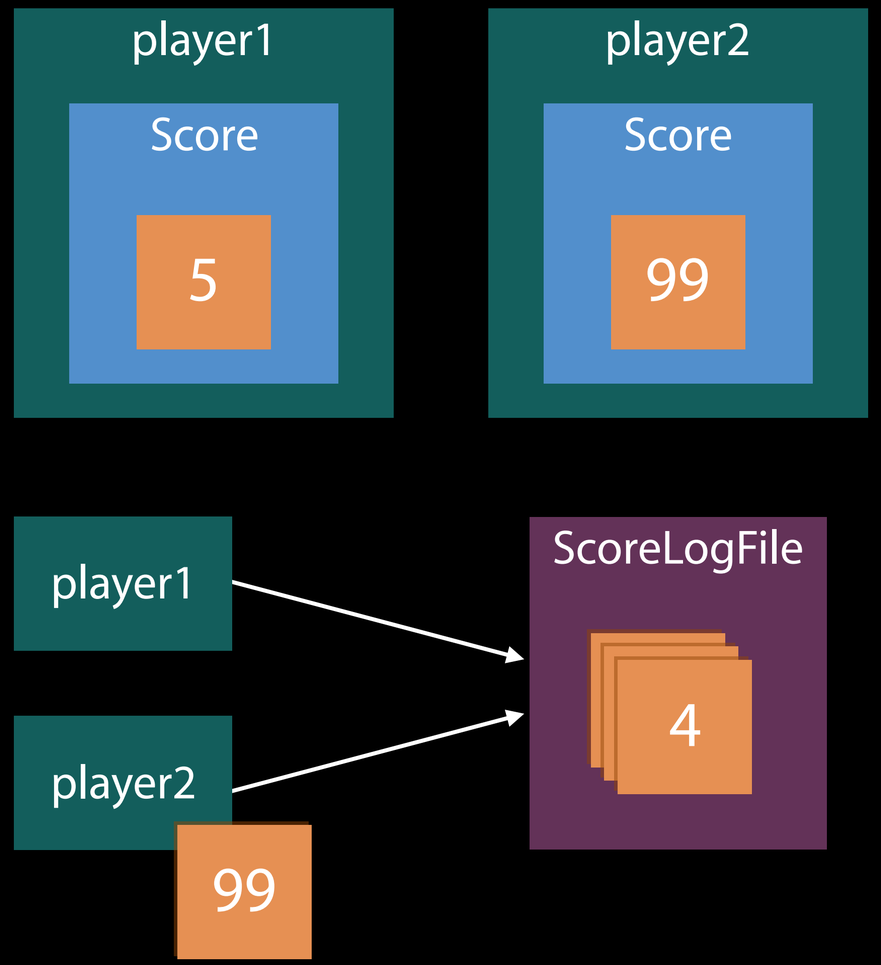
class ScoreLogFile {…}
let scoreLog = ScoreLogFile()
player1.scoreLog = scoreLog
player2.scoreLog = scoreLog
player2.logCurrentScore()
```



Values and References

```
struct Score { var value: Int }
player1.score = Score(value: 5)
player2.score = player1.score
player2.score.value = 99

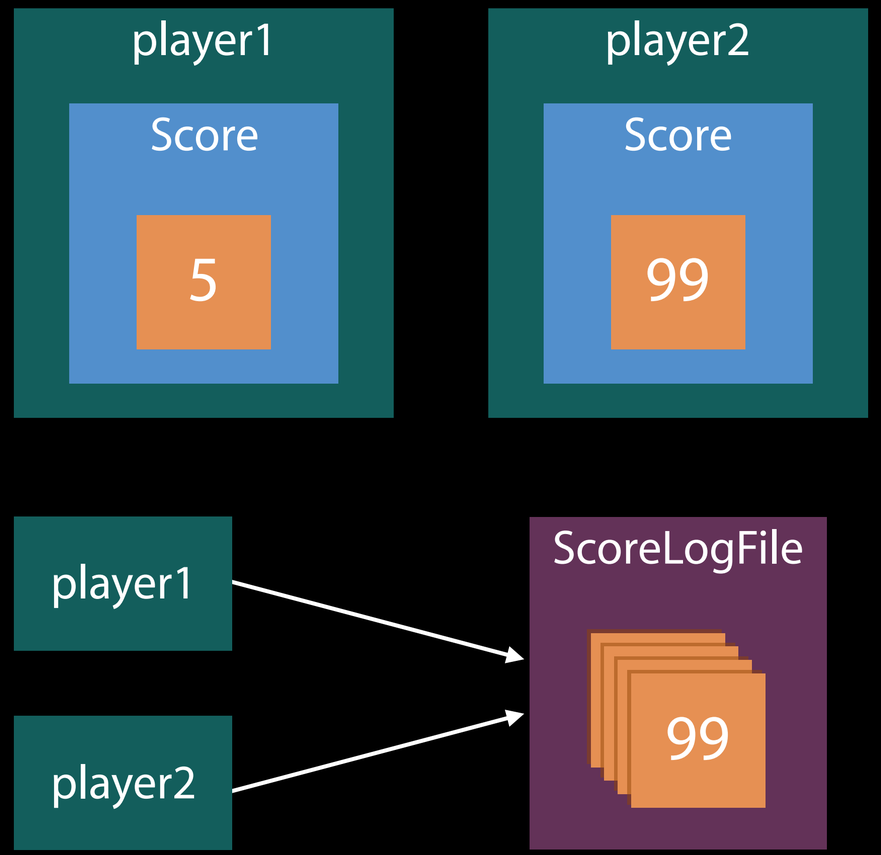
class ScoreLogFile {…}
let scoreLog = ScoreLogFile()
player1.scoreLog = scoreLog
player2.scoreLog = scoreLog
player2.logCurrentScore()
```



Values and References

```
struct Score { var value: Int }
player1.score = Score(value: 5)
player2.score = player1.score
player2.score.value = 99

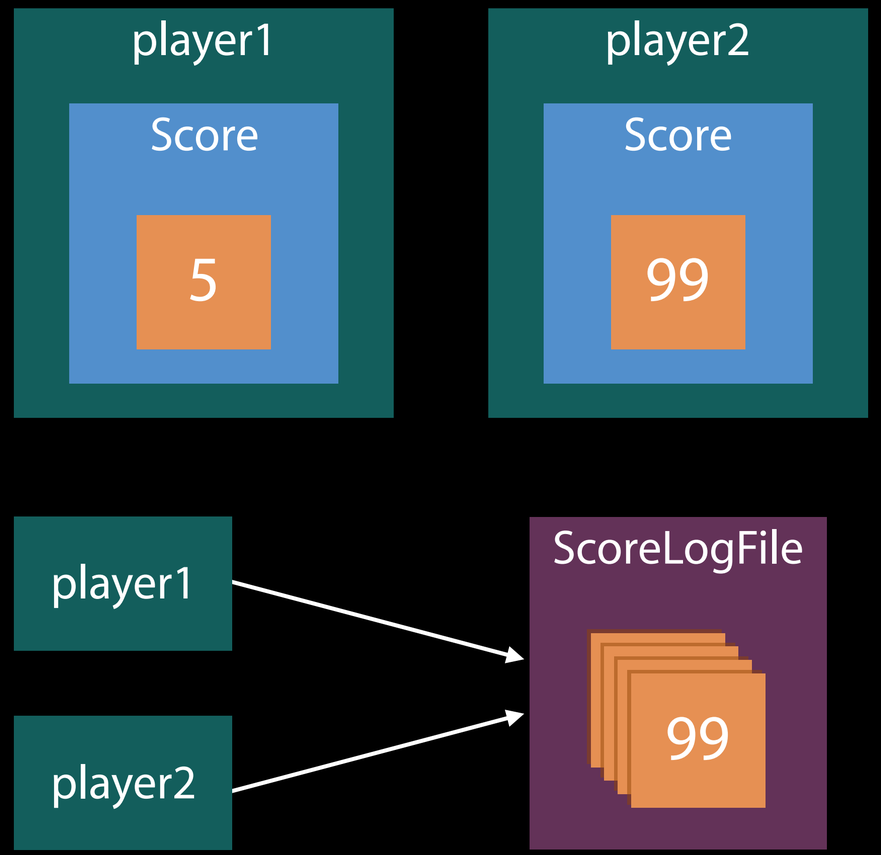
class ScoreLogFile {…}
let scoreLog = ScoreLogFile()
player1.scoreLog = scoreLog
player2.scoreLog = scoreLog
player2.logCurrentScore()
```



Values and References

```
struct Score { var value: Int }
player1.score = Score(value: 5)
player2.score = player1.score
player2.score.value = 99

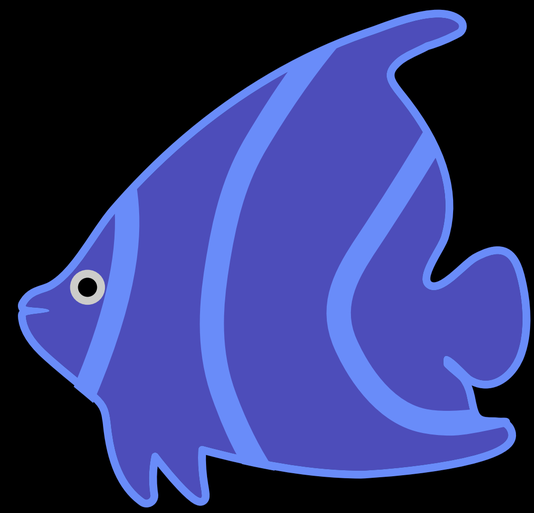
class ScoreLogFile {…}
let scoreLog = ScoreLogFile()
player1.scoreLog = scoreLog
player2.scoreLog = scoreLog
player2.logCurrentScore()
```



Protocol and Value Oriented Programming in UIKit Apps Nob Hill Friday 4:00PM

Subclasses

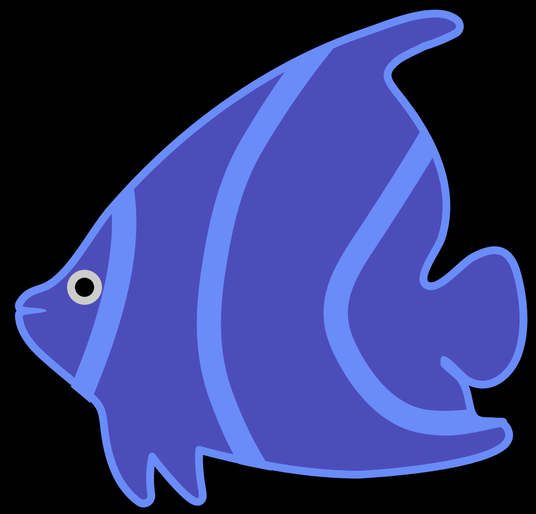
```
class Fish {
    func swim() {
        print("I'm swimming.")
    }
}
```

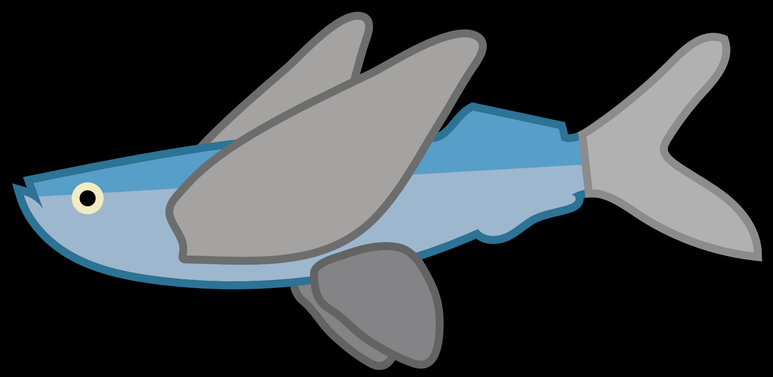


Subclasses Can Add Functionality

```
class Fish {
    func swim() {
        print("I'm swimming.")
    }
}

class FlyingFish: Fish {
    func fly() {
        print("Flying throught the air!")
    }
    // Inherits swim() with no changes.
}
```

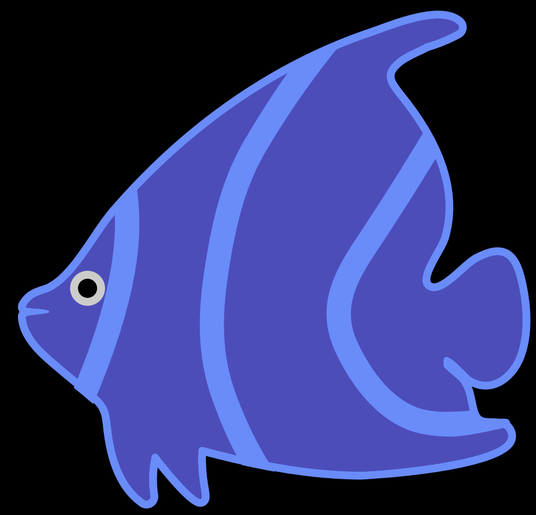




Subclasses Can Override Functionality

```
class Fish {
    func swim() {
        print("I'm swimming.")
    }
}

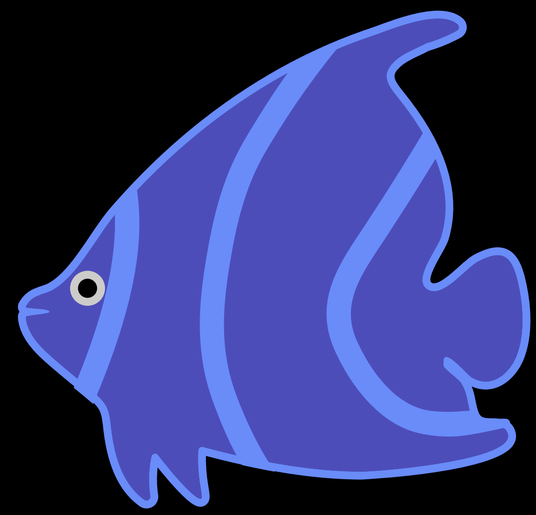
class ComplainingFish: Fish {
    func swim() {
        print("Grumble grumble grumble...")
        super.swim()
    }
}
```



Subclasses Can Override Functionality

```
class Fish {
    func swim() {
        print("I'm swimming.")
    }
}

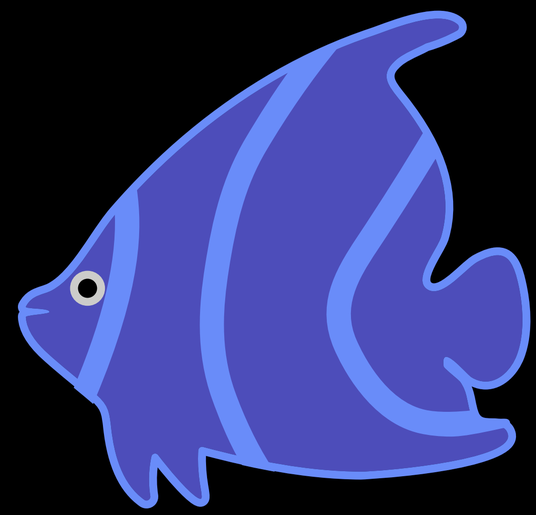
class ComplainingFish: Fish {
    func swim() {
        print("Grumble grumble grumble...")
        super.swim()
    }
}
```



Subclasses Can Override Functionality

```
class Fish {
    func swim() {
        print("I'm swimming.")
    }
}

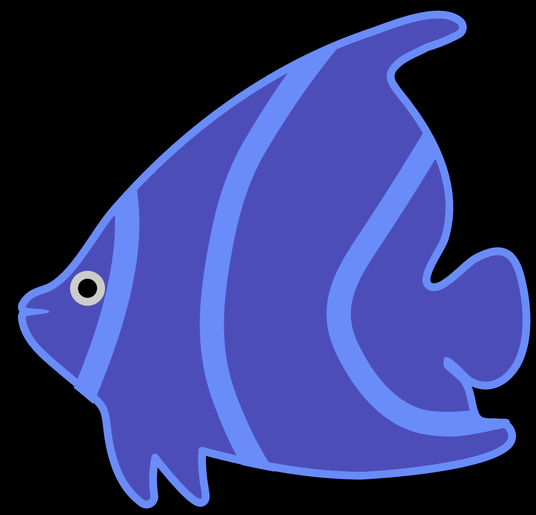
class ComplainingFish: Fish {
    func swim() {                          Error
        print("Grumble grumble grumble...")
        super.swim()
    }
}
```



Subclasses Can Override Functionality

```
class Fish {
    func swim() {
        print("I'm swimming.")
    }
}

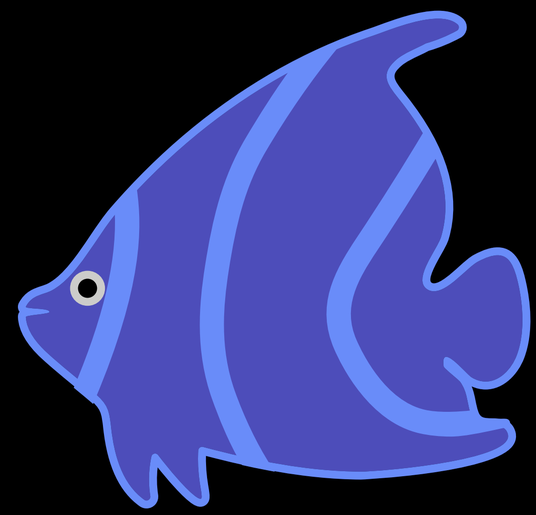
class ComplainingFish: Fish {
    override func swim() {
        print("Grumble grumble grumble...")
        super.swim()
    }
}
```



Subclasses Can Override Functionality

```
class Fish {
    func swim() {
        print("I'm swimming.")
    }
}

class ComplainingFish: Fish {
    override func swimmm() {    Error
        print("Grumble grumble grumble...")
        super.swim()
    }
}
```



Subclass Initializers

```
class Fish {
    var name: String
    init(name: String) {
        self.name = name
    }
}


let fish = Fish(name: "Herring")
```

Subclass Initializers

```
class Fish {
    var name: String
    init(name: String) {
        self.name = name
    }
}
```

```
class ComplainingFish: Fish {
    var complaint: String
    init(name: String, complaint: String) {
        }
    }
```

```
let fish = ComplainingFish(name: "Salmon", complaint: "Grumble grumble grumble...")
```

Subclass Initializers

```
class Fish {
    var name: String
    init(name: String) {
        self.name = name
    }
}
```

```
class ComplainingFish: Fish {
    var complaint: String
    init(name: String, complaint: String) {
        self.complaint = complaint
    }
}
```

```
let fish = ComplainingFish(name: "Salmon", complaint: "Grumble grumble grumble...")
```

Subclass Initializers

```
class Fish {
    var name: String
    init(name: String) {
        self.name = name
    }
}
```

```
class ComplainingFish: Fish {
    var complaint: String
    init(name: String, complaint: String) {
        self.complaint = complaint
        super.init(name: name)
    }
}
```

```
let fish = ComplainingFish(name: "Salmon", complaint: "Grumble grumble grumble...")
```

Subclass Initializers

```
class Fish {
    var name: String
    init(name: String) {
        self.name = name
    }
}
```

```
class ComplainingFish: Fish {
    var complaint: String
    init(name: String, complaint: String) {
        self.complaint = complaint
        super.init(name: name)
    }
}
```

```
let fish = ComplainingFish(name: "Salmon", complaint: "Grumble grumble grumble...")
```

Subclass Initializers

```
class Fish {
    var name: String
    init(name: String) {
        self.name = name
    }
}
```

```
class ComplainingFish: Fish {
    var complaint: String
    init(name: String, complaint: String) {
        self.complaint = complaint
        super.init(name: name)
    }
}
```

```
let fish = ComplainingFish(name: "Salmon", complaint: "Grumble grumble grumble...")
```

The Swift Programming Language > Initializers

Subclass Problem

```
class Player {
   func takeTurn(on board: Board) {…}
}
```

Subclass Problem

```
class Player {
   func takeTurn(on board: Board) {…}
}
```

```
class HumanPlayer: Player {
   override func takeTurn(on board: Board) { /* Show move UI and wait */ }
}
```

Subclass Problem

```
class Player {
    func takeTurn(on board: Board) {…}
}

class HumanPlayer: Player {
    override func takeTurn(on board: Board) { /* Show move UI and wait */ }
}

class ComputerPlayer: Player {
    override func takeTurn(on board: Board) { /* Pick the best legal move using AI */ }
}
```

Subclass Problem

```
class Player {
    func takeTurn(on board: Board) {…}
}


class HumanPlayer: Player {
    override func takeTurn(on board: Board) { /* Show move UI and wait */ }
}

class ComputerPlayer: Player {
    override func takeTurn(on board: Board) { /* Pick the best legal move using AI */ }
}
```

Subclass Problem

```
class Player {
    func takeTurn(on board: Board) { /* fatal error */ }
}

class HumanPlayer: Player {
    override func takeTurn(on board: Board) { /* Show move UI and wait */ }
}

class ComputerPlayer: Player {
    override func takeTurn(on board: Board) { /* Pick the best legal move using AI */ }
}
```

Protocols

```
protocol Player {
    func takeTurn(on board: Board) { /* fatal error */ }
}

class HumanPlayer: Player {
    override func takeTurn(on board: Board) { /* Show move UI and wait */ }
}

class ComputerPlayer: Player {
    override func takeTurn(on board: Board) { /* Pick the best legal move using AI */ }
}
```

Protocols

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protocol Player {
    func takeTurn(on board: Board)
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Protocols

```
struct HumanPlayer: Player {
    var name: String
    var score: Int
    func takeTurn(on board: Board) {…}
}
let player = HumanPlayer(name: "Lynn", score: 0)
```

Protocols

```
struct HumanPlayer: Player {
    var name: String
    var score: Int
    func takeTurn(on board: Board) {…}
}
let player = HumanPlayer(name: "Lynn", score: 0)
print(player)
```

Protocols

```
struct HumanPlayer: Player {
    var name: String
    var score: Int
    func takeTurn(on board: Board) {…}
}
let player = HumanPlayer(name: "Lynn", score: 0)
print(player)
```

```
HumanPlayer(name: "Lynn", score: 0)
```

Protocols

```
protocol CustomStringConvertible {
    var description: String { get }
}
```

Protocols and Extensions

```
struct HumanPlayer: Player {…}

extension HumanPlayer: CustomStringConvertible {

}
```

Protocols and Extensions

```
struct HumanPlayer: Player {…}

extension HumanPlayer: CustomStringConvertible {
    var description: String {
        return "Human player \(name) has a score of \(score)"
    }
}
```

Protocols and Extensions

```
struct HumanPlayer: Player {…}

extension HumanPlayer: CustomStringConvertible {
    var description: String {
        return "Human player \(name) has a score of \(score)"
    }
}
let player = HumanPlayer(name: "Lynn", score: 0)
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Protocols and Extensions

```
struct HumanPlayer: Player {…}

extension HumanPlayer: CustomStringConvertible {
    var description: String {
        return "Human player \(name) has a score of \(score)"
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}
let player = HumanPlayer(name: "Lynn", score: 0)
print(player)
```

```
Human player Lynn has a score of 0
```

Protocols and Extensions

```
struct HumanPlayer: Player {…}

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```

Enumerations

```
enum Alignment {
   case left
   case right
}
```

Enumerations

```
enum Alignment {
   case left
   case right
}

let textAlignment = Alignment.left
```

Enumerations

```
enum Alignment {
   case left, right
}
let textAlignment = Alignment.left
```

Enumerations

```
enum Alignment {
   case left, right
}
let textAlignment = Alignment.left

switch textAlignment {
case Alignment.left:
   print("Lean to the left")
case Alignment.right:
   print("Lean to the right")
}
```

Enumerations

```
enum Alignment {
   case left, right
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switch textAlignment {
case Alignment.left:
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Enumerations

```
enum Alignment {
   case left, right
}
let textAlignment = Alignment.left

switch textAlignment {
case .left:
   print("Lean to the left")
case .right:
   print("Lean to the right")
}
```

Enumerations

```
enum Alignment {
   case left, right
}
let textAlignment = Alignment.left

switch textAlignment {
case .left:
   print("Lean to the left")
case .right:
   print("Lean to the right")
}
```

Enumerations

```
enum Alignment {
    case left, right, center
}
let textAlignment = Alignment.left

switch textAlignment {                          switch must be exhaustive
case .left:
    print("Lean to the left")
case .right:
    print("Lean to the right")
}
```

Enumerations

```
enum Alignment {
   case left, right, center
}
let textAlignment = Alignment.left
switch textAlignment {
case .left:
   print("Lean to the left")
case .right:
   print("Lean to the right")
case .center:
   print("Stand up straight")
}
```

Enumerations with Associated Values

```
enum Alignment {
   case left(padding: Double), right(padding: Double), center
}
let textAlignment = Alignment.left(padding: 42.7)
```

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enum Alignment {
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```

Enumerations with Associated Values

```
enum Alignment {
   case left(padding: Double), right(padding: Double), center
}
let textAlignment = Alignment.left(padding: 42.7)
switch textAlignment {
case .left(let padding):
   print("Left with \(padding) pixels of padding")
…
}
```

Enumerations with Associated Values

```
enum Alignment {
   case left(padding: Double), right(padding: Double), center
}
let textAlignment = Alignment.left(padding: 42.7)
switch textAlignment {
case .left(let padding):
   print("Left with \(padding) pixels of padding")
…
}
```

```
Left with 42.7 pixels of padding
```

Enumerations with Raw Values

```
enum ServerAddress: String {
    case staging = "https://staging.example.com"
    case production = "https://example.com"
}
```

Enumerations with Raw Values

```
enum ServerAddress: String {
    case staging = "https://staging.example.com"
    case production = "https://example.com"
}

func findPhotos(matchingQuery query: String, from server: ServerAddress) {
    let serverAddress = server.rawValue
    …
}

findPhotos(matchingQuery: "strawberry", from: .staging)
```

```
// Error Handling
enum SomeError: ErrorProtocol {
   case somethingWentWrong, somethingFailed
}

func doSomething() throws -> Data {
   progressBar.visible = true
   defer { progressBar.visible = false }

   let data: Data?
   do {
      data = try somethingThatMightFail()
   } catch SomeError.somethingWentWrong {
      data = nil
   }

   guard let result = summarize(data) else { throw SomeError.somethingFailed }
   return result
}
```

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The Swift Programming Language > Error Handling

More Information

https://developer.apple.com/wwdc16/404

Related Sessions

What's New in Swift	Presidio	Tuesday 9:00AM
Swift API Design Guidelines	Presidio	Tuesday 10:00AM
What's New in Foundation for Swift	Mission	Tuesday 4:00PM
Introducing Swift Playgrounds	Mission	Wednesday 11:00AM
Going Server-Side with Swift Open Source	Mission	Friday 9:00AM
Protocol and Value Oriented Programming in UIKit Apps	Nob Hill	Friday 4:00PM

Labs

Swift Get-Together	Graphics, Games, and Media Lab A	Wednesday 6:15 PM
Swift Open Hours	Developer Tools Lab A	Tuesday 12:00PM
Swift Open Hours	Developer Tools Lab A	Wed–Fri 9:00AM

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