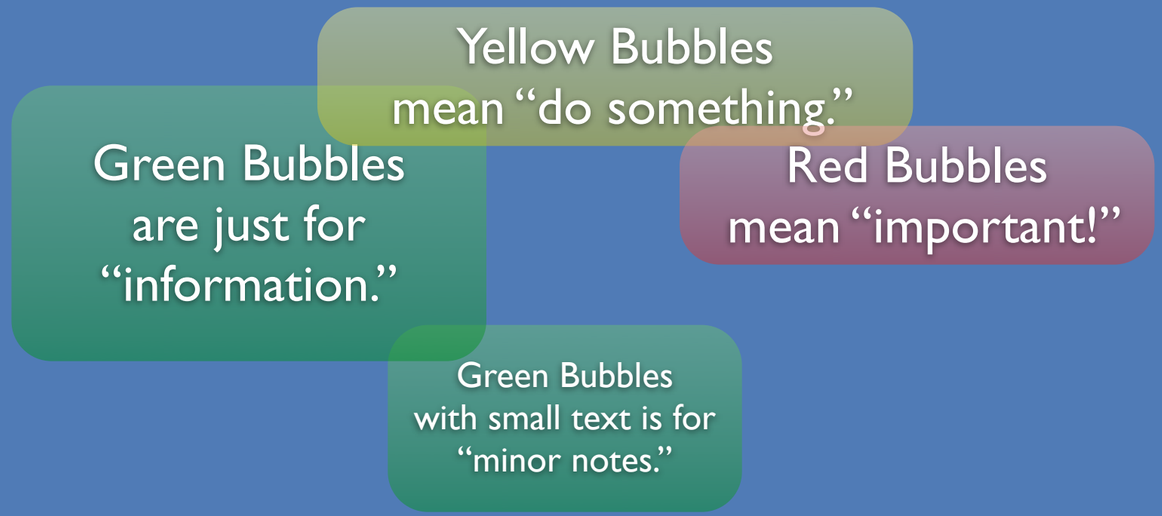
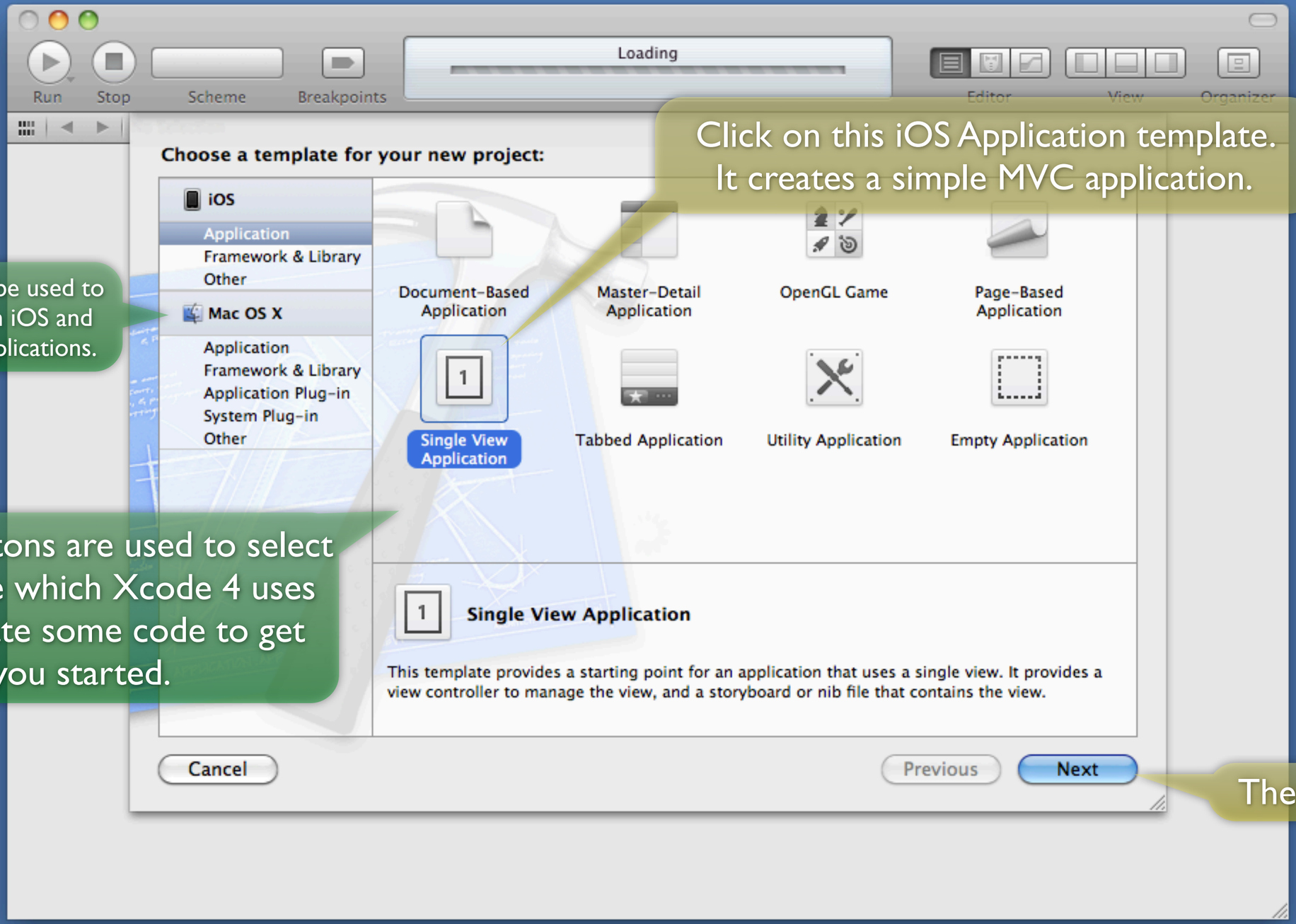
Welcome to CS193p!
This document is a walkthrough of the demonstration done in class.
You will need this walkthrough to do your first homework assignment.



Xcode 4 Splash Screen

Launch Xcode 4 and click here to create a new project.

As you create projects, they will appear here.

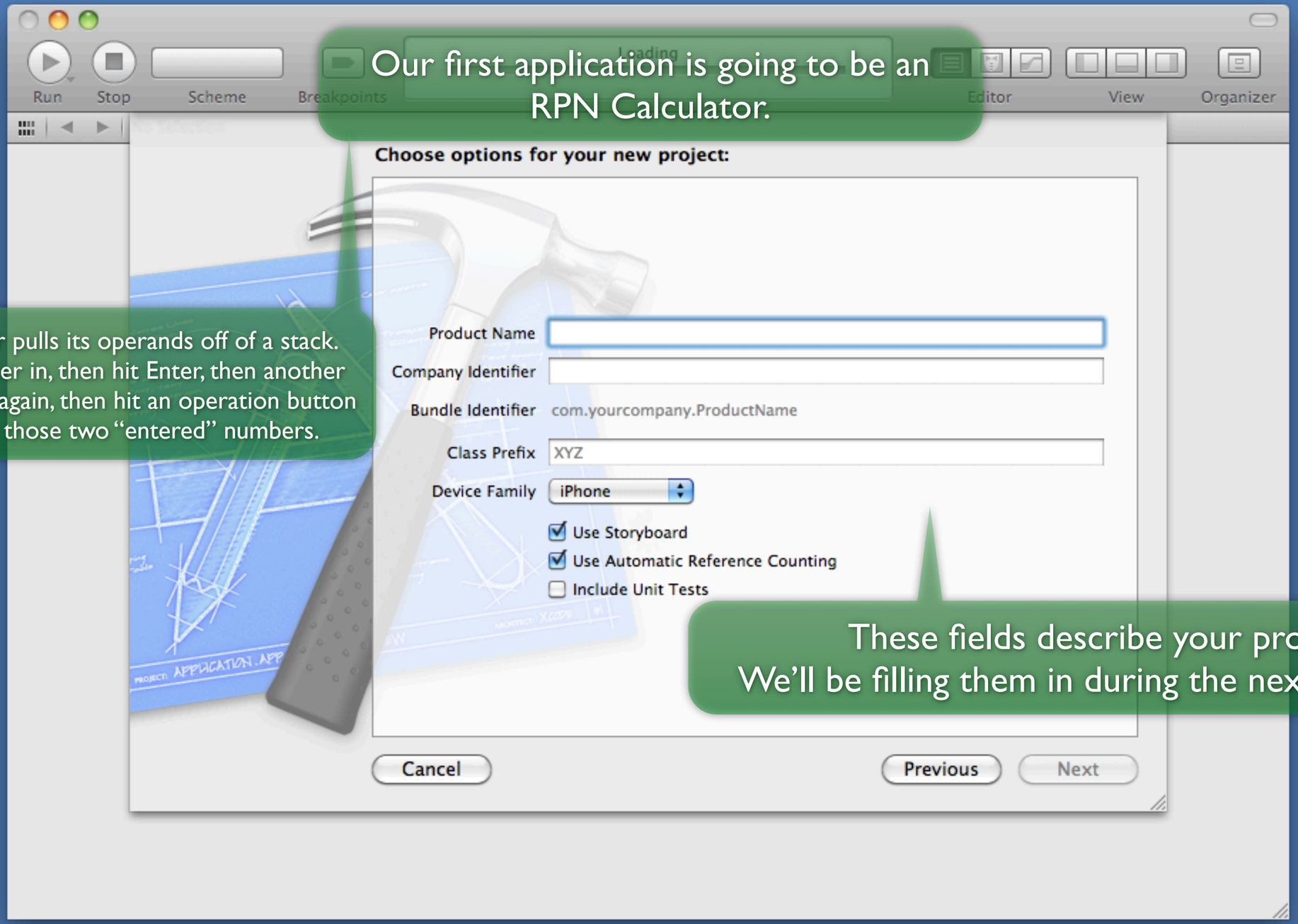


Click on this iOS Application template. It creates a simple MVC application.

Xcode 4 can be used to develop both iOS and Mac OSX applications.

These buttons are used to select a template which Xcode 4 uses to generate some code to get you started.

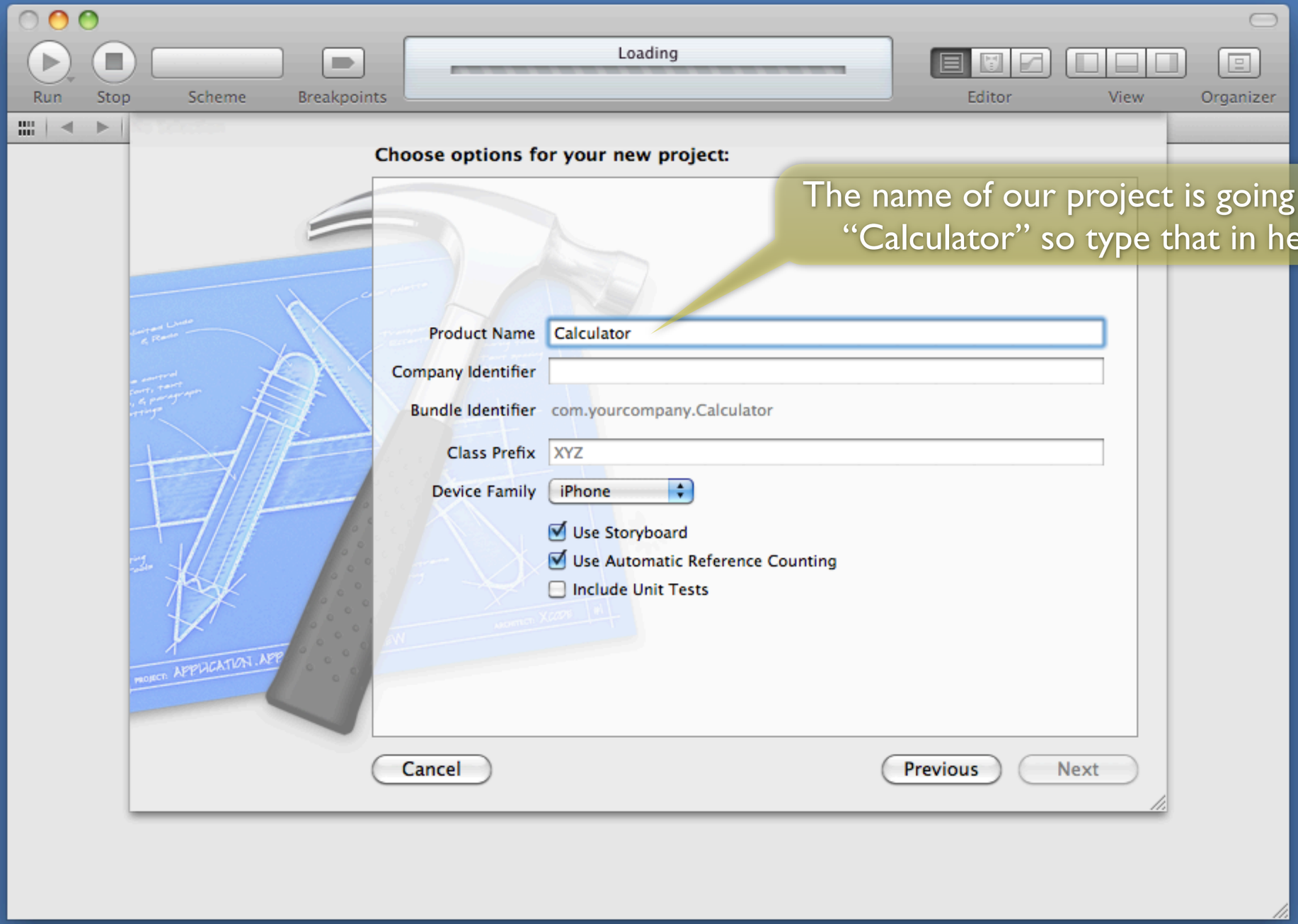
Then click Next.



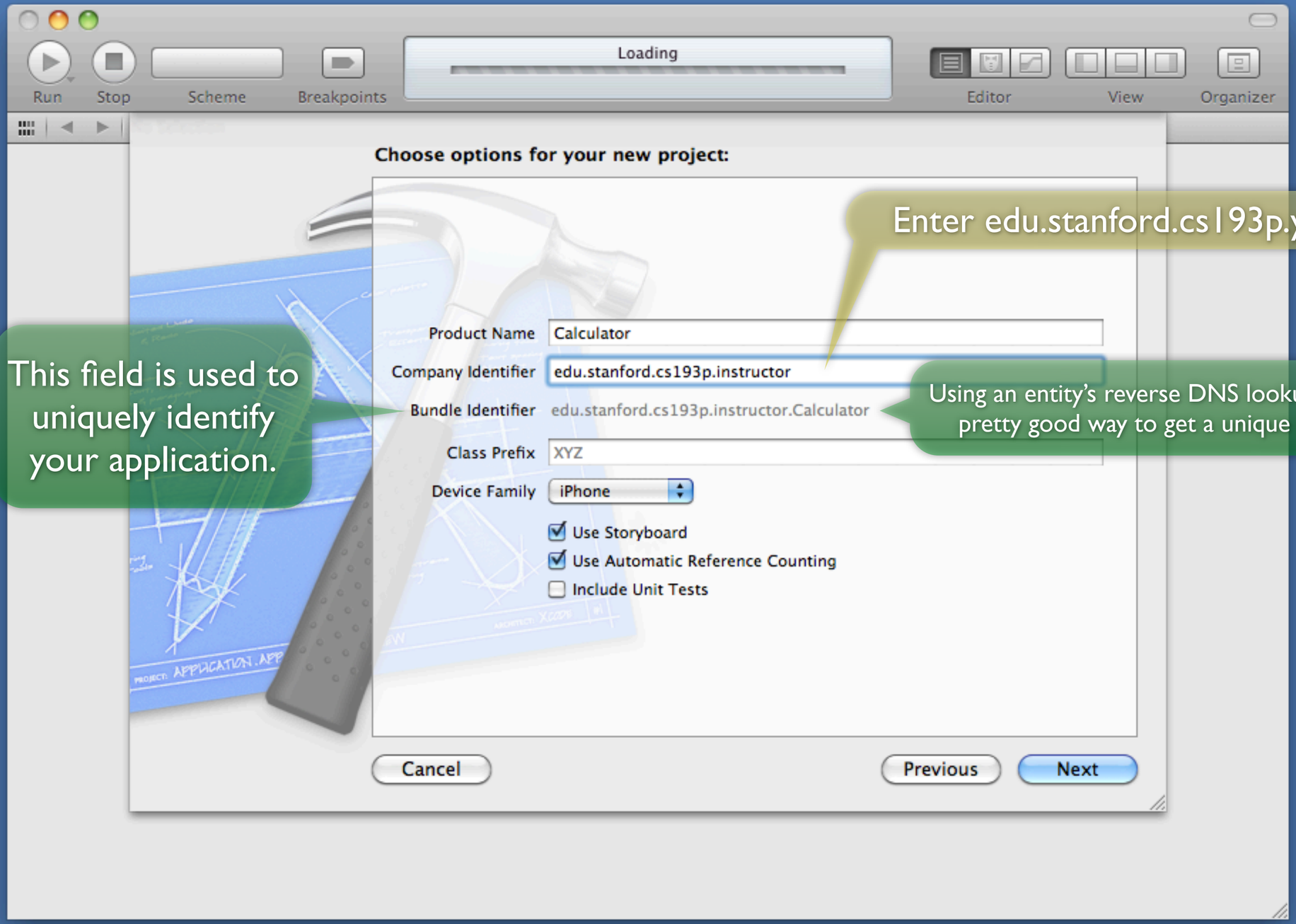
Our first application is going to be an RPN Calculator.

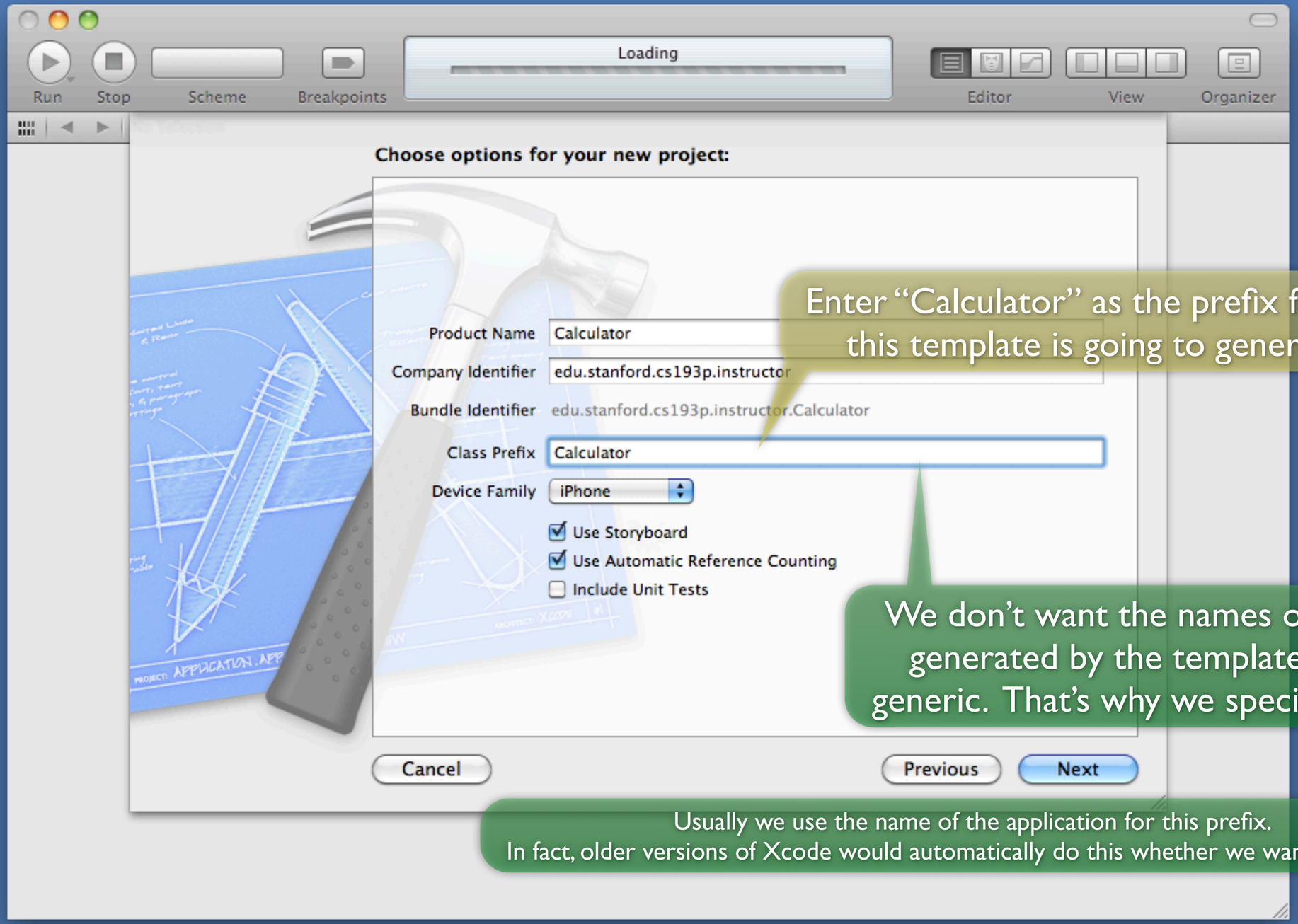
An RPN calculator pulls its operands off of a stack. Users type a number in, then hit Enter, then another number, then Enter again, then hit an operation button which works on those two "entered" numbers.

These fields describe your project.
We'll be filling them in during the next few slides.



The name of our project is going to be "Calculator" so type that in here.

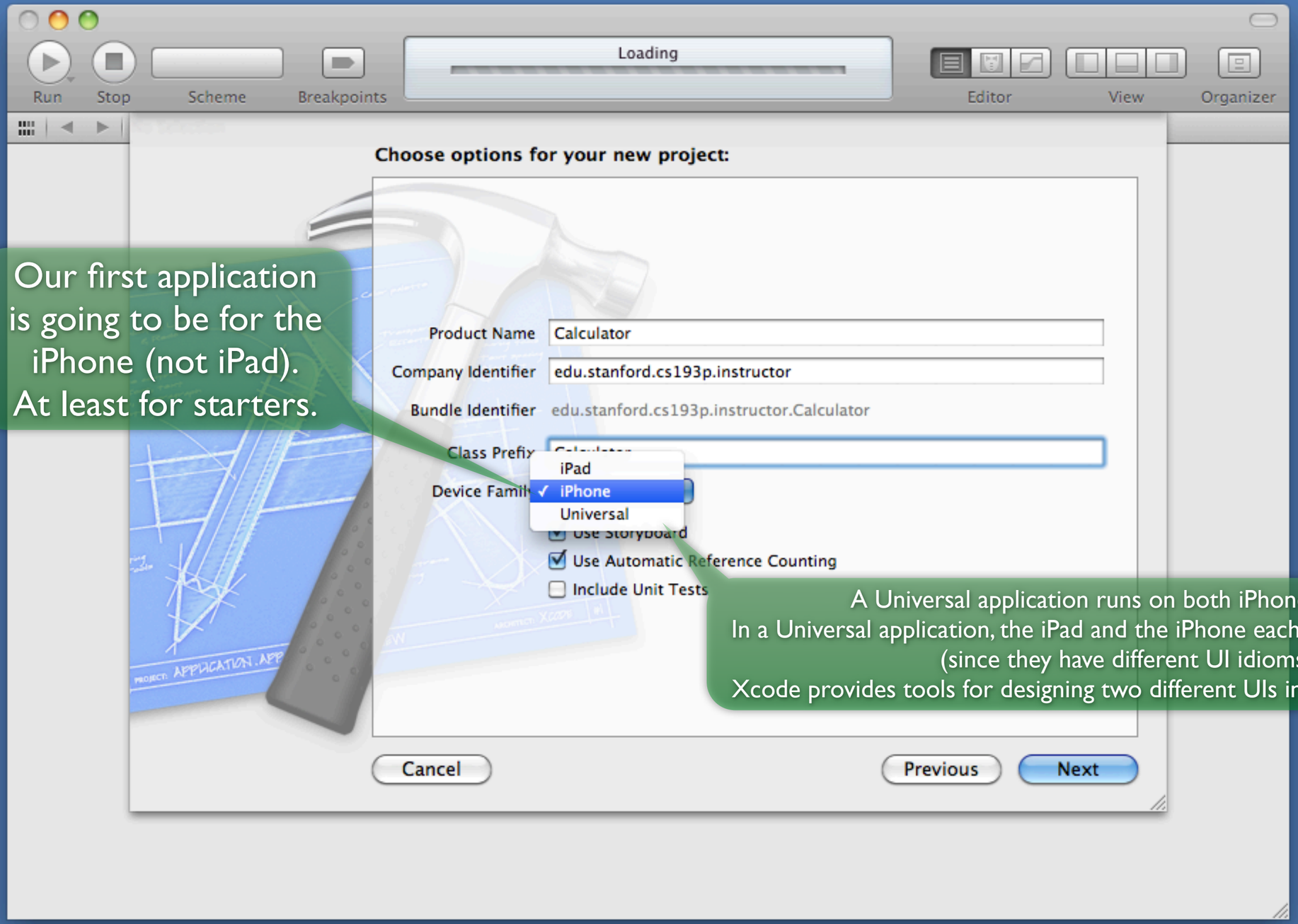

Run
Stop
Scheme
Breakpoints
Loading
Editor
View
Organizer
Choose options for your new project:
Product Name
Calculator
Company Identifier
edu.stanford.cs193p.instructor
Bundle Identifier
edu.stanford.cs193p.instructor.Calculator
Class Prefix
XYZ
Device Family
iPhone
Use Storyboard
Use Automatic Reference Counting
Include Unit Tests
Cancel
Previous
Next
Enter edu.stanford.cs193p.yourname
This field is used to uniquely identify your application.
Using an entity's reverse DNS lookup string is a pretty good way to get a unique identifier.



Enter "Calculator" as the prefix for the classes this template is going to generate for us.

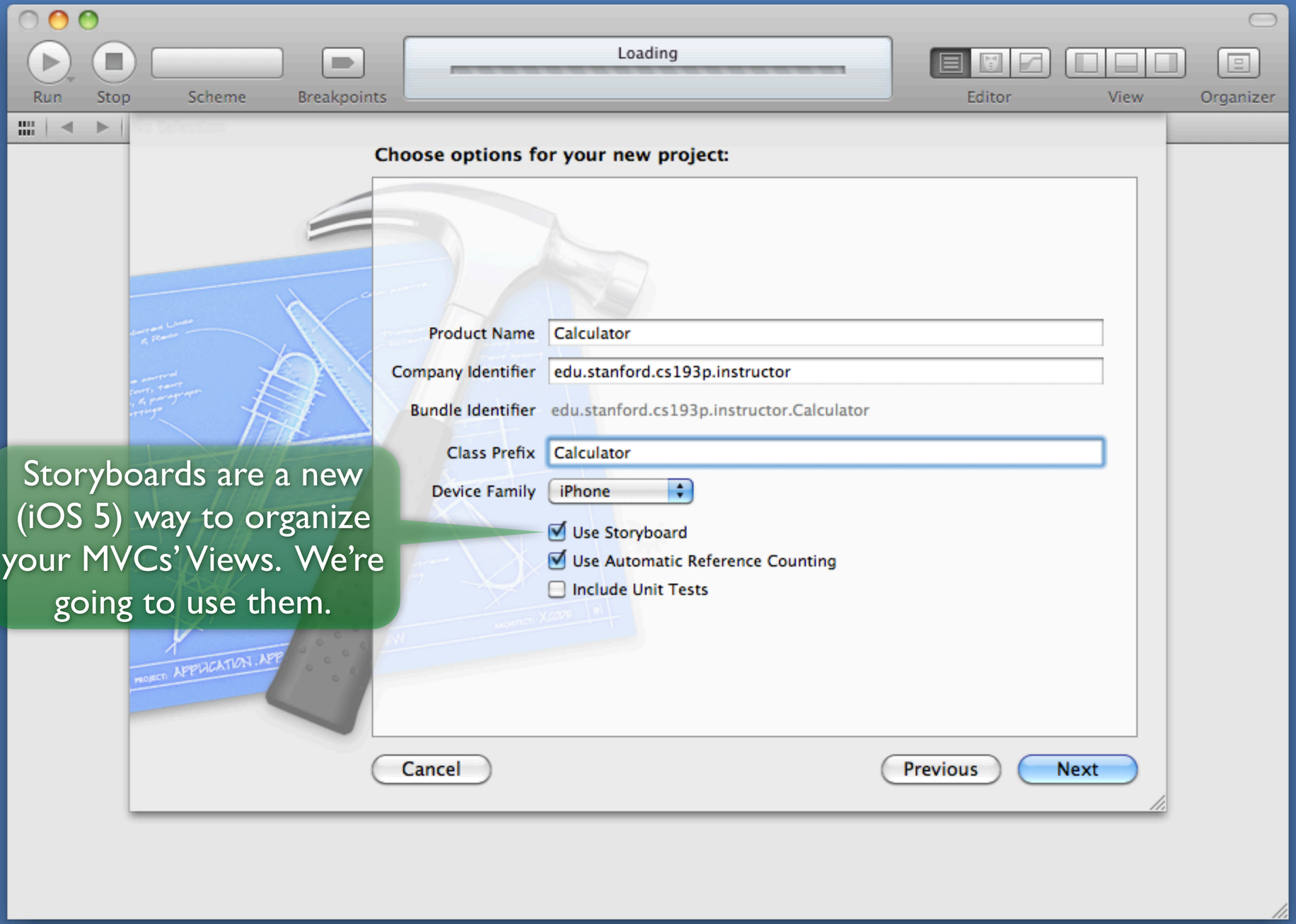
We don't want the names of the classes generated by the template to be too generic. That's why we specify this prefix.

Usually we use the name of the application for this prefix.
In fact, older versions of Xcode would automatically do this whether we wanted it or not.

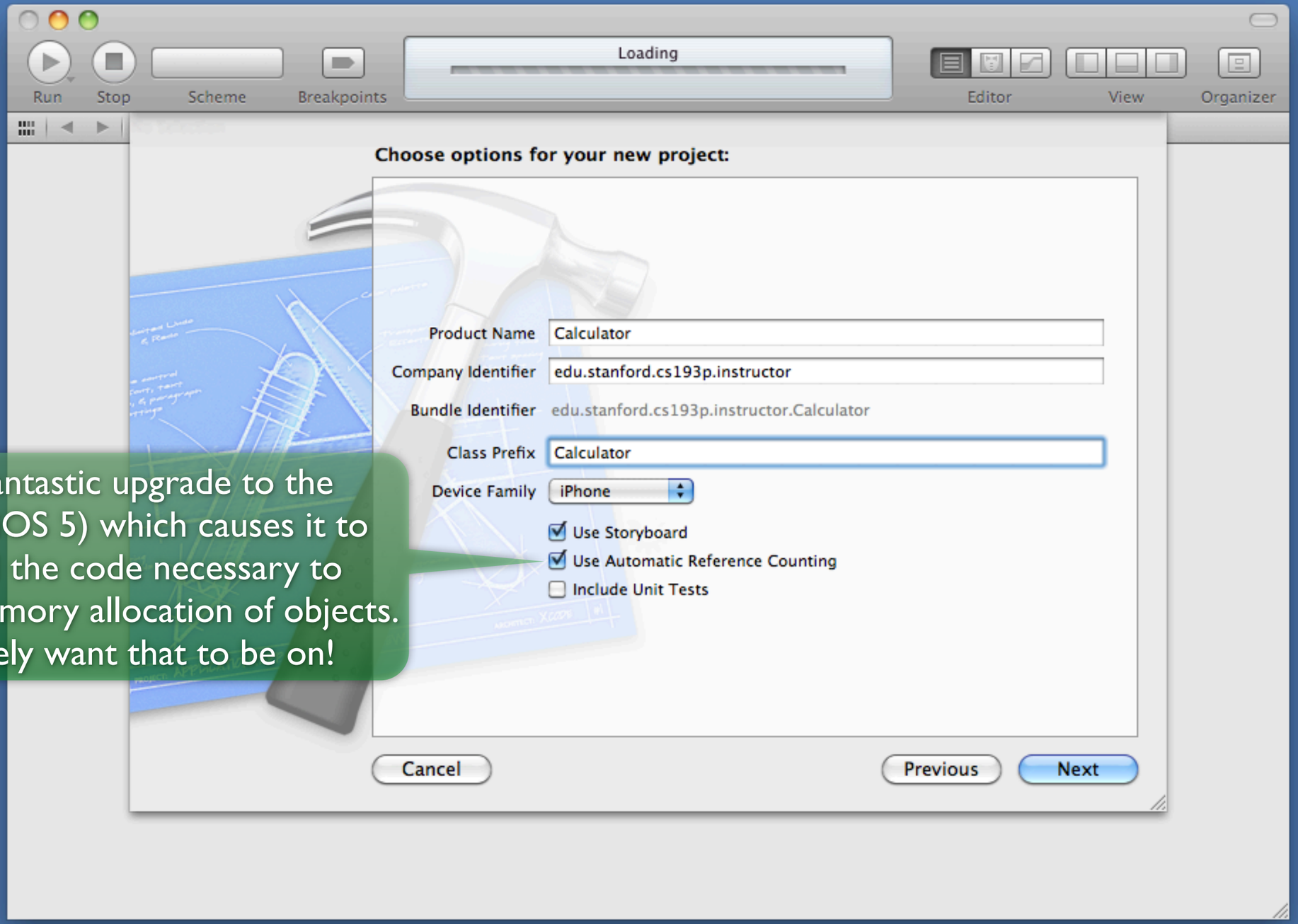


Our first application is going to be for the iPhone (not iPad). At least for starters.

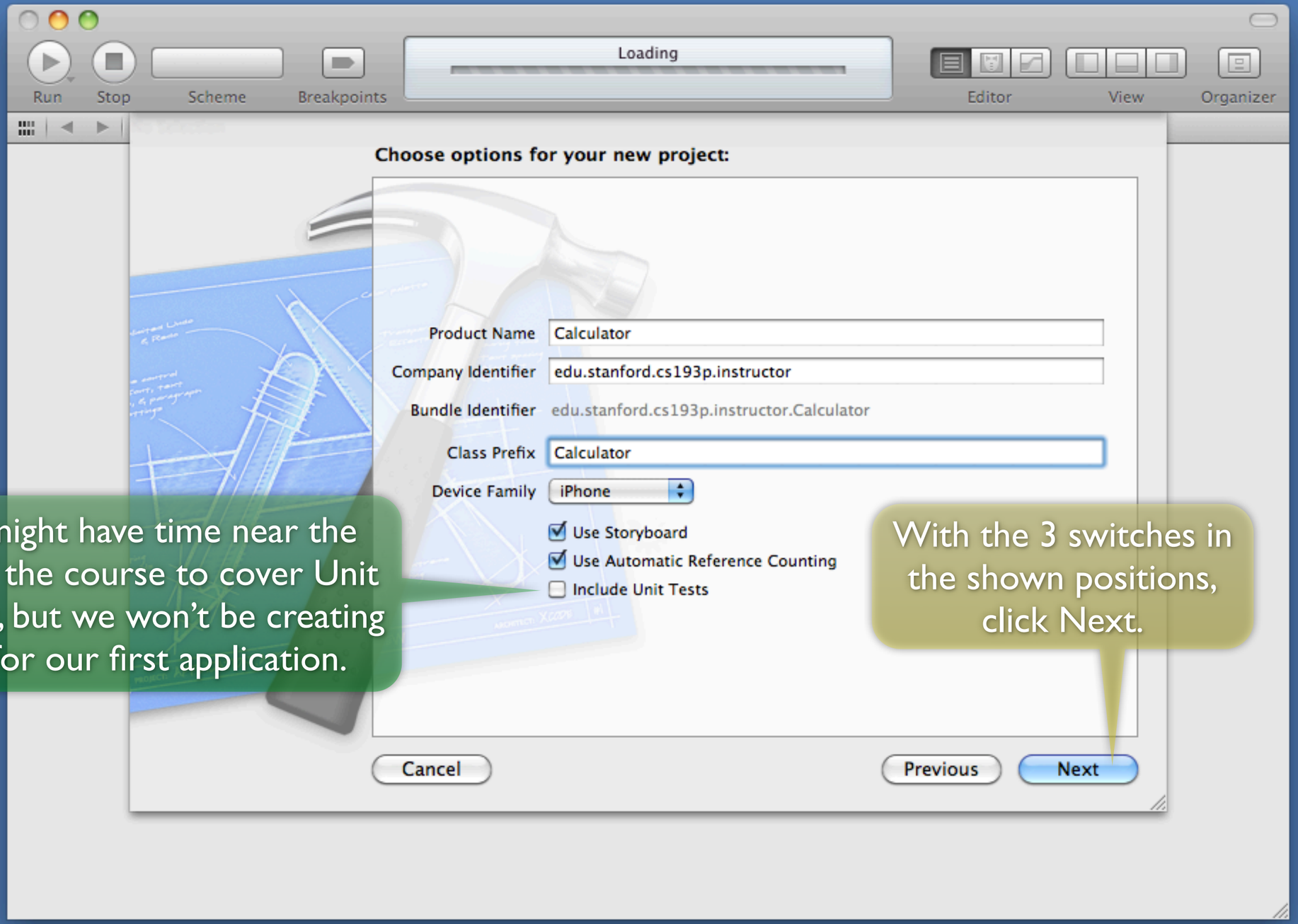
A Universal application runs on both iPhone and iPad.
In a Universal application, the iPad and the iPhone each has its own UI design (since they have different UI idioms).
Xcode provides tools for designing two different UIs in the same application.



Storyboards are a new (iOS 5) way to organize your MVCs' Views. We're going to use them.

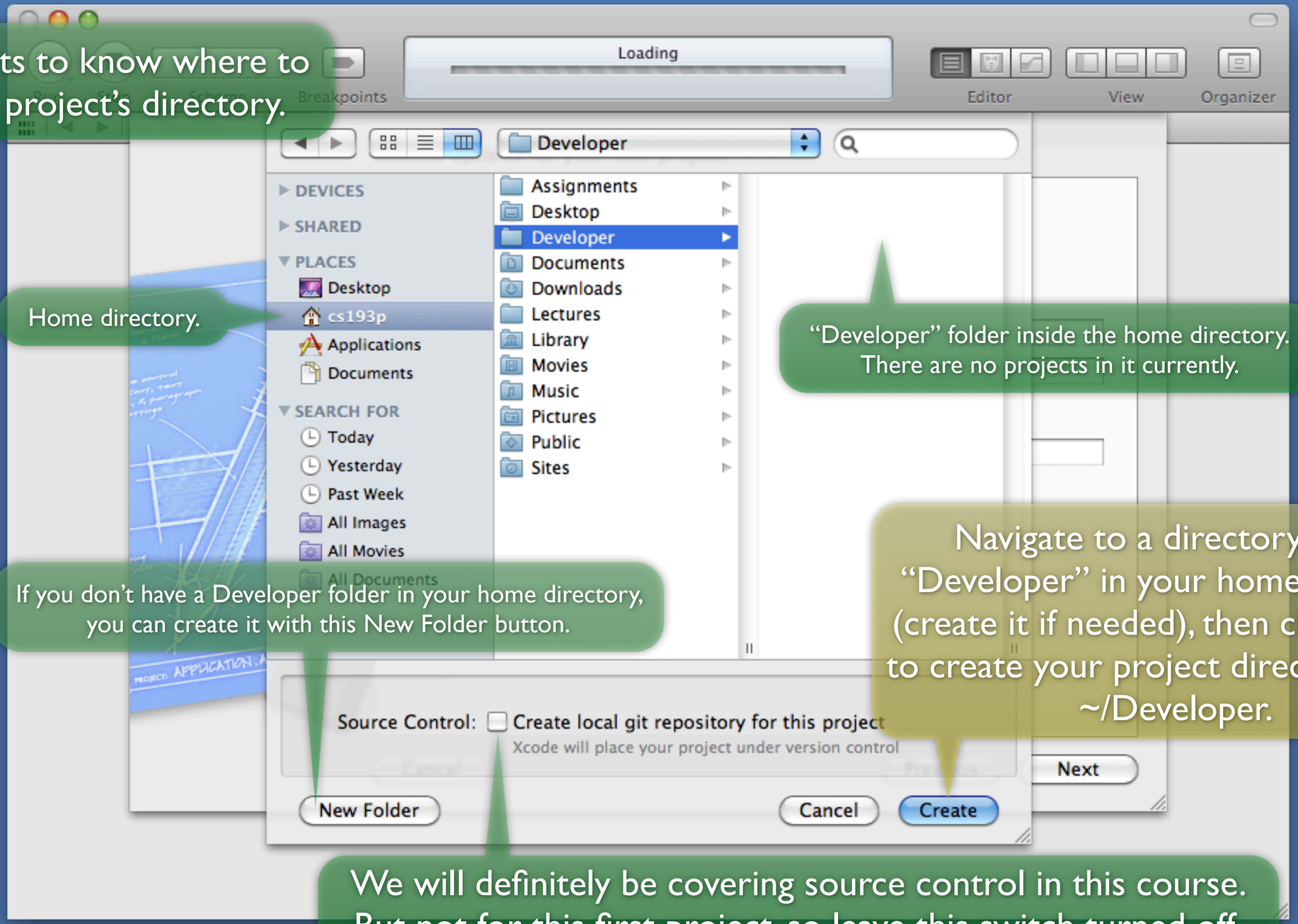


ARC is a fantastic upgrade to the compiler (in iOS 5) which causes it to generate all the code necessary to manage the memory allocation of objects. We definitely want that to be on!



We might have time near the end of the course to cover Unit Testing, but we won't be creating any for our first application.

With the 3 switches in the shown positions, click Next.



Xcode wants to know where to store this project's directory.

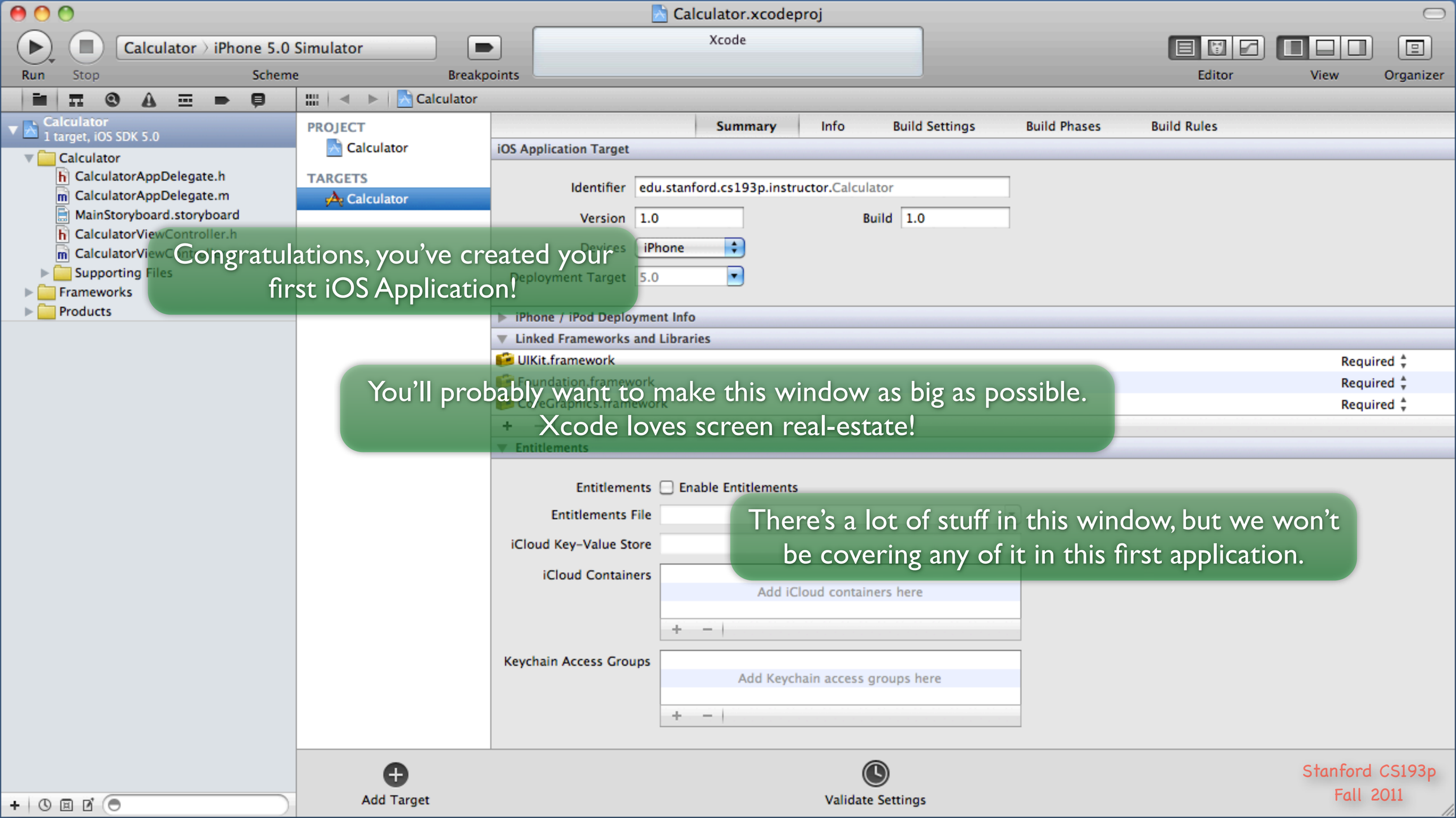
Home directory.

"Developer" folder inside the home directory. There are no projects in it currently.

If you don't have a Developer folder in your home directory, you can create it with this New Folder button.

Navigate to a directory called "Developer" in your home directory (create it if needed), then click Create to create your project directory inside ~/Developer.

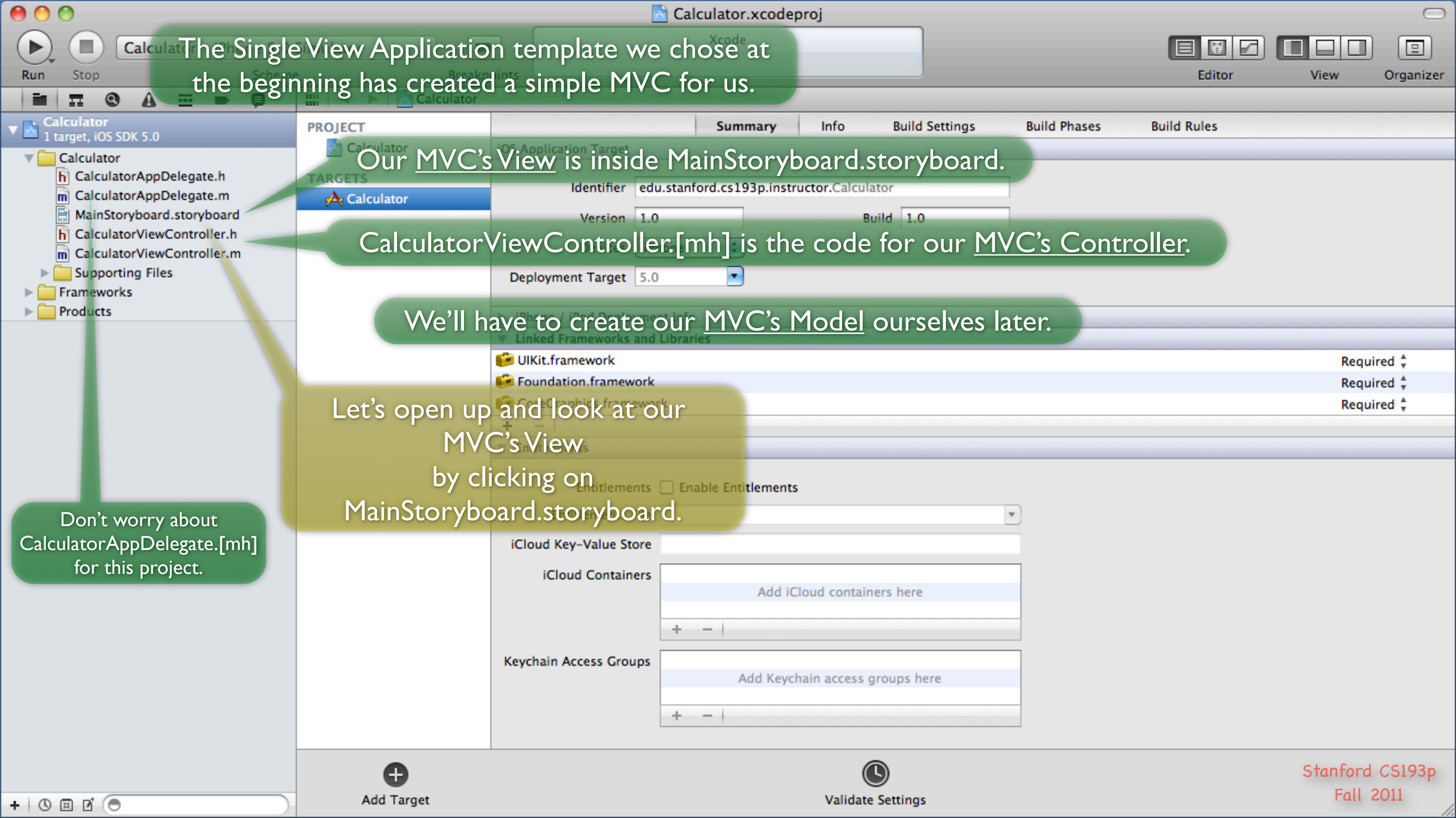
We will definitely be covering source control in this course. But not for this first project, so leave this switch turned off.



Congratulations, you've created your first iOS Application!

You'll probably want to make this window as big as possible. Xcode loves screen real-estate!

There's a lot of stuff in this window, but we won't be covering any of it in this first application.


Calculator.xcodeproj
Run
Stop
Editor
View
Organizer
The Single View Application template we chose at the beginning has created a simple MVC for us.
Calculator
1 target, iOS SDK 5.0
Calculator
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Frameworks
Products
Our MVC's View is inside MainStoryboard.storyboard.
CalculatorViewController.[mh] is the code for our MVC's Controller.
We'll have to create our MVC's Model ourselves later.
Let's open up and look at our MVC's View by clicking on MainStoryboard.storyboard.
Don't worry about CalculatorAppDelegate.[mh] for this project.
PROJECT
Calculator
TARGETS
Calculator
Summary
Info
Build Settings
Build Phases
Build Rules
Identifier
edu.stanford.cs193p.instructor.Calculator
Version
1.0
Build
1.0
Deployment Target
5.0
Linked Frameworks and Libraries
UIKit.framework
Foundation.framework
Required
Entitlements
Enable Entitlements
iCloud Key-Value Store
iCloud Containers
Add iCloud containers here
Keychain Access Groups
Add Keychain access groups here
Add Target
Validate Settings
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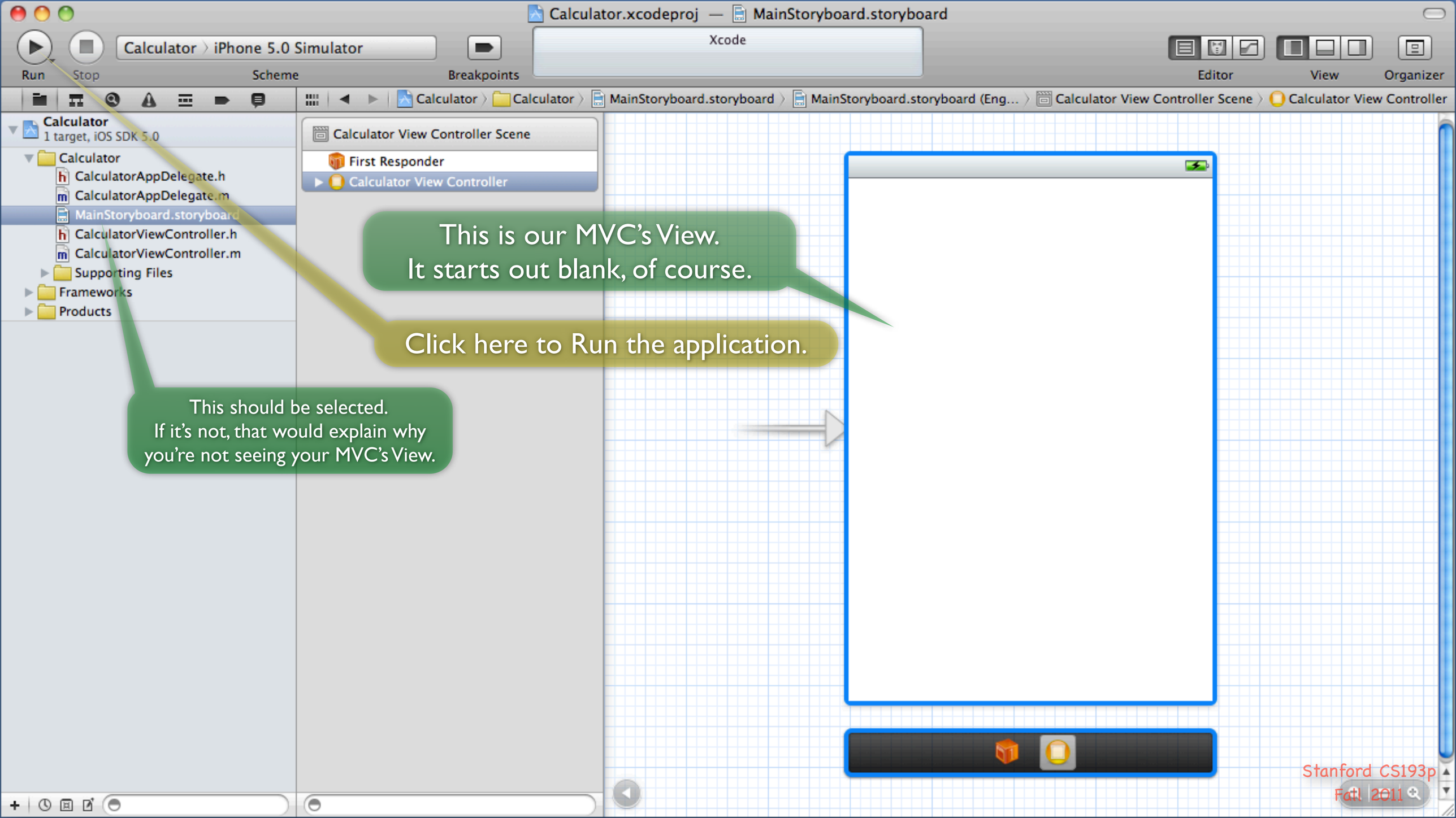
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Xcode
Editor
View
Organizer
Calculator 〉 Calculator 〉 MainStoryboard.storyboard 〉 MainStoryboard.storyboard (Eng... 〉 Calculator View Controller Scene 〉 Calculator View Controller
Calculator
1 target, iOS SDK 5.0
Calculator
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Frameworks
Products
Calculator View Controller Scene
First Responder
Calculator View Controller
This is our MVC's View.
It starts out blank, of course.
Click here to Run the application.
This should be selected.
If it's not, that would explain why
you're not seeing your MVC's View.
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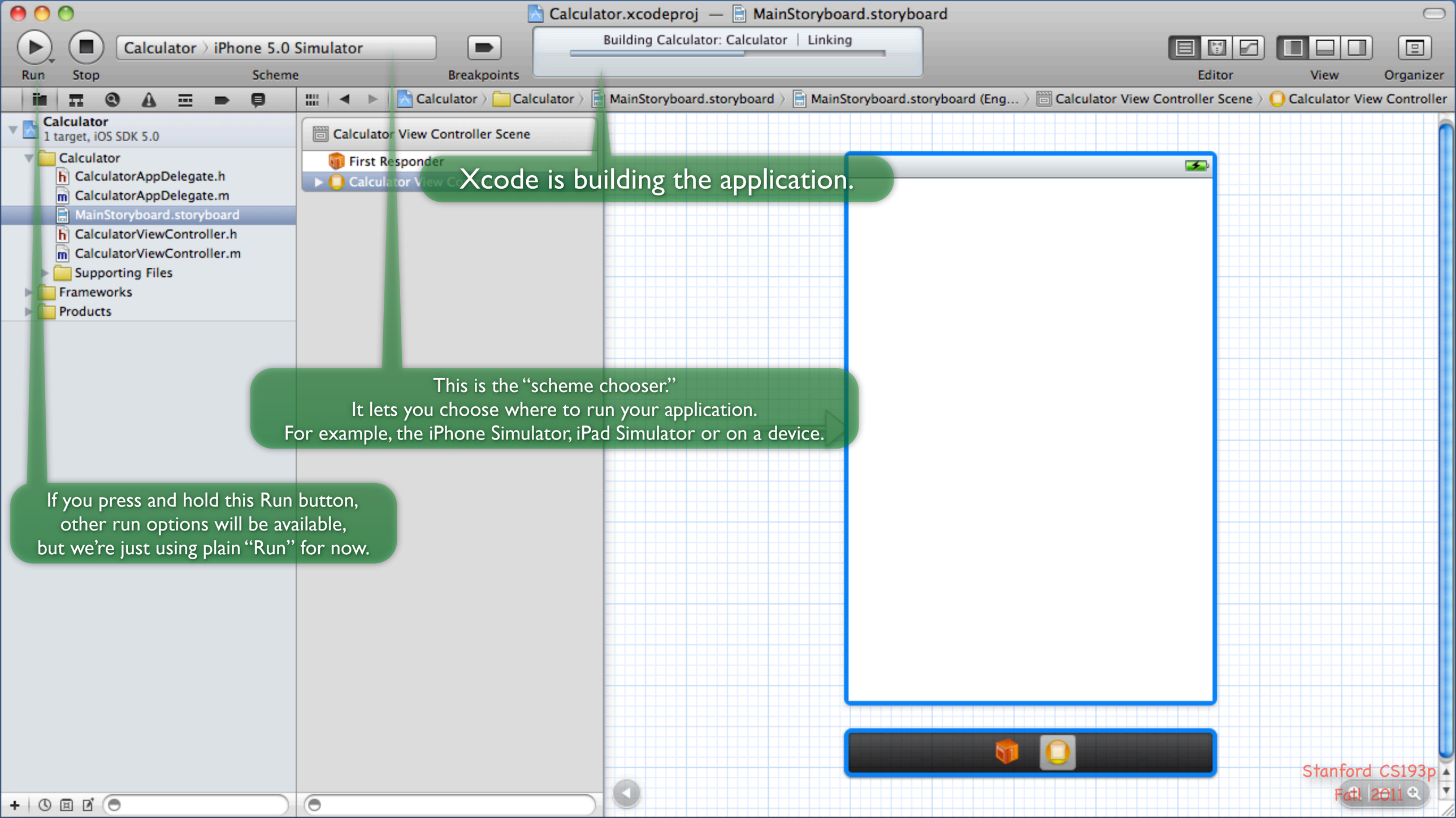
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Building Calculator: Calculator | Linking
Editor
View
Organizer
Calculator 〉 Calculator 〉 MainStoryboard.storyboard 〉 MainStoryboard.storyboard (Eng... 〉 Calculator View Controller Scene 〉 Calculator View Controller
Calculator
1 target, iOS SDK 5.0
Calculator
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Frameworks
Products
Calculator View Controller Scene
First Responder
Xcode is building the application.
This is the "scheme chooser."
It lets you choose where to run your application.
For example, the iPhone Simulator, iPad Simulator or on a device.
If you press and hold this Run button,
other run options will be available,
but we're just using plain "Run" for now.
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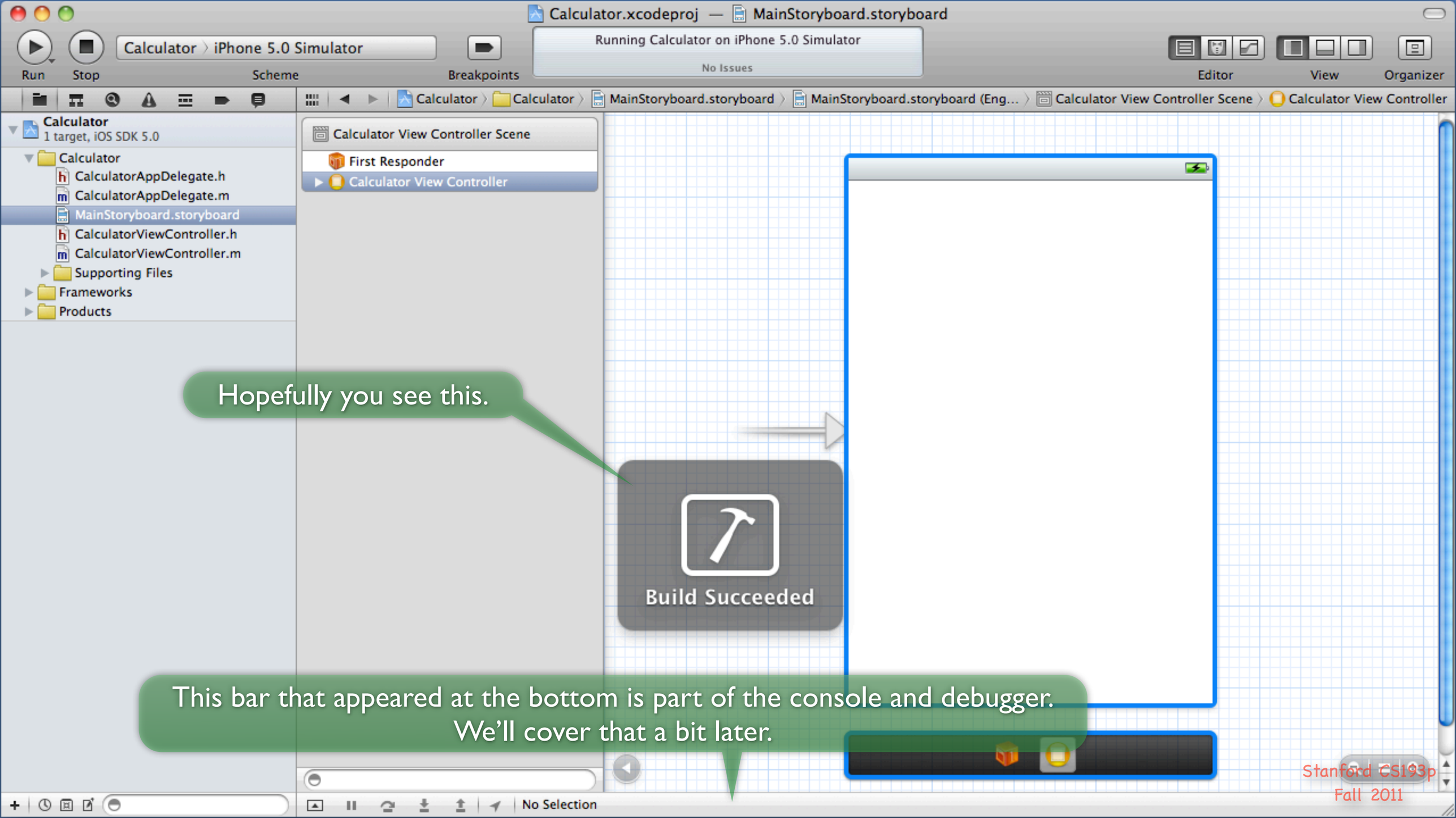
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator › Calculator › MainStoryboard.storyboard › MainStoryboard.storyboard (Eng… › Calculator View Controller Scene › Calculator View Controller
Calculator
1 target, iOS SDK 5.0
Calculator
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Frameworks
Products
Calculator View Controller Scene
First Responder
Calculator View Controller
Hopefully you see this.
Build Succeeded
This bar that appeared at the bottom is part of the console and debugger.
We'll cover that a bit later.
No Selection
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Calculator.xcodeproj — MainStoryboard.storyb
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Running Calculator on iPhone 5.0 Simulator
No Issues
View
Organizer
Calculator View Controller
Calculator
1 target, iOS SDK 5.0
Calculator
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Frameworks
Products
Calculator View Controller Scene
First Responder
Calculator View Controller
iOS iPhone Simulator
Carrier
Congratulations again!
You've run your first iOS app in the iOS Simulator.
You will use the simulator for most (but not all) of your assignments.
When you are done glorying in the wonder of it all, click the Stop button.
Blank MVC View.
This button shows or hides the debugger/console.
You can click it if you want to see.
No Selection
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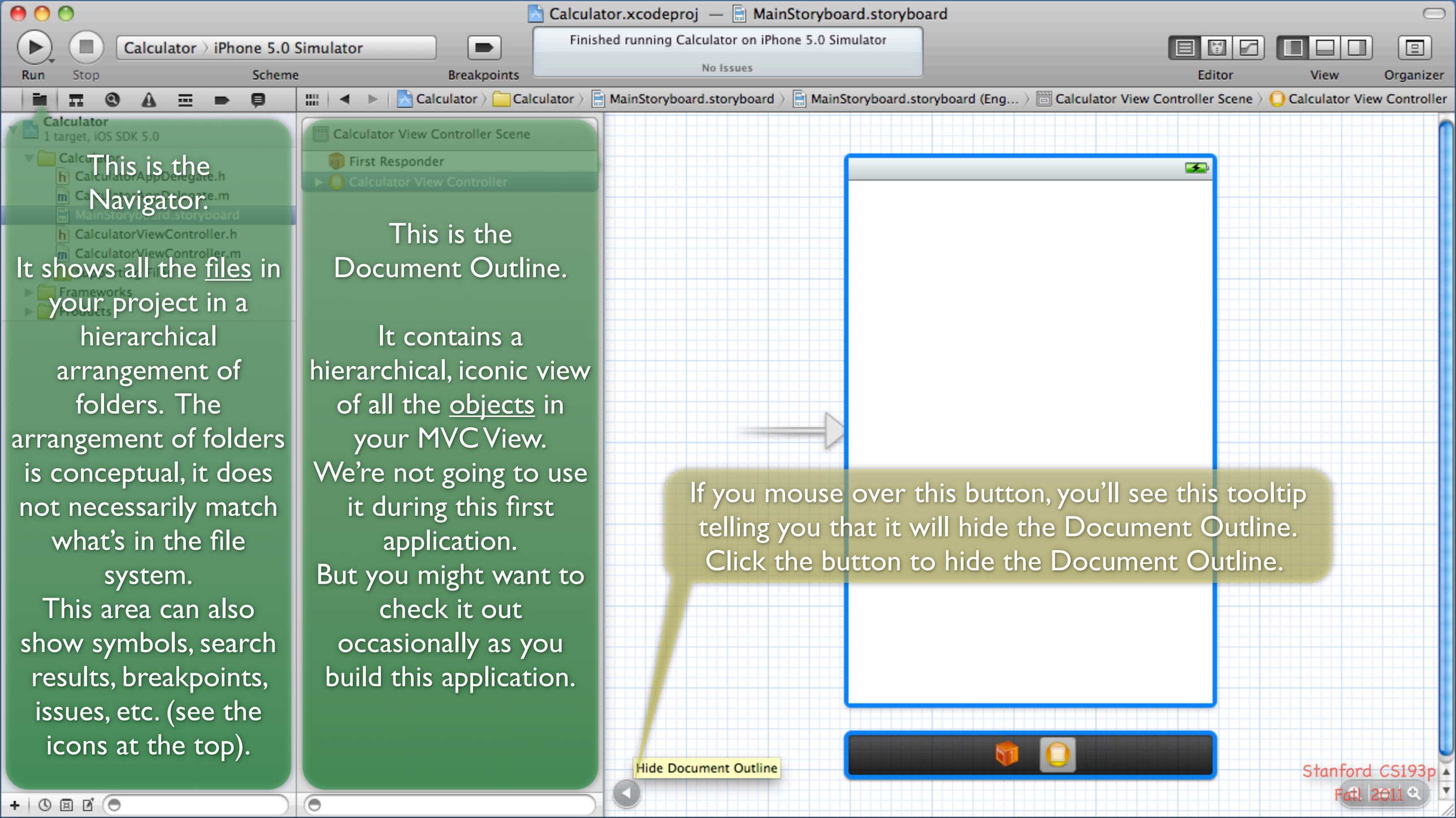
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator 〉 Calculator 〉 MainStoryboard.storyboard 〉 MainStoryboard.storyboard (Eng… 〉 Calculator View Controller Scene 〉 Calculator View Controller
Calculator
1 target, iOS SDK 5.0
CalculatorViewController.h
CalculatorViewController.m
Frameworks
Products
Calculator View Controller Scene
First Responder
Calculator View Controller
This is the Navigator.
It shows all the files in your project in a hierarchical arrangement of folders. The arrangement of folders is conceptual, it does not necessarily match what's in the file system.
This area can also show symbols, search results, breakpoints, issues, etc. (see the icons at the top).
This is the Document Outline.
It contains a hierarchical, iconic view of all the objects in your MVC View.
We're not going to use it during this first application.
But you might want to check it out occasionally as you build this application.
If you mouse over this button, you'll see this tooltip telling you that it will hide the Document Outline.
Click the button to hide the Document Outline.
Hide Document Outline
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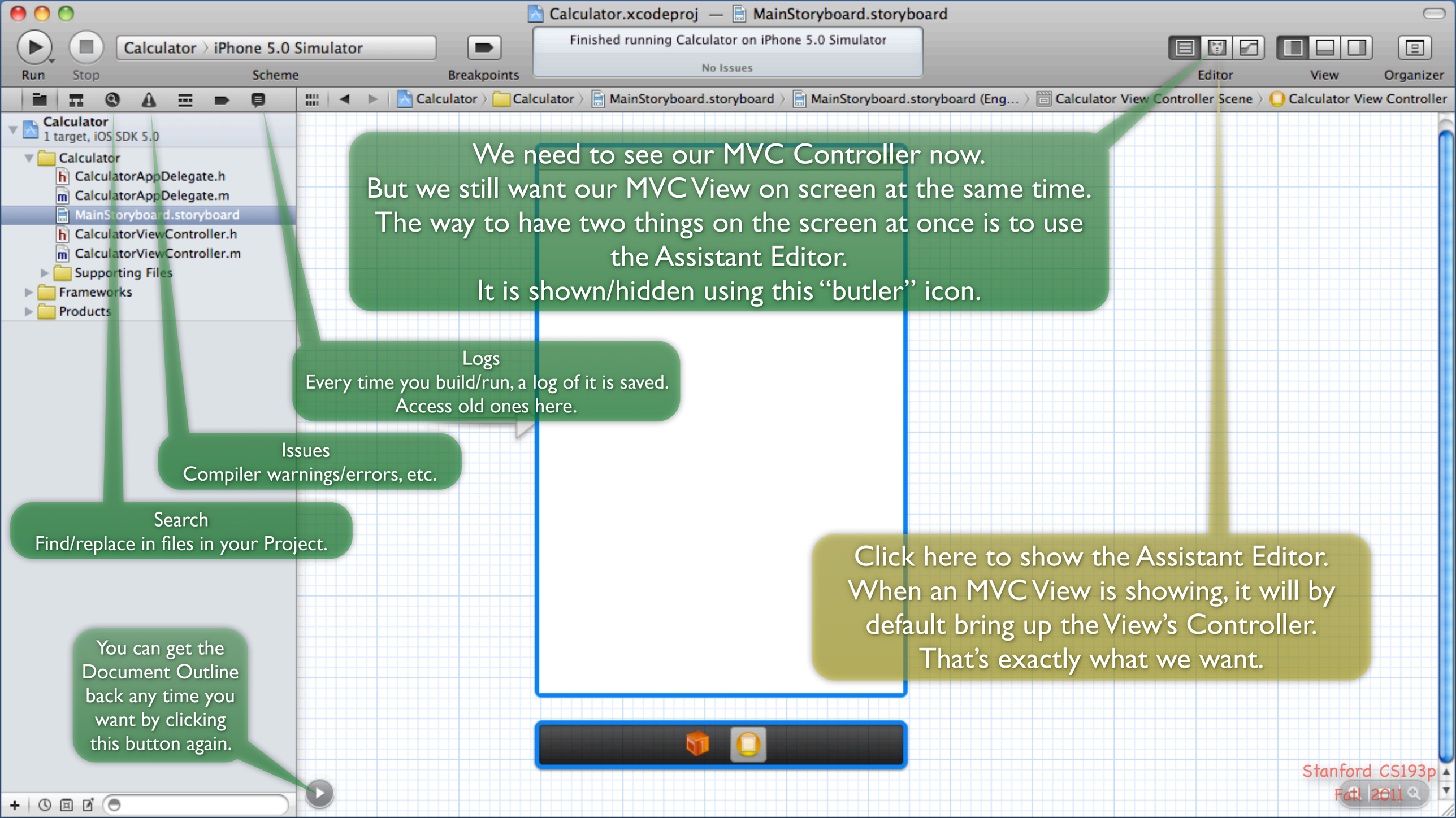
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator › Calculator › MainStoryboard.storyboard › MainStoryboard.storyboard (Eng… › Calculator View Controller Scene › Calculator View Controller
Calculator
1 target, iOS SDK 5.0
Calculator
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Frameworks
Products
We need to see our MVC Controller now.
But we still want our MVC View on screen at the same time.
The way to have two things on the screen at once is to use the Assistant Editor.
It is shown/hidden using this "butler" icon.
Logs
Every time you build/run, a log of it is saved.
Access old ones here.
Issues
Compiler warnings/errors, etc.
Search
Find/replace in files in your Project.
Click here to show the Assistant Editor.
When an MVC View is showing, it will by default bring up the View's Controller.
That's exactly what we want.
You can get the Document Outline back any time you want by clicking this button again.
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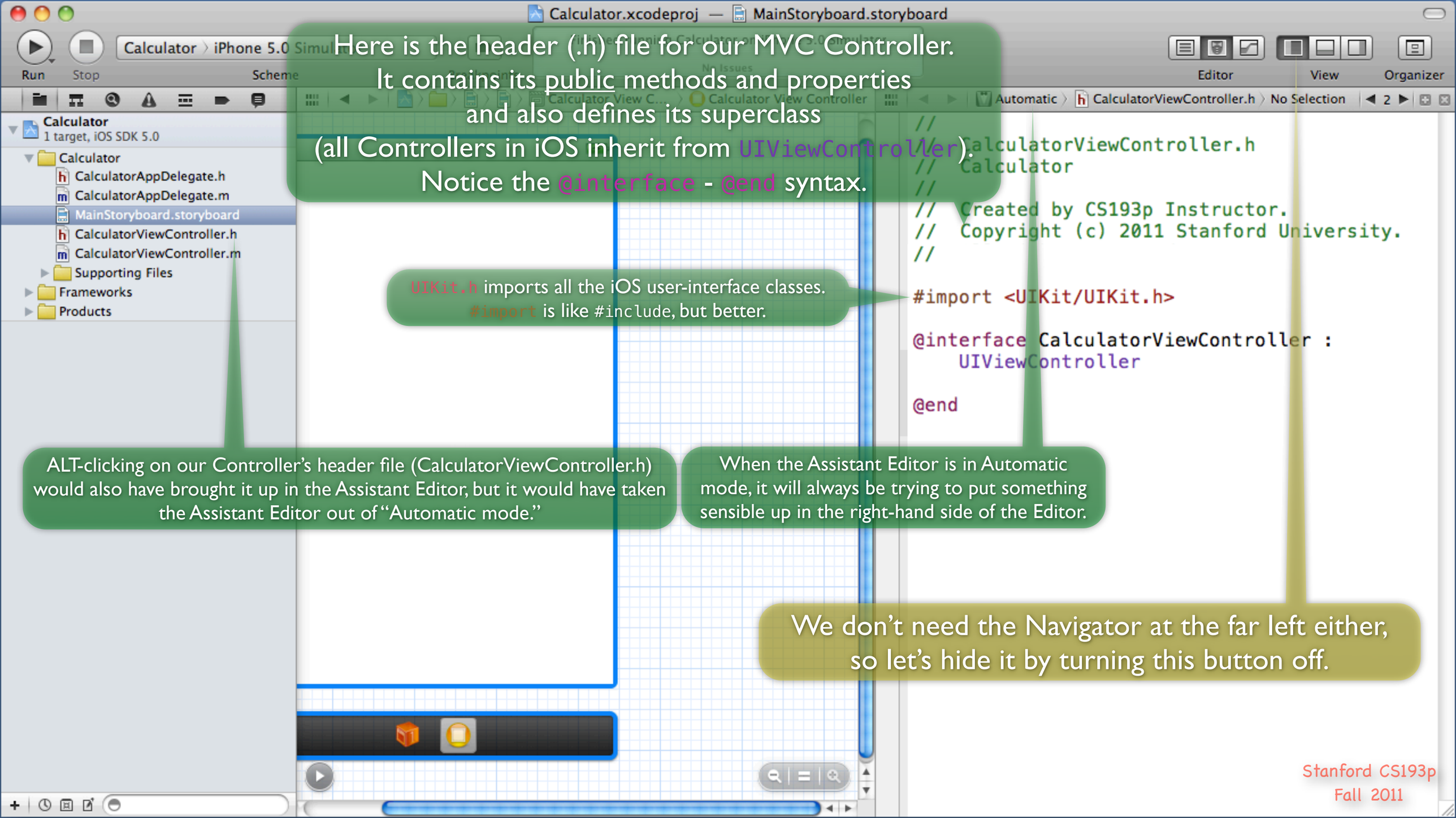
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Scheme
Editor
View
Organizer
Here is the header (.h) file for our MVC Controller.
It contains its public methods and properties
and also defines its superclass
(all Controllers in iOS inherit from UIViewController).
Notice the @interface - @end syntax.
Calculator
1 target, iOS SDK 5.0
Calculator
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Frameworks
Products
Automatic
CalculatorViewController.h
No Selection
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController :
UIViewController
@end
UIKit.h imports all the iOS user-interface classes.
#import is like #include, but better.
ALT-clicking on our Controller's header file (CalculatorViewController.h)
would also have brought it up in the Assistant Editor, but it would have taken
the Assistant Editor out of "Automatic mode."
When the Assistant Editor is in Automatic
mode, it will always be trying to put something
sensible up in the right-hand side of the Editor.
We don't need the Navigator at the far left either,
so let's hide it by turning this button off.
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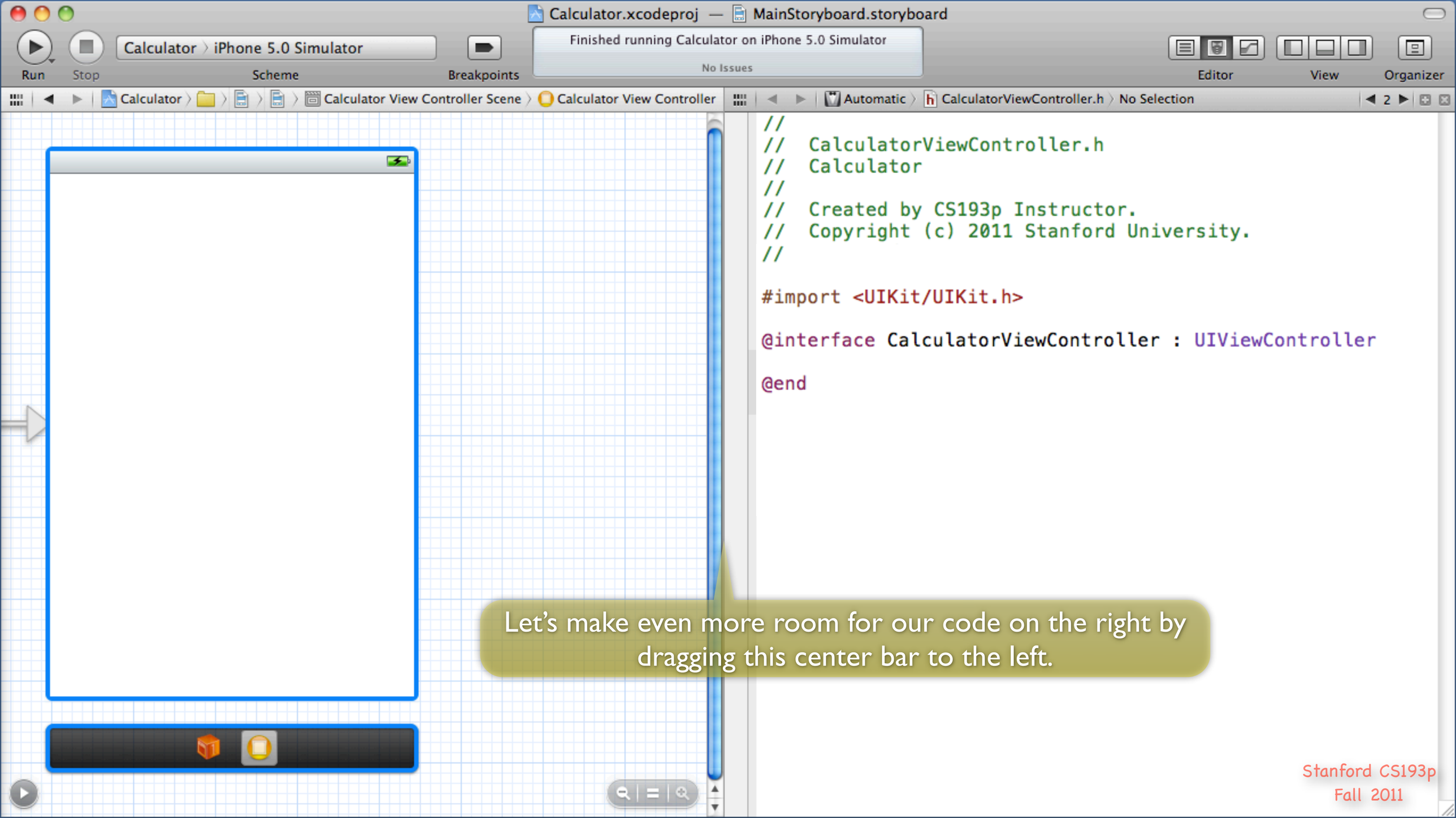
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator 〉 Calculator View Controller Scene 〉 Calculator View Controller
Automatic 〉 CalculatorViewController.h 〉 No Selection
2
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Let's make even more room for our code on the right by dragging this center bar to the left.
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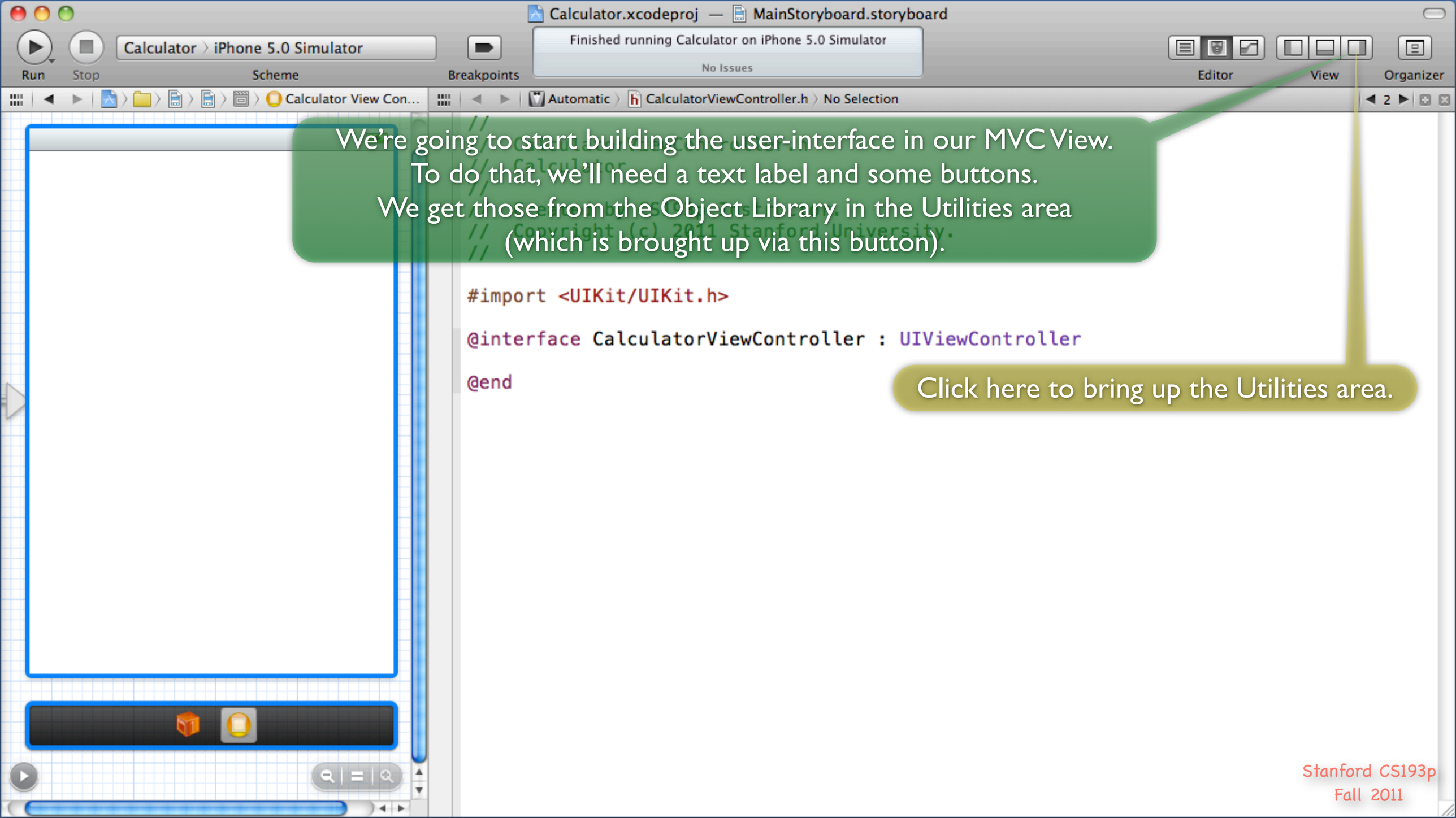
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator View Con...
Automatic 〉 CalculatorViewController.h 〉 No Selection
We're going to start building the user-interface in our MVC View.
To do that, we'll need a text label and some buttons.
We get those from the Object Library in the Utilities area
(which is brought up via this button).
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Click here to bring up the Utilities area.
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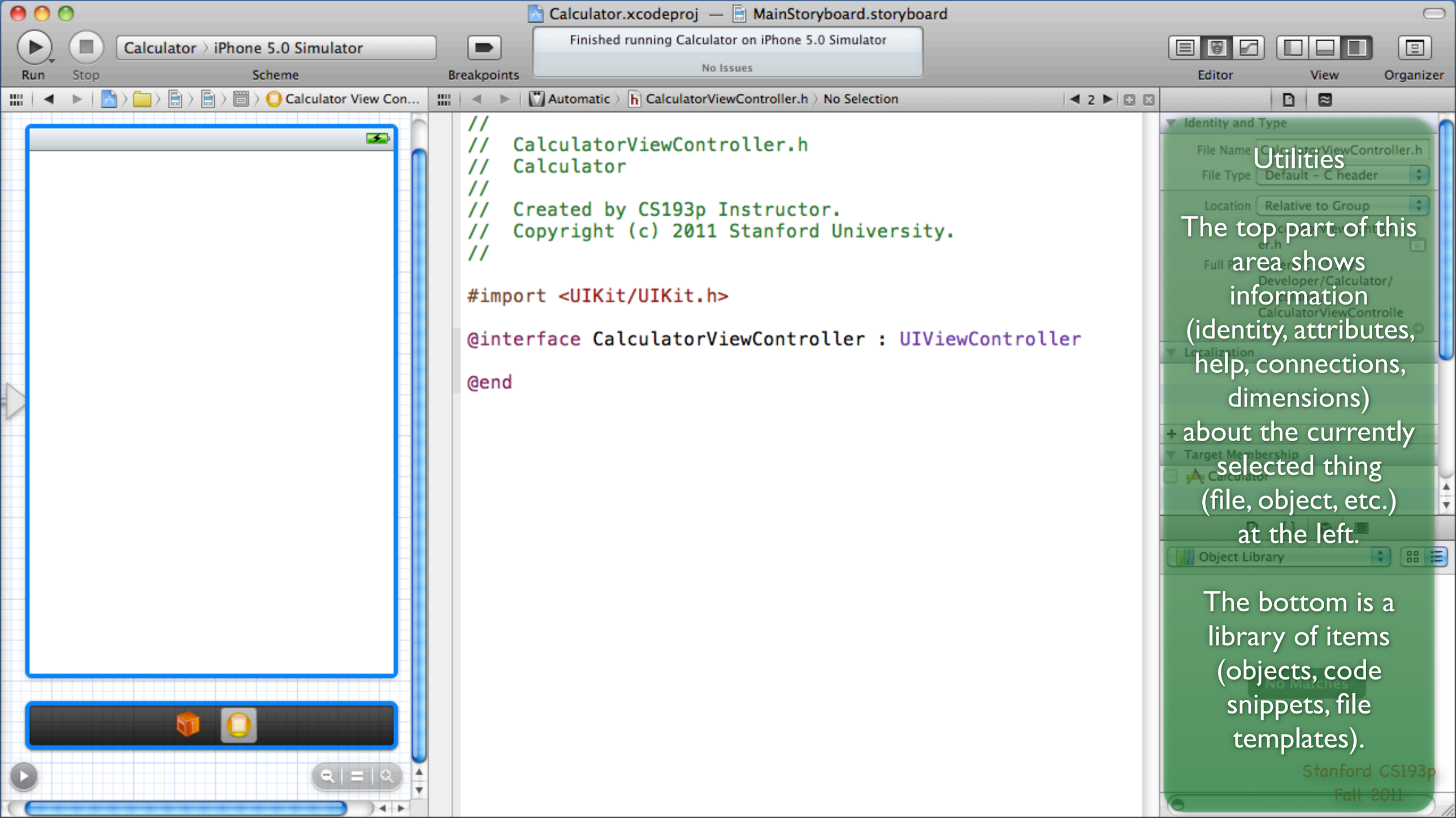
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator View Con…
Automatic › CalculatorViewController.h › No Selection
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Utilities
The top part of this area shows information (identity, attributes, help, connections, dimensions) about the currently selected thing (file, object, etc.) at the left.
Object Library
The bottom is a library of items (objects, code snippets, file templates).
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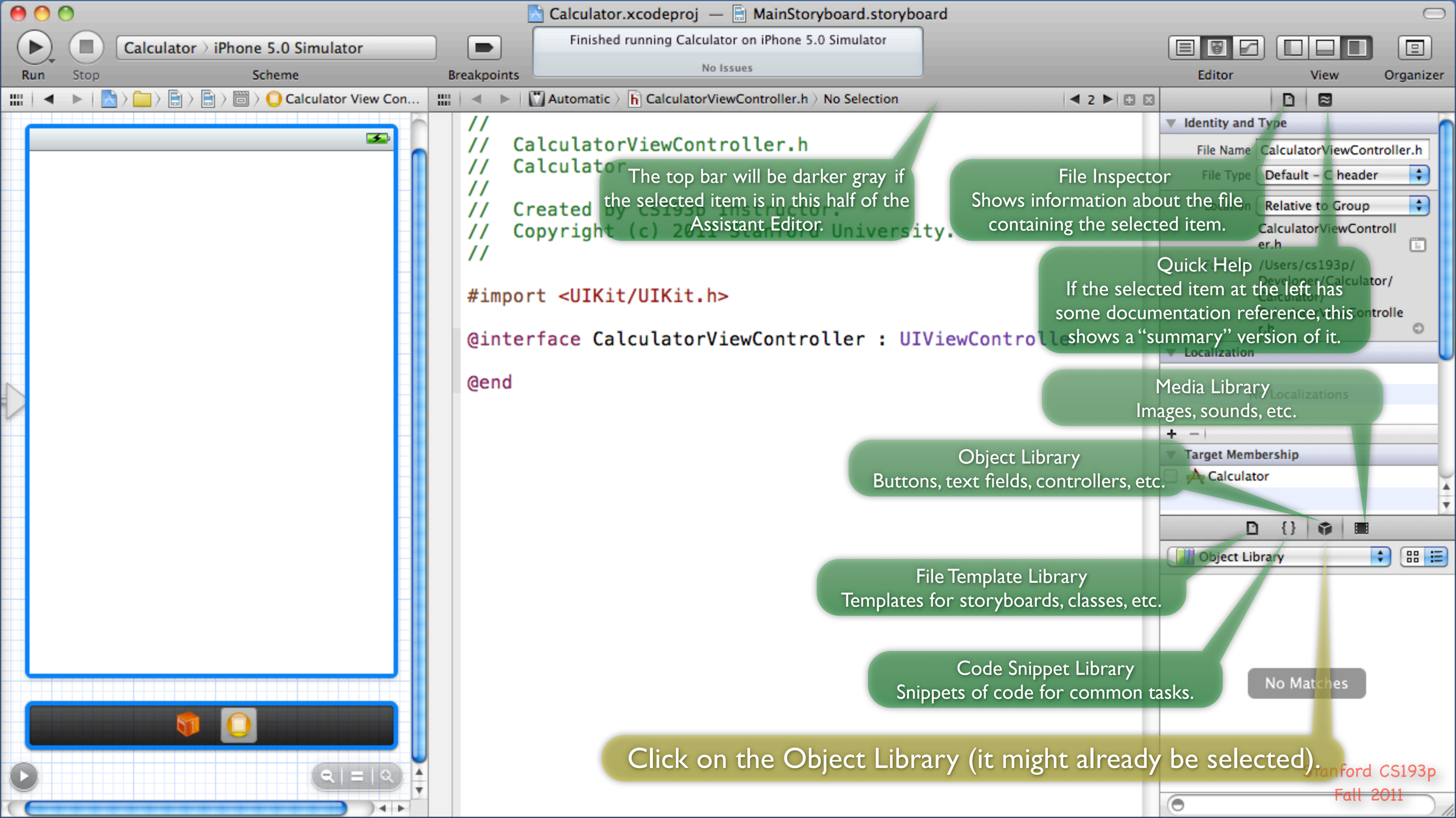
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator View Con…
Automatic › CalculatorViewController.h › No Selection
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewControlle
@end
The top bar will be darker gray if the selected item is in this half of the Assistant Editor.
File Inspector
Shows information about the file containing the selected item.
Quick Help
If the selected item at the left has some documentation reference, this shows a "summary" version of it.
Media Library
Images, sounds, etc.
Object Library
Buttons, text fields, controllers, etc.
File Template Library
Templates for storyboards, classes, etc.
Code Snippet Library
Snippets of code for common tasks.
Identity and Type
File Name
CalculatorViewController.h
File Type
Default – C header
Relative to Group
Localization
Target Membership
Calculator
Object Library
No Matches
Click on the Object Library (it might already be selected).
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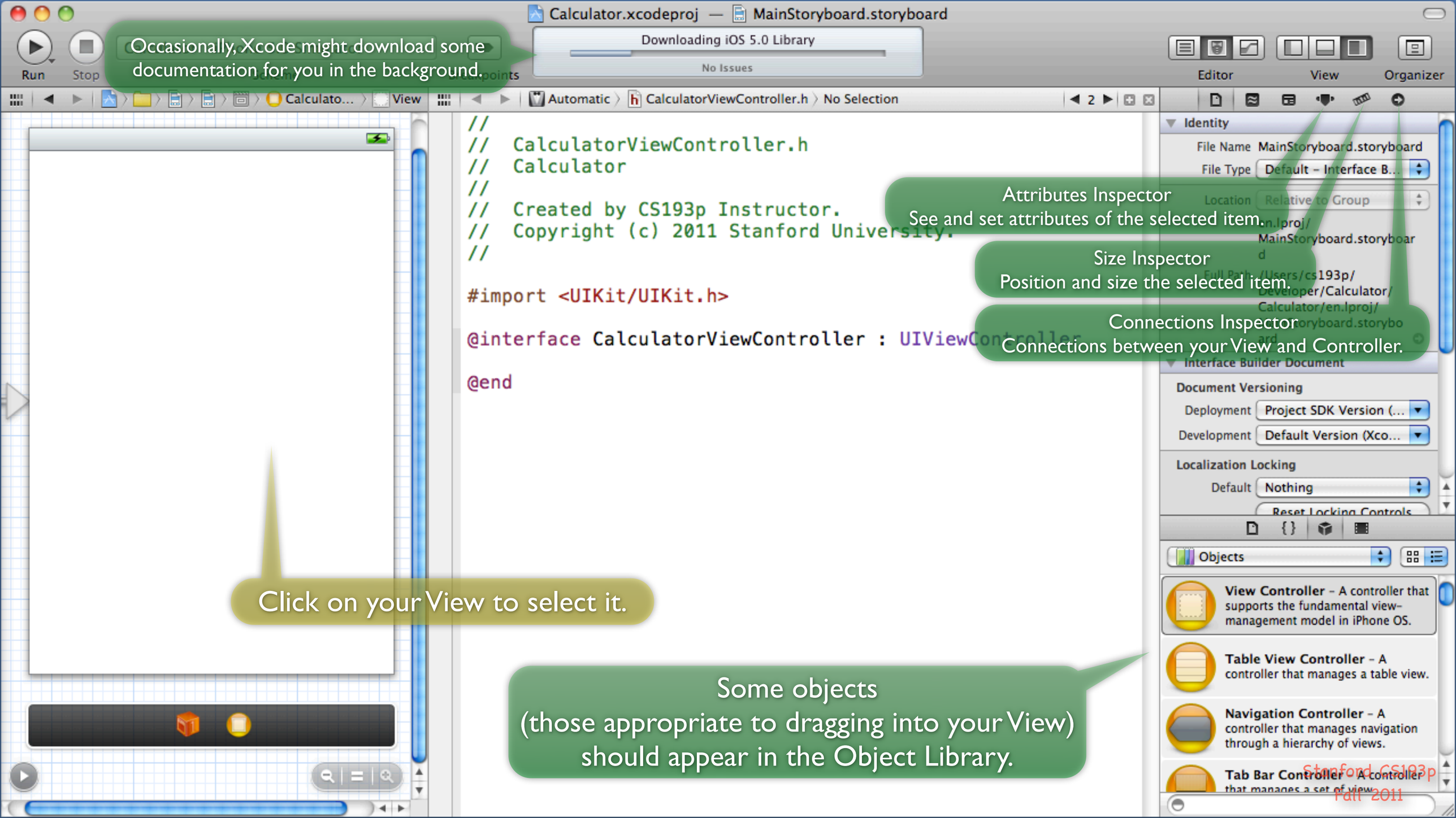
Calculator.xcodeproj — MainStoryboard.storyboard
Downloading iOS 5.0 Library
No Issues
Run
Stop
Editor
View
Organizer
Occasionally, Xcode might download some documentation for you in the background.
Automatic
CalculatorViewController.h
No Selection
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Identity
File Name MainStoryboard.storyboard
File Type Default - Interface B...
Location Relative to Group
Attributes Inspector
See and set attributes of the selected item.
Size Inspector
Position and size the selected item.
Connections Inspector
Connections between your View and Controller.
Interface Builder Document
Document Versioning
Deployment Project SDK Version (...
Development Default Version (Xco...
Localization Locking
Default Nothing
Reset Locking Controls
Objects
View Controller - A controller that supports the fundamental view-management model in iPhone OS.
Table View Controller - A controller that manages a table view.
Navigation Controller - A controller that manages navigation through a hierarchy of views.
Tab Bar Controller - A controller
Click on your View to select it.
Some objects
(those appropriate to dragging into your View)
should appear in the Object Library.
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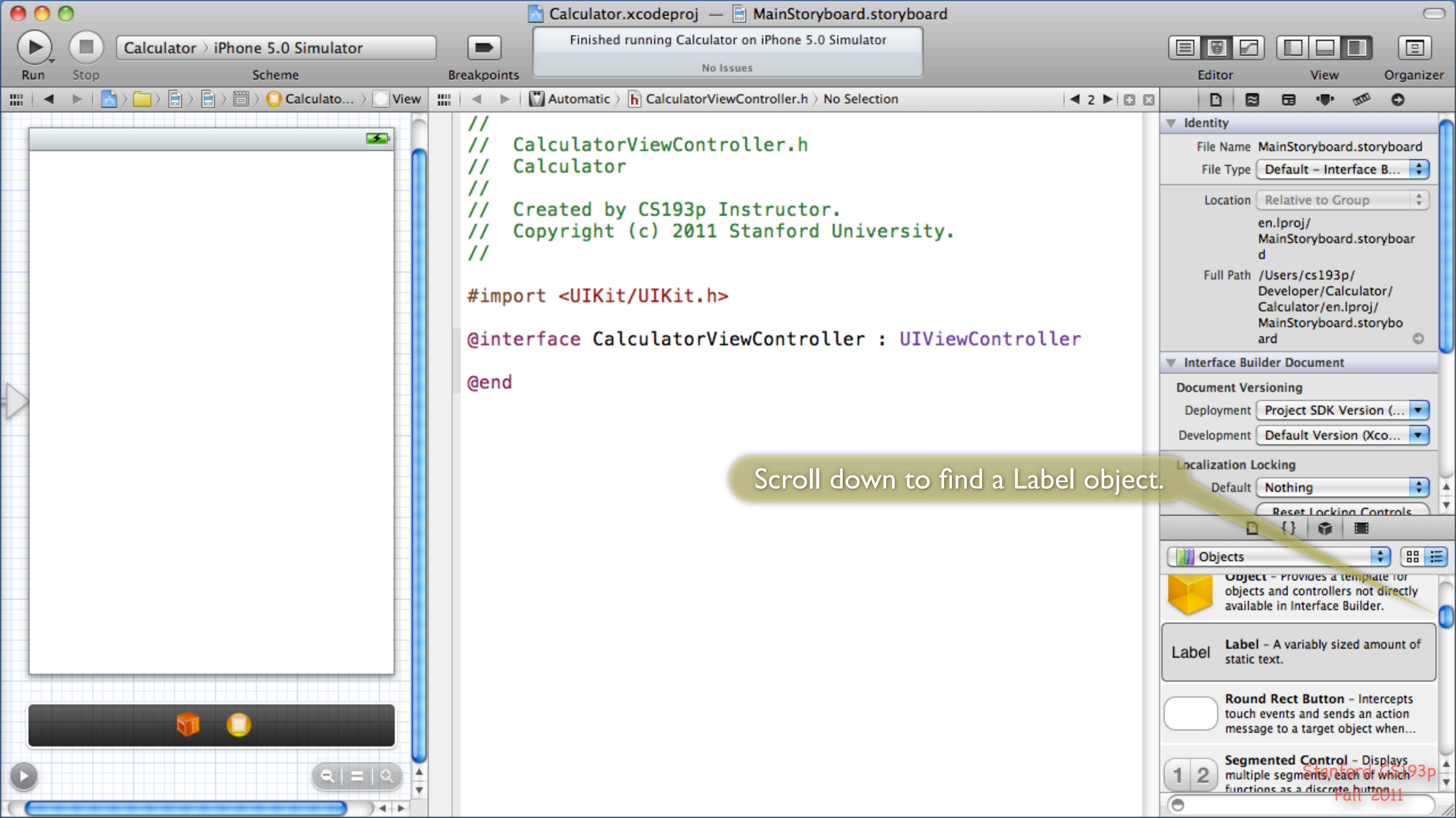
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.h
No Selection
2
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Identity
File Name MainStoryboard.storyboard
File Type Default - Interface B...
Location Relative to Group
en.lproj/MainStoryboard.storyboard
Full Path /Users/cs193p/Developer/Calculator/Calculator/en.lproj/MainStoryboard.storyboard
Interface Builder Document
Document Versioning
Deployment Project SDK Version (...
Development Default Version (Xco...
Localization Locking
Default Nothing
Reset Locking Controls
Scroll down to find a Label object.
Objects
Object - Provides a template for objects and controllers not directly available in Interface Builder.
Label
Label - A variably sized amount of static text.
Round Rect Button - Intercepts touch events and sends an action message to a target object when...
1 2
Segmented Control - Displays multiple segments, each of which functions as a discrete button...
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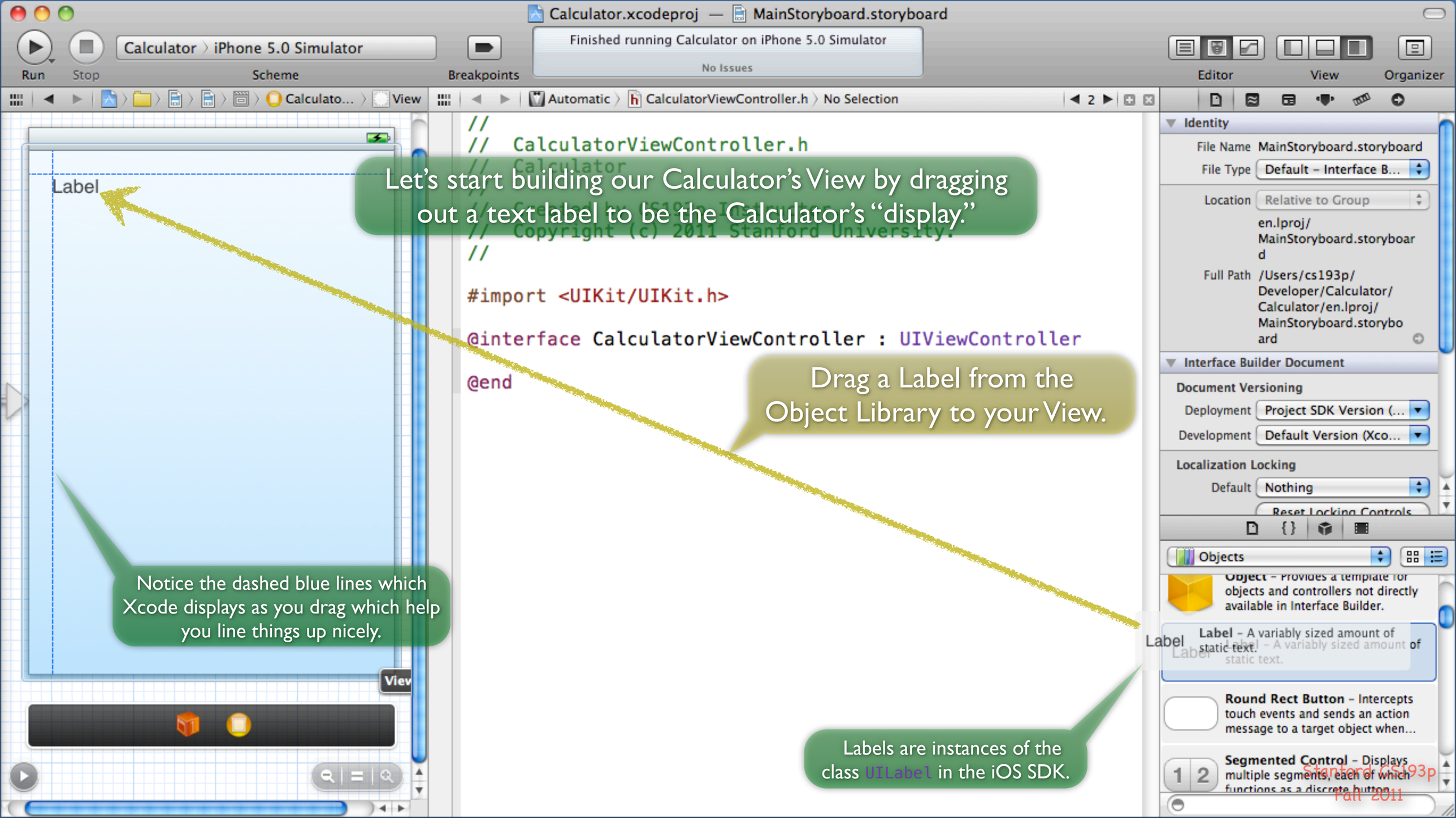
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.h
No Selection
2
//
// CalculatorViewController.h
// Calculator
//
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Label
Let's start building our Calculator's View by dragging out a text label to be the Calculator's "display."
Drag a Label from the Object Library to your View.
Notice the dashed blue lines which Xcode displays as you drag which help you line things up nicely.
Labels are instances of the class UILabel in the iOS SDK.
Identity
File Name MainStoryboard.storyboard
File Type Default – Interface B...
Location Relative to Group
en.lproj/MainStoryboard.storyboard
Full Path /Users/cs193p/Developer/Calculator/Calculator/en.lproj/MainStoryboard.storyboard
Interface Builder Document
Document Versioning
Deployment Project SDK Version (...
Development Default Version (Xco...
Localization Locking
Default Nothing
Reset Locking Controls
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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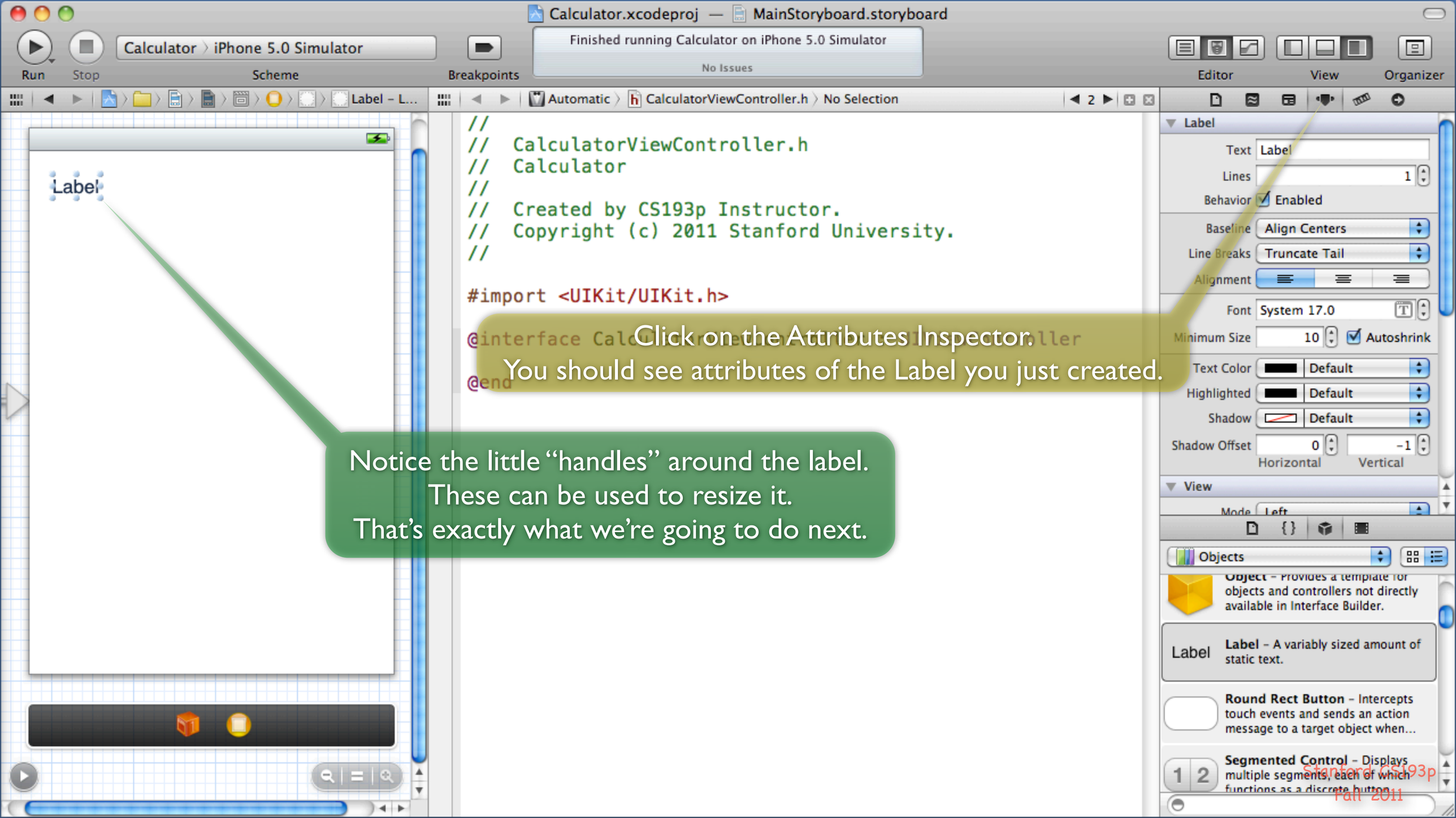
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – L...
Automatic 〉 CalculatorViewController.h 〉 No Selection
2
Label
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface Calc
ller
@end
Click on the Attributes Inspector.
You should see attributes of the Label you just created.
Notice the little "handles" around the label.
These can be used to resize it.
That's exactly what we're going to do next.
Label
Text Label
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 17.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
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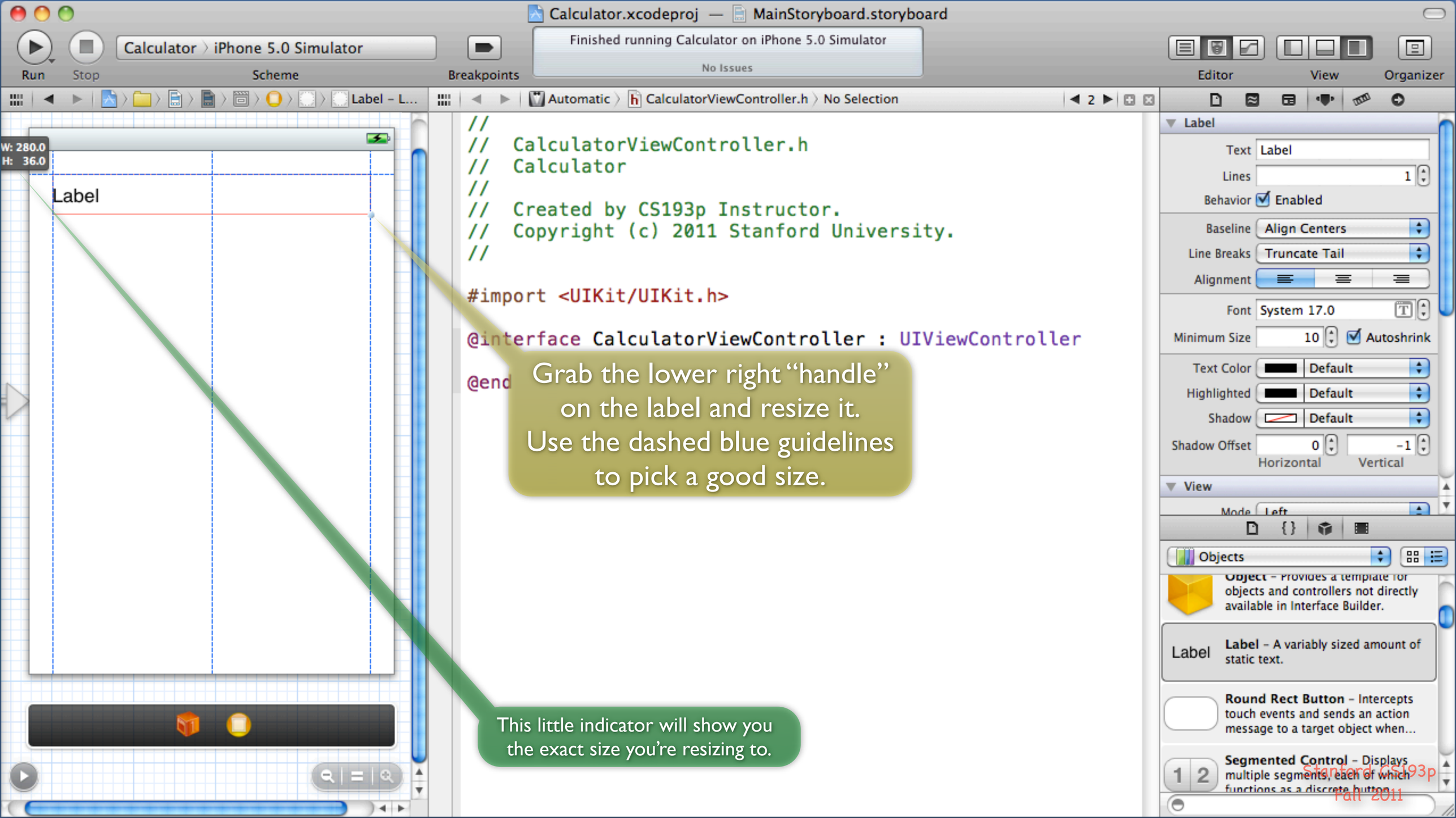
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – L...
Automatic 〉 CalculatorViewController.h 〉 No Selection
W: 280.0
H: 36.0
Label
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Grab the lower right "handle" on the label and resize it. Use the dashed blue guidelines to pick a good size.
This little indicator will show you the exact size you're resizing to.
Label
Text Label
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 17.0
Minimum Size 10 Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
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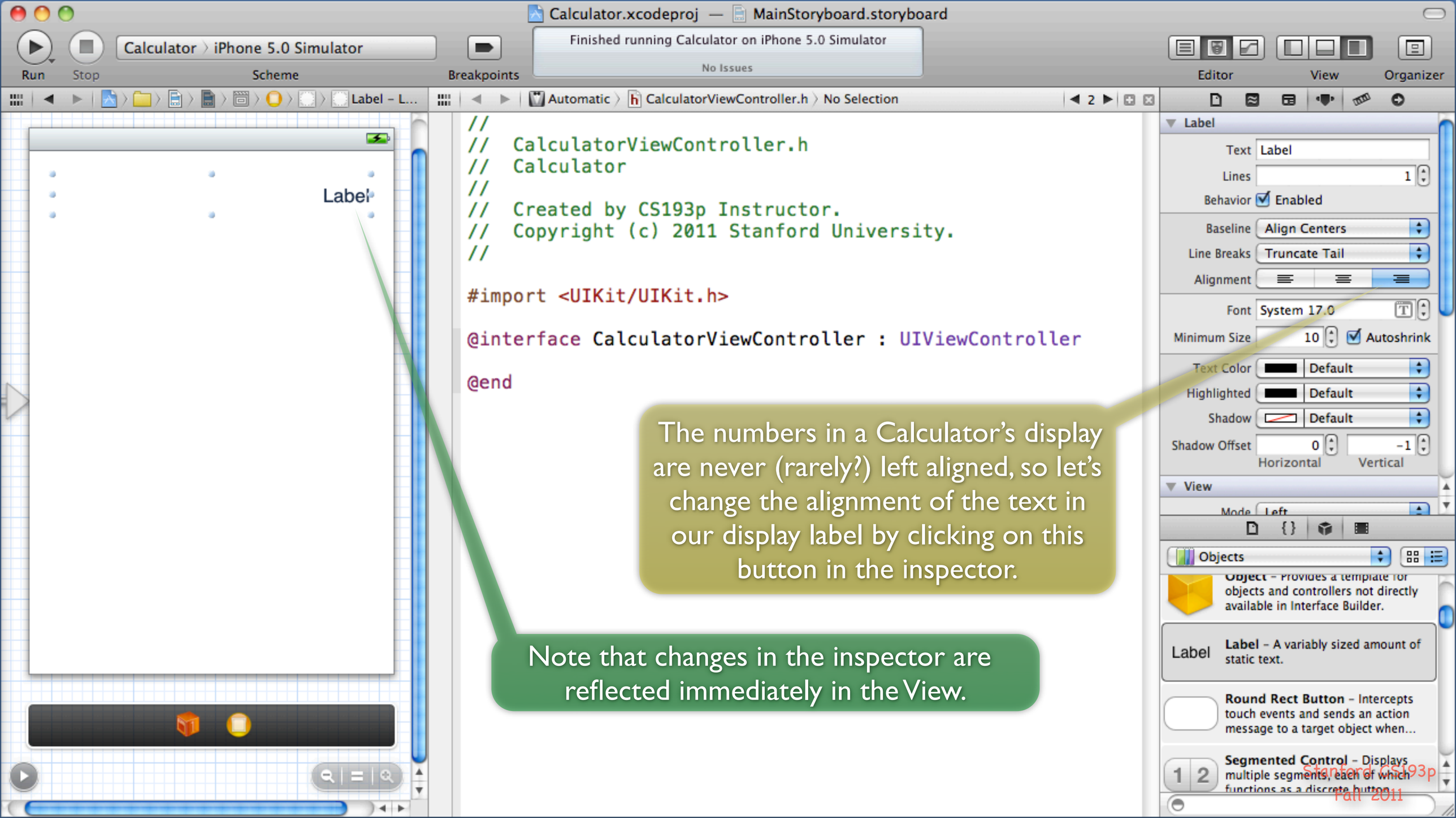
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – L...
Automatic 〉 CalculatorViewController.h 〉 No Selection
2
Label
//
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// Calculator
//
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//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Label
Text Label
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 17.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
The numbers in a Calculator's display are never (rarely?) left aligned, so let's change the alignment of the text in our display label by clicking on this button in the inspector.
Note that changes in the inspector are reflected immediately in the View.
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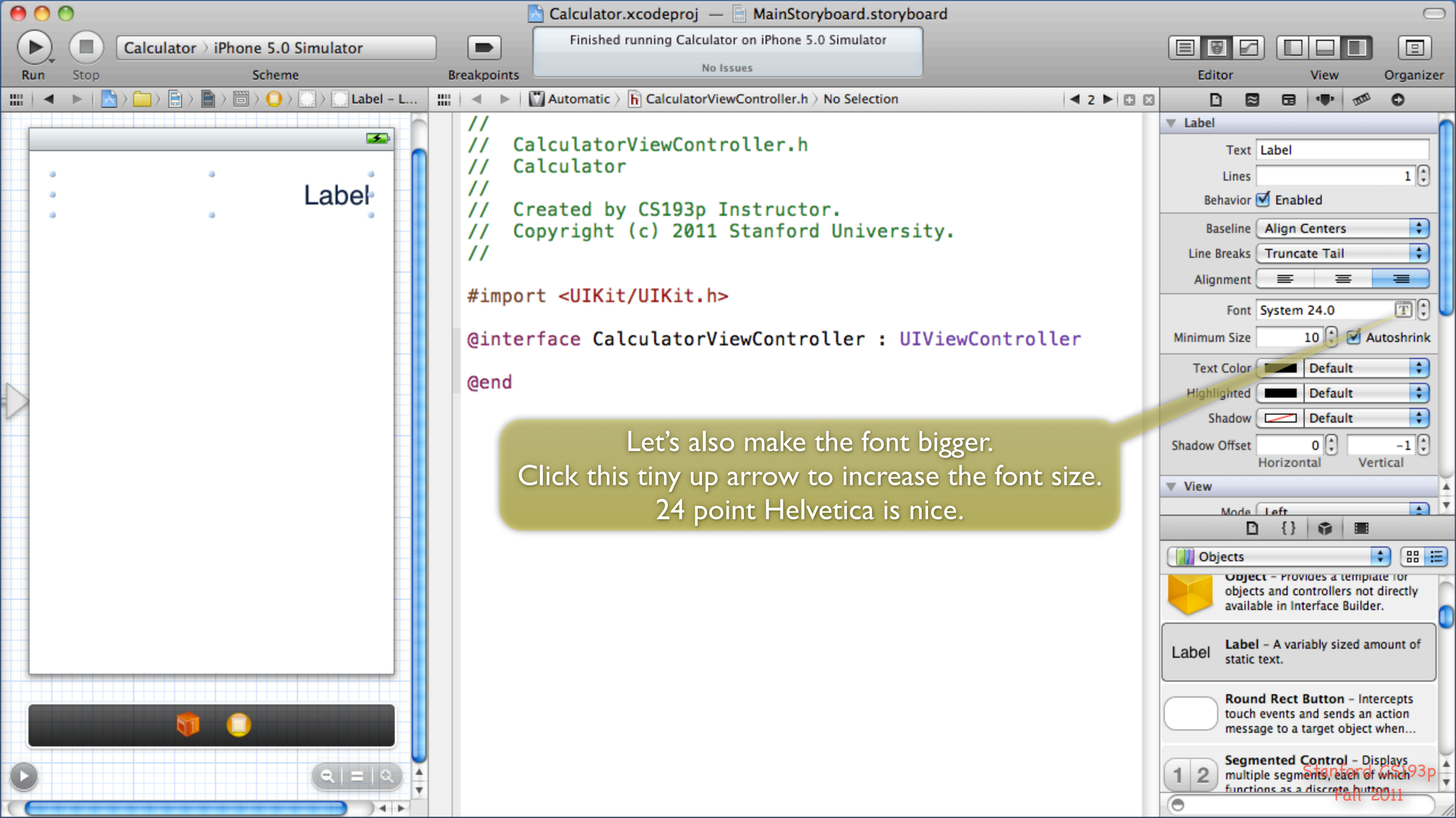
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – L...
Label
Automatic 〉 CalculatorViewController.h 〉 No Selection
2
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Let's also make the font bigger.
Click this tiny up arrow to increase the font size.
24 point Helvetica is nice.
Label
Text Label
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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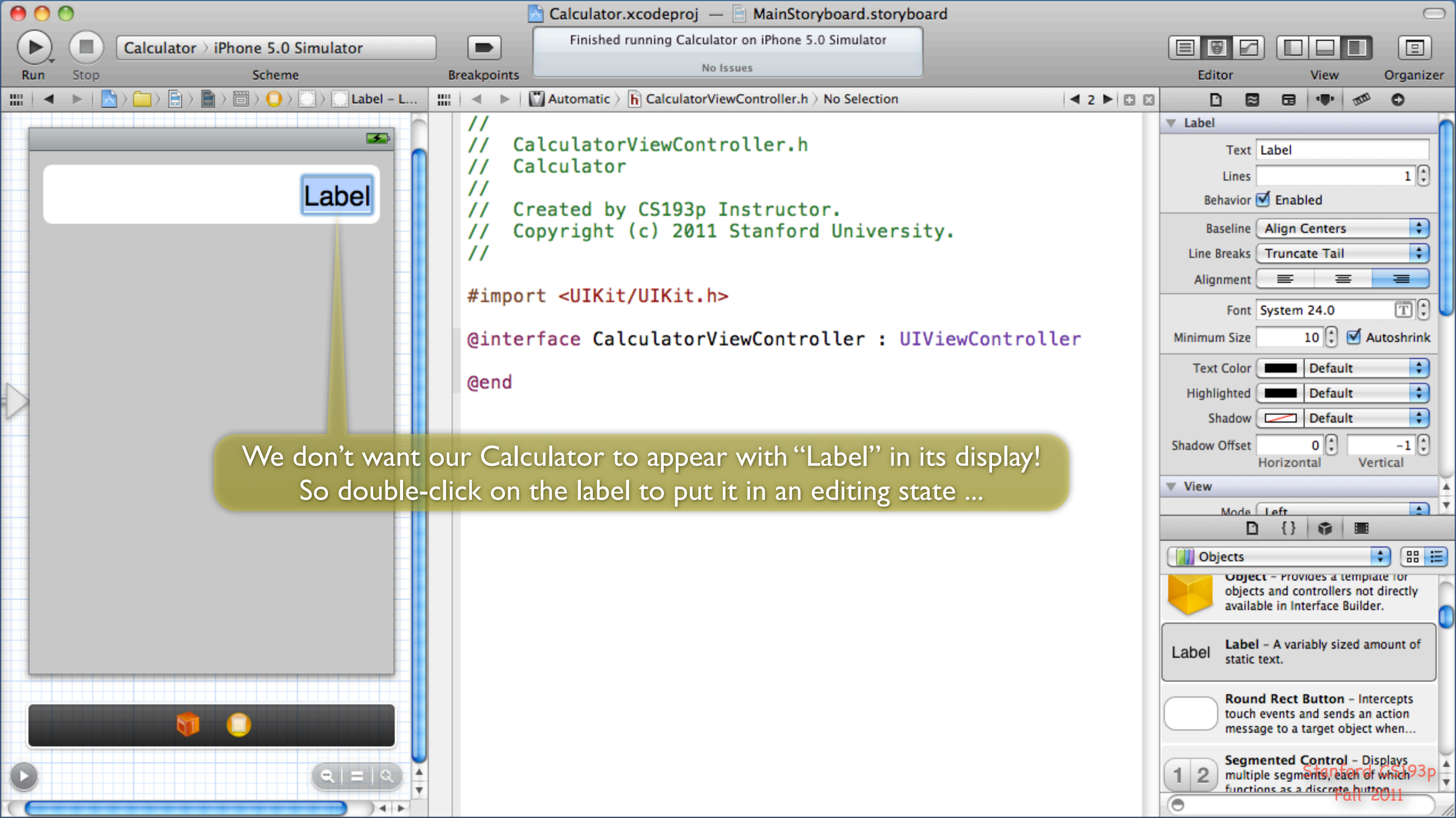
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – L...
Automatic 〉 CalculatorViewController.h 〉 No Selection
2
Label
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
We don't want our Calculator to appear with "Label" in its display!
So double-click on the label to put it in an editing state ...
Label
Text Label
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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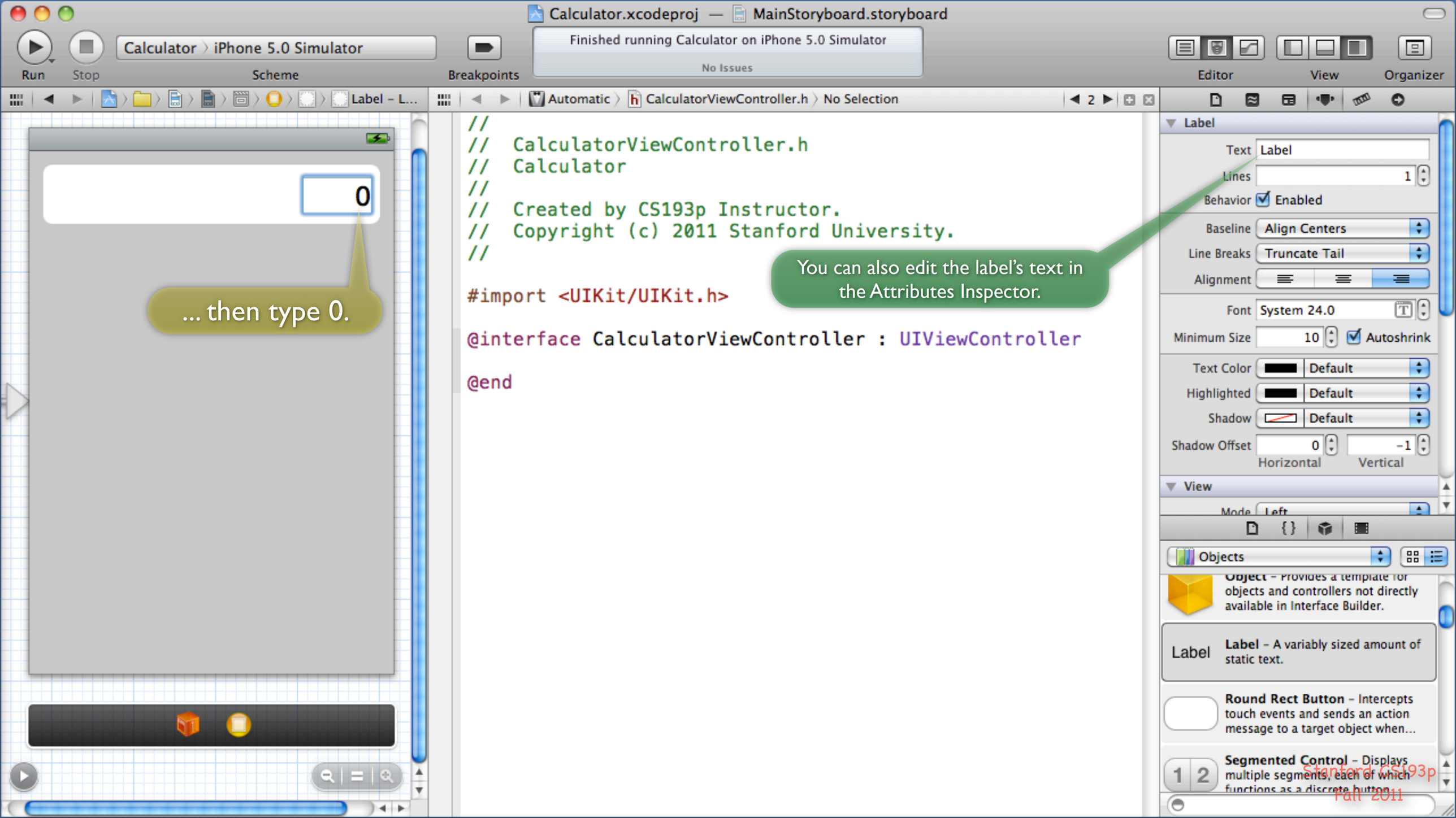
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – L...
Automatic 〉 CalculatorViewController.h 〉 No Selection
2
0
... then type 0.
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
You can also edit the label's text in the Attributes Inspector.
Label
Text Label
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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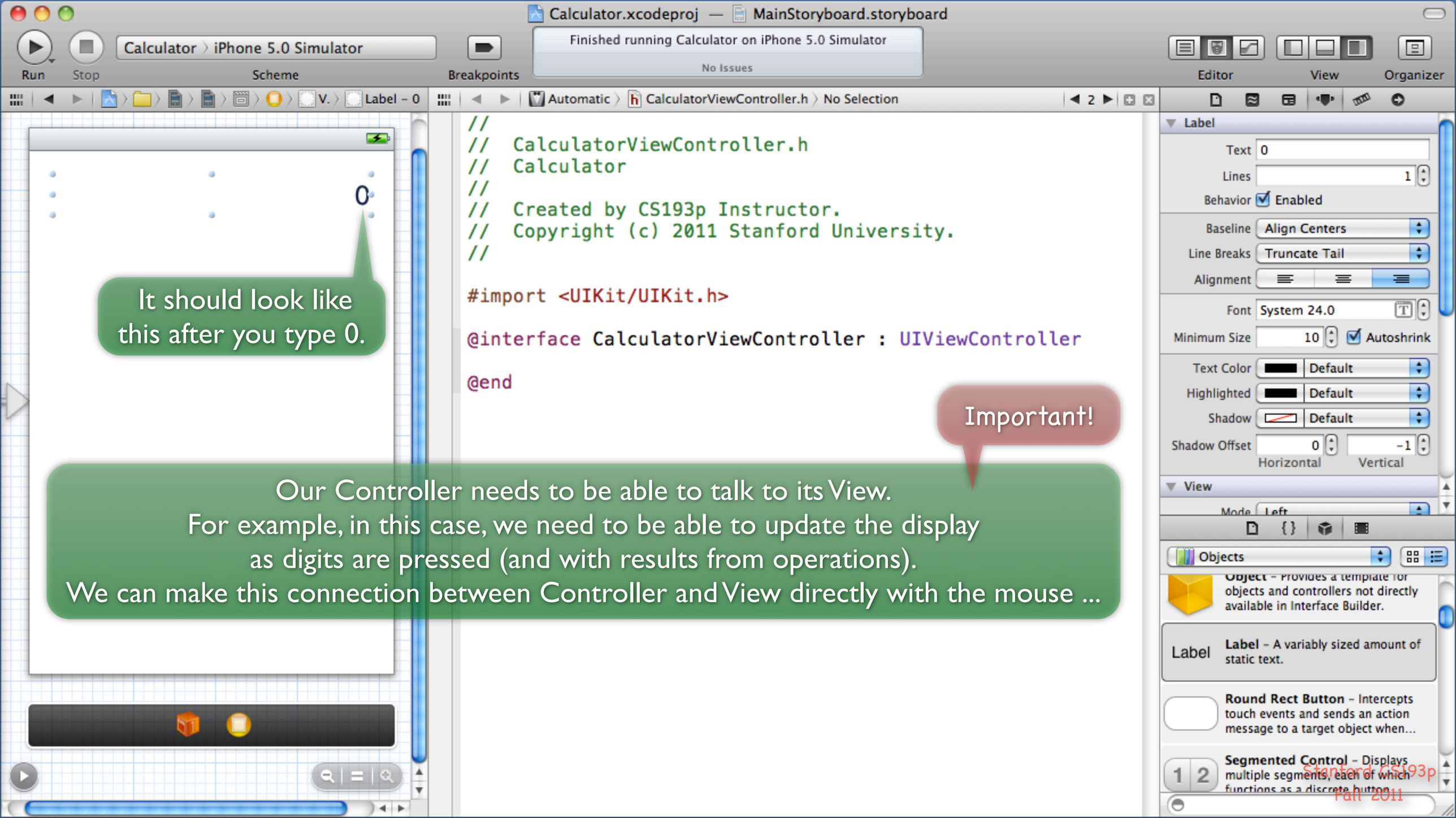
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic 〉 CalculatorViewController.h 〉 No Selection
0
It should look like this after you type 0.
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Important!
Our Controller needs to be able to talk to its View.
For example, in this case, we need to be able to update the display
as digits are pressed (and with results from operations).
We can make this connection between Controller and View directly with the mouse ...
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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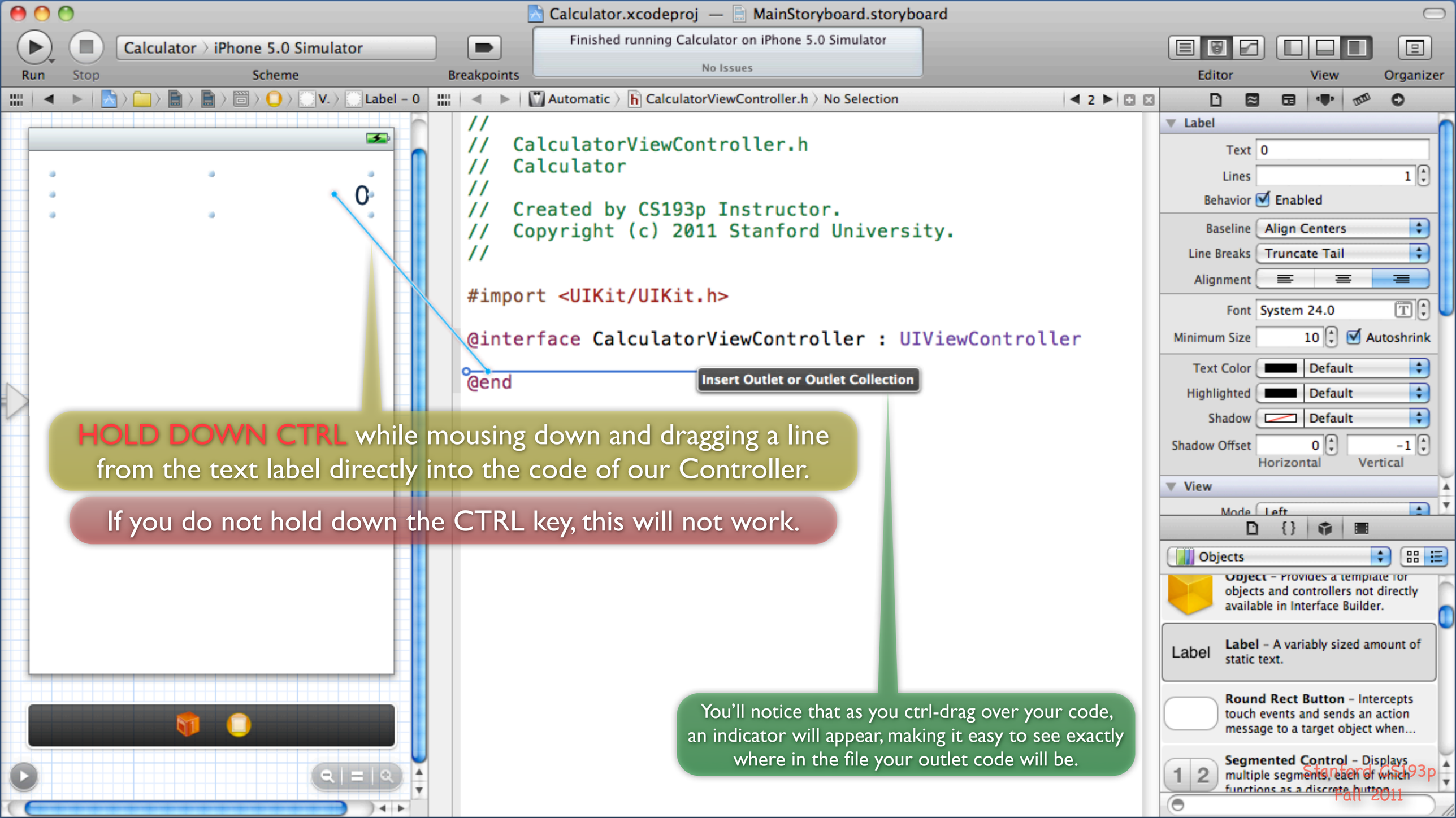
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic 〉 CalculatorViewController.h 〉 No Selection
0
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Insert Outlet or Outlet Collection
HOLD DOWN CTRL while mousing down and dragging a line from the text label directly into the code of our Controller.
If you do not hold down the CTRL key, this will not work.
You'll notice that as you ctrl-drag over your code, an indicator will appear, making it easy to see exactly where in the file your outlet code will be.
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button
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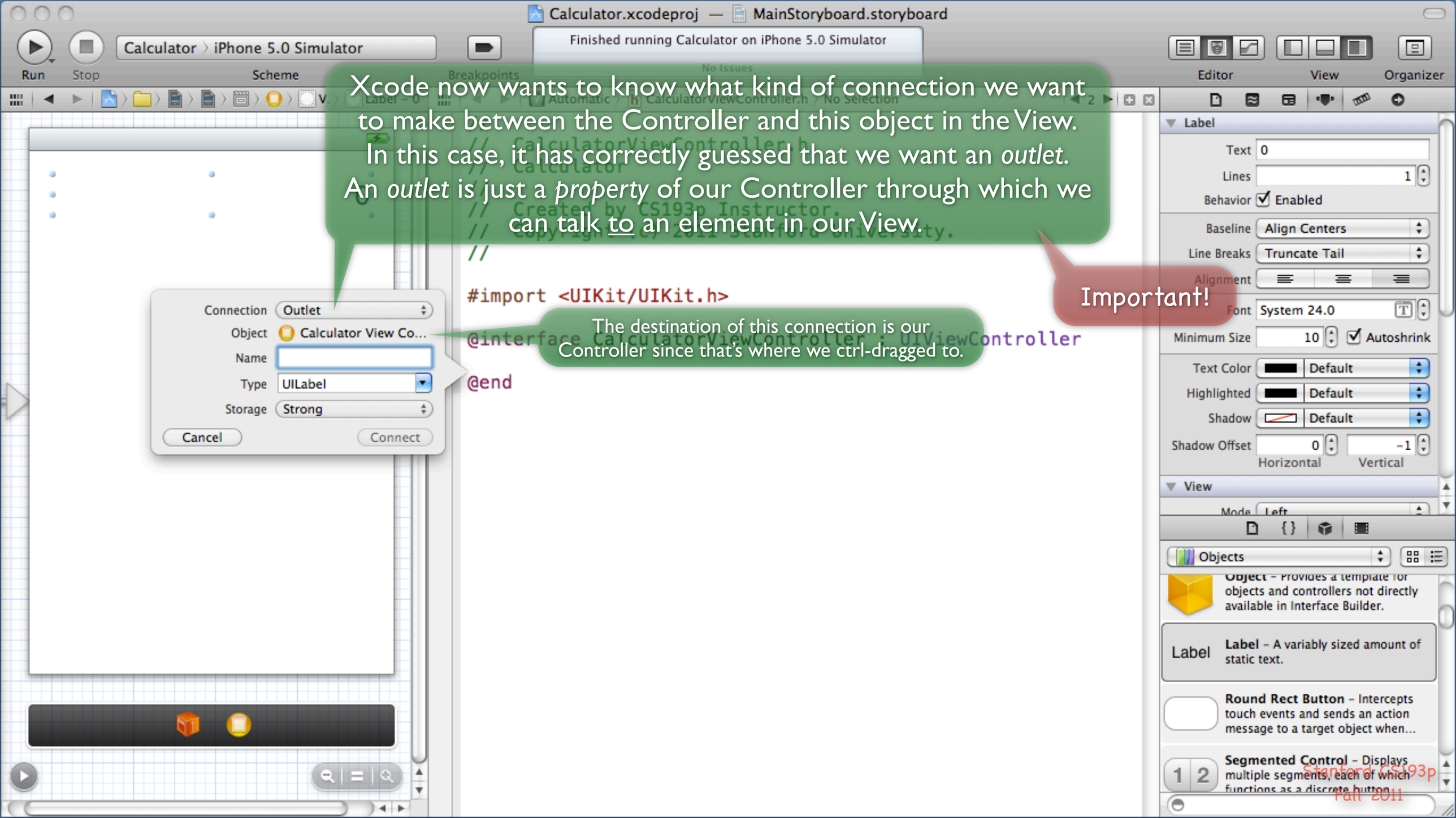
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Xcode now wants to know what kind of connection we want to make between the Controller and this object in the View.
In this case, it has correctly guessed that we want an outlet.
An outlet is just a property of our Controller through which we can talk to an element in our View.
Important!
Connection Outlet
Object Calculator View Co...
Name
Type UILabel
Storage Strong
Cancel
Connect
The destination of this connection is our Controller since that's where we ctrl-dragged to.
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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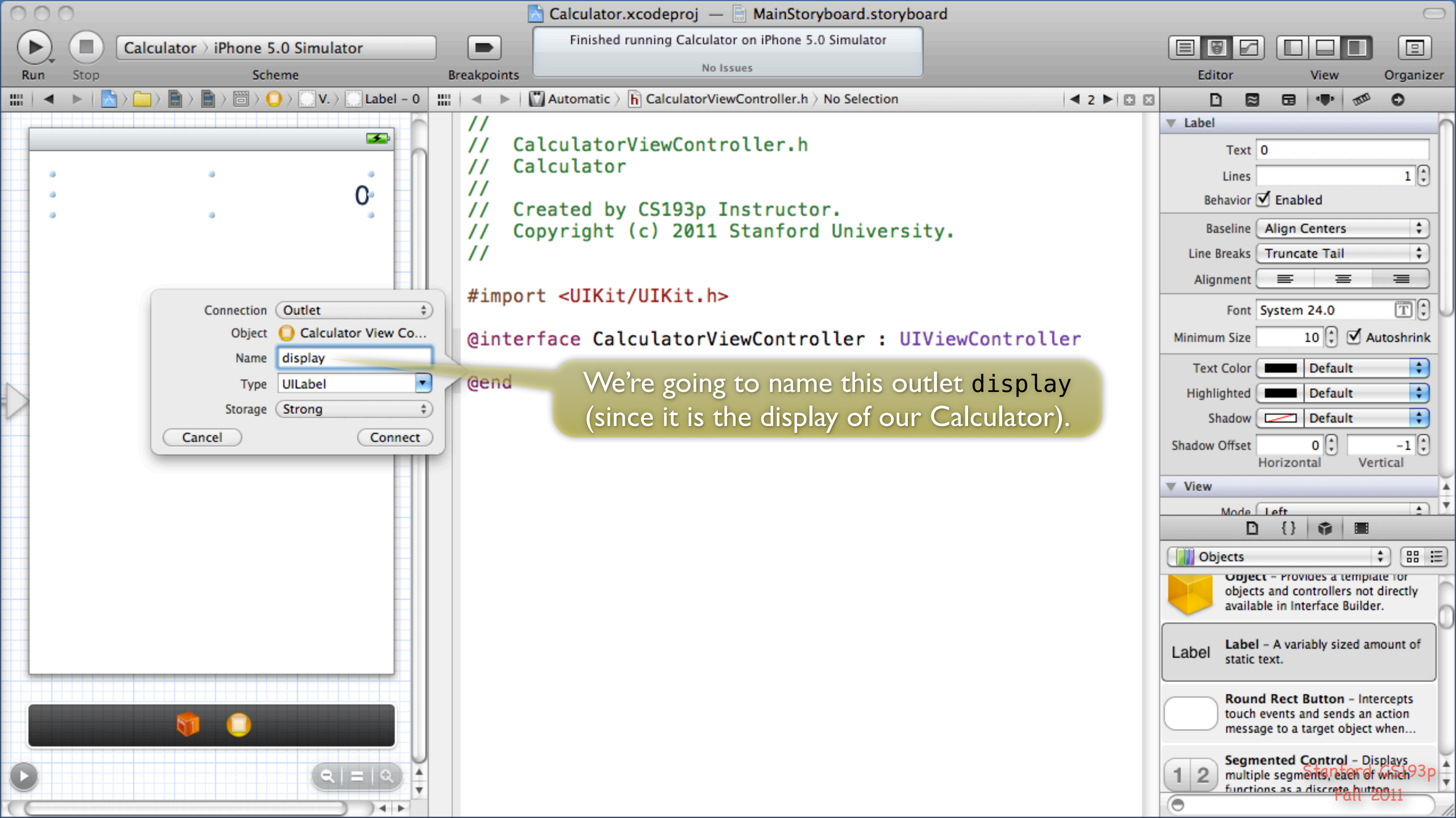
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic 〉 CalculatorViewController.h 〉 No Selection
0
Connection Outlet
Object Calculator View Co...
Name display
Type UILabel
Storage Strong
Cancel
Connect
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
We're going to name this outlet display (since it is the display of our Calculator).
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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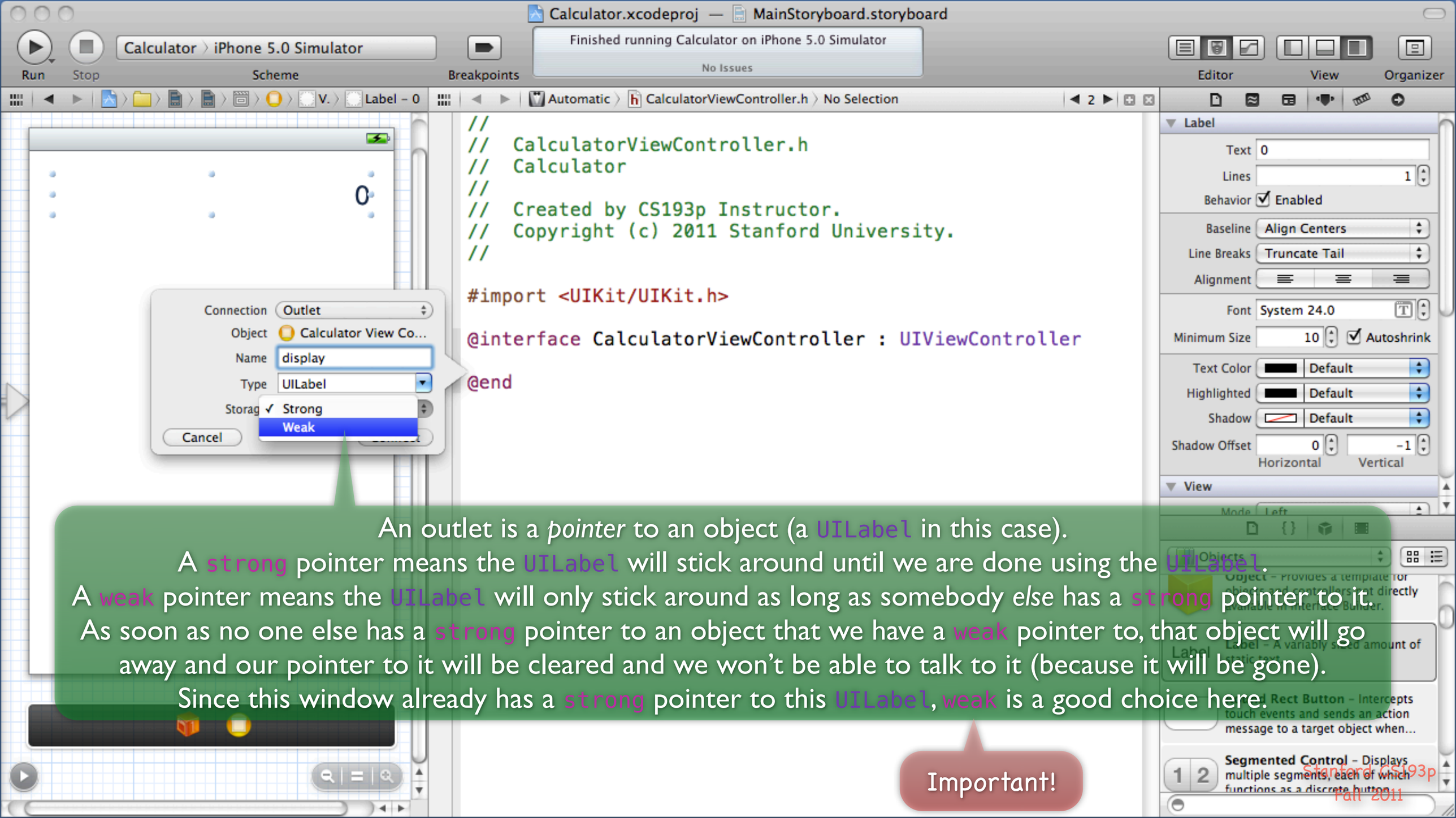
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic › CalculatorViewController.h › No Selection
0
Connection Outlet
Object Calculator View Co...
Name display
Type UILabel
Storag ✓ Strong
Weak
Cancel
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
An outlet is a pointer to an object (a UILabel in this case).
A strong pointer means the UILabel will stick around until we are done using the UILabel.
A weak pointer means the UILabel will only stick around as long as somebody else has a strong pointer to it.
As soon as no one else has a strong pointer to an object that we have a weak pointer to, that object will go away and our pointer to it will be cleared and we won't be able to talk to it (because it will be gone).
Since this window already has a strong pointer to this UILabel, weak is a good choice here.
Important!
Segmented Control – Displays multiple segments, each of which functions as a discrete button
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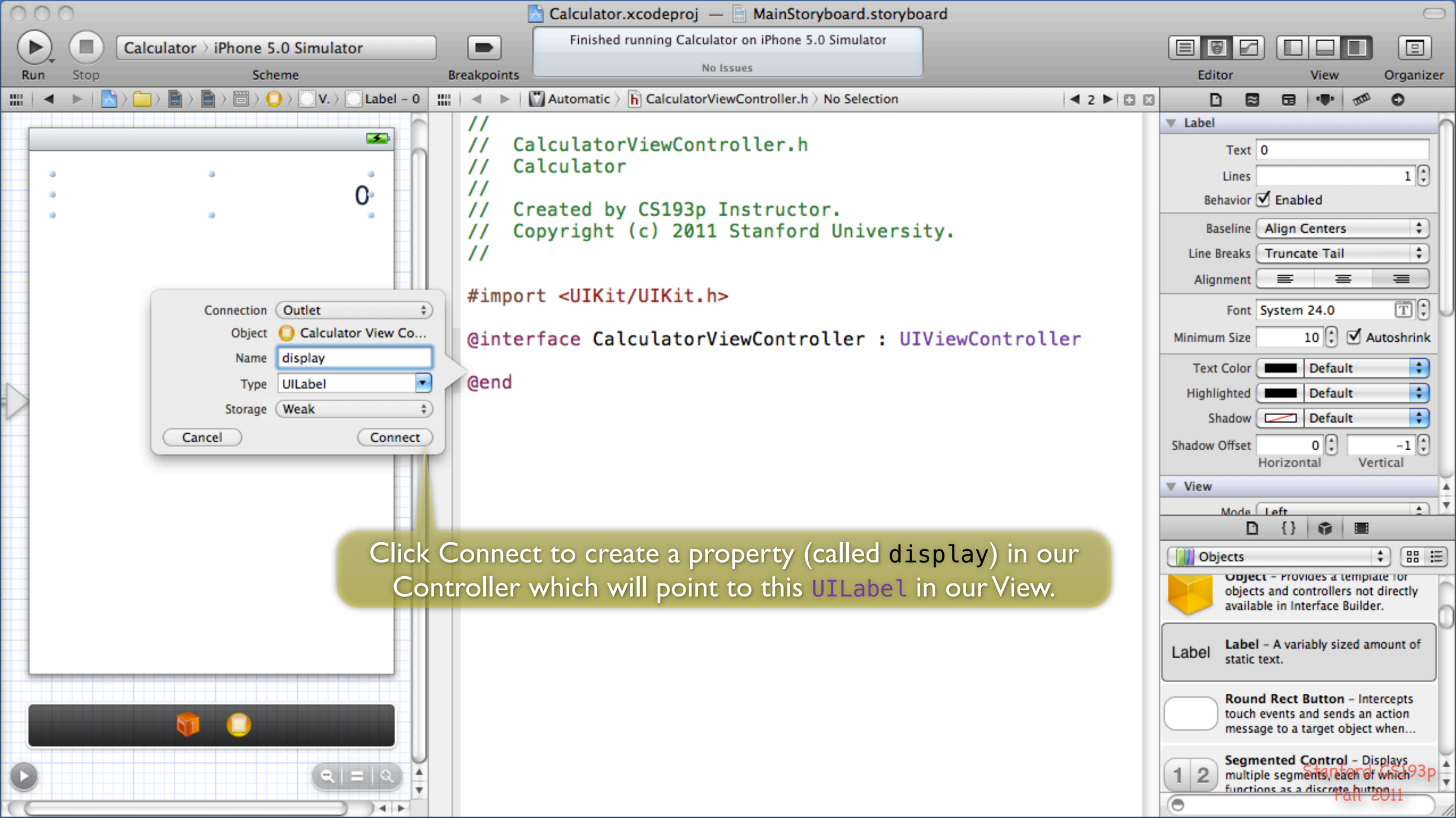
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic › CalculatorViewController.h › No Selection
0
Connection Outlet
Object Calculator View Co...
Name display
Type UILabel
Storage Weak
Cancel
Connect
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@end
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button
Click Connect to create a property (called display) in our Controller which will point to this UILabel in our View.
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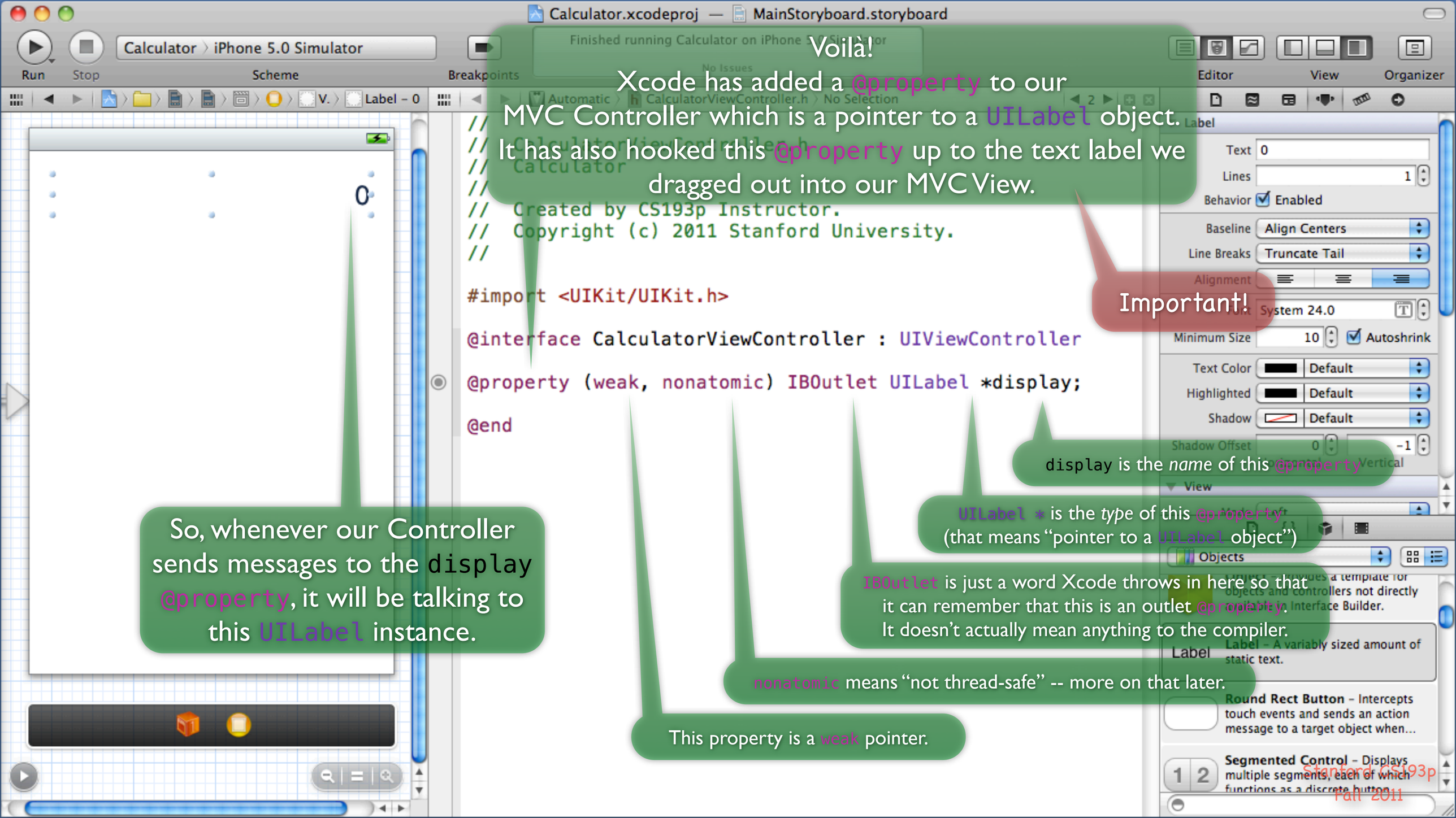
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Breakpoints
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View
Organizer
Label – 0
Automatic
CalculatorViewController.h
No Selection
0
//
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@property (weak, nonatomic) IBOutlet UILabel *display;
@end
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset
Vertical
View
Objects
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
Voilà!
Xcode has added a @property to our MVC Controller which is a pointer to a UILabel object.
It has also hooked this @property up to the text label we dragged out into our MVC View.
Important!
So, whenever our Controller sends messages to the display @property, it will be talking to this UILabel instance.
display is the name of this @property
UILabel * is the type of this @property (that means "pointer to a UILabel object")
IBOutlet is just a word Xcode throws in here so that it can remember that this is an outlet @property. It doesn't actually mean anything to the compiler.
nonatomic means "not thread-safe" -- more on that later.
This property is a weak pointer.
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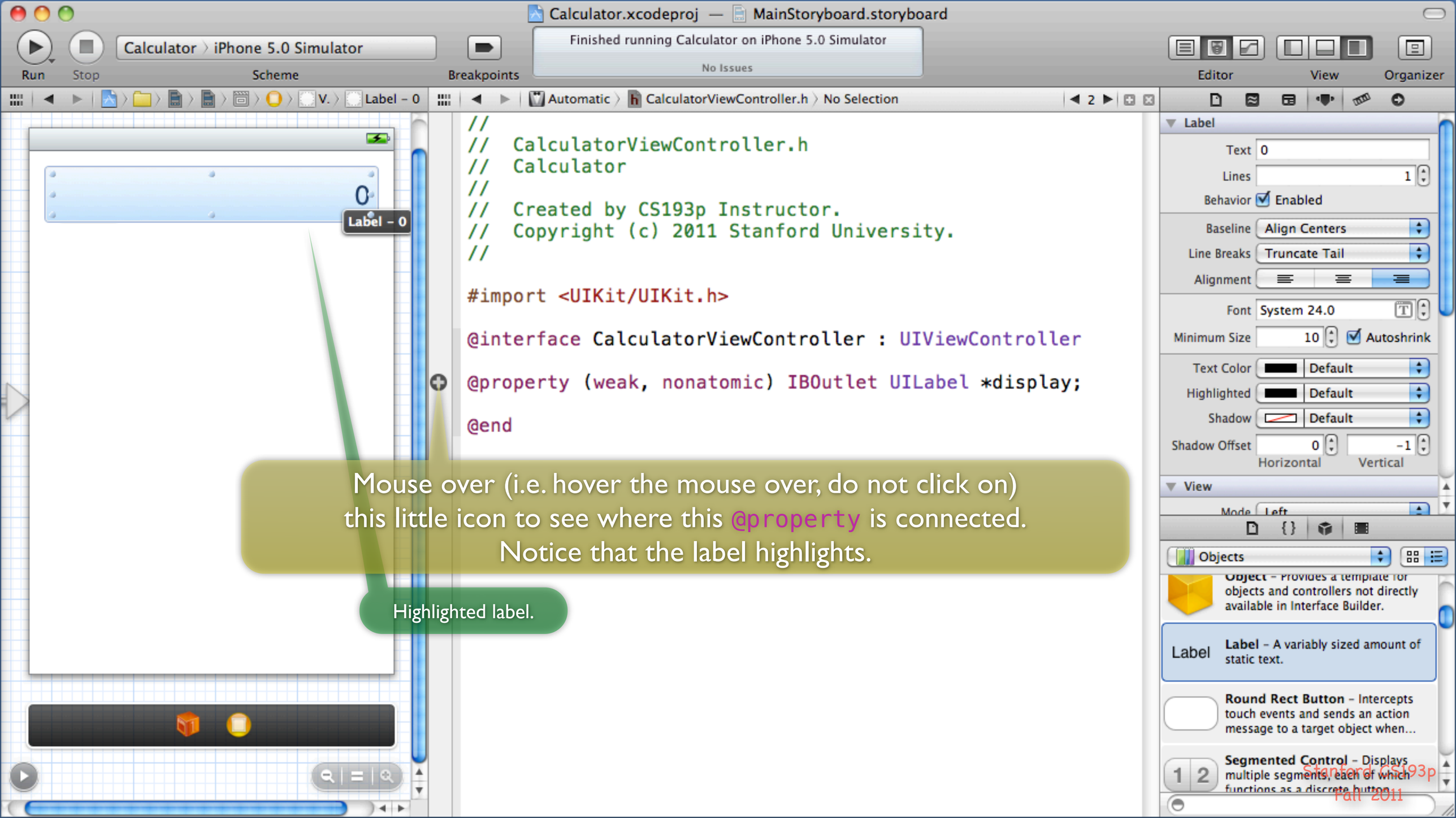
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic 〉 CalculatorViewController.h 〉 No Selection
0
Label – 0
//
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// Calculator
//
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#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
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Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
Mouse over (i.e. hover the mouse over, do not click on) this little icon to see where this @property is connected. Notice that the label highlights.
Highlighted label.
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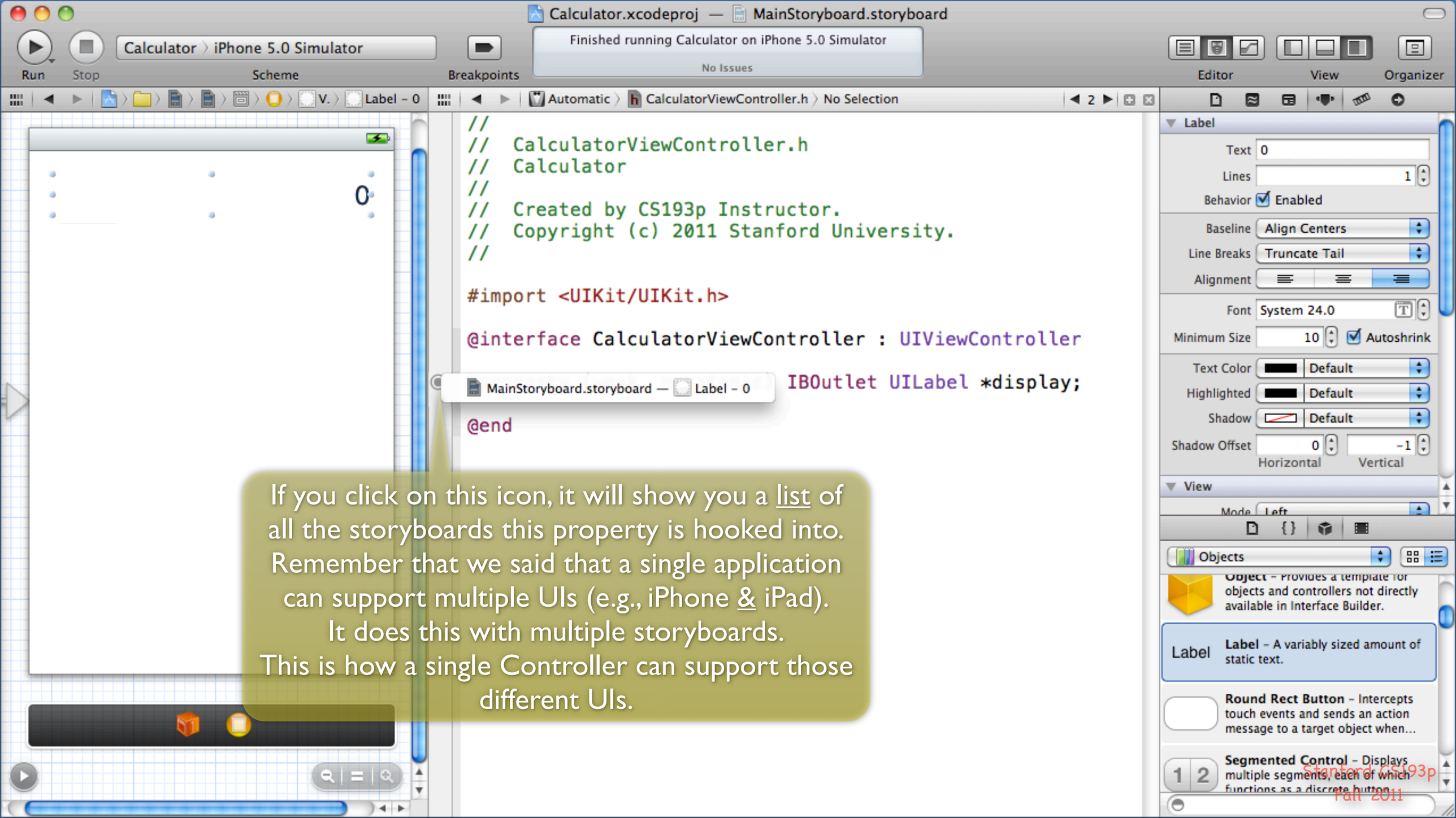
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic 〉 CalculatorViewController.h 〉 No Selection
0
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
MainStoryboard.storyboard — Label – 0
IBOutlet UILabel *display;
@end
If you click on this icon, it will show you a list of all the storyboards this property is hooked into.
Remember that we said that a single application can support multiple UIs (e.g., iPhone & iPad).
It does this with multiple storyboards.
This is how a single Controller can support those different UIs.
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
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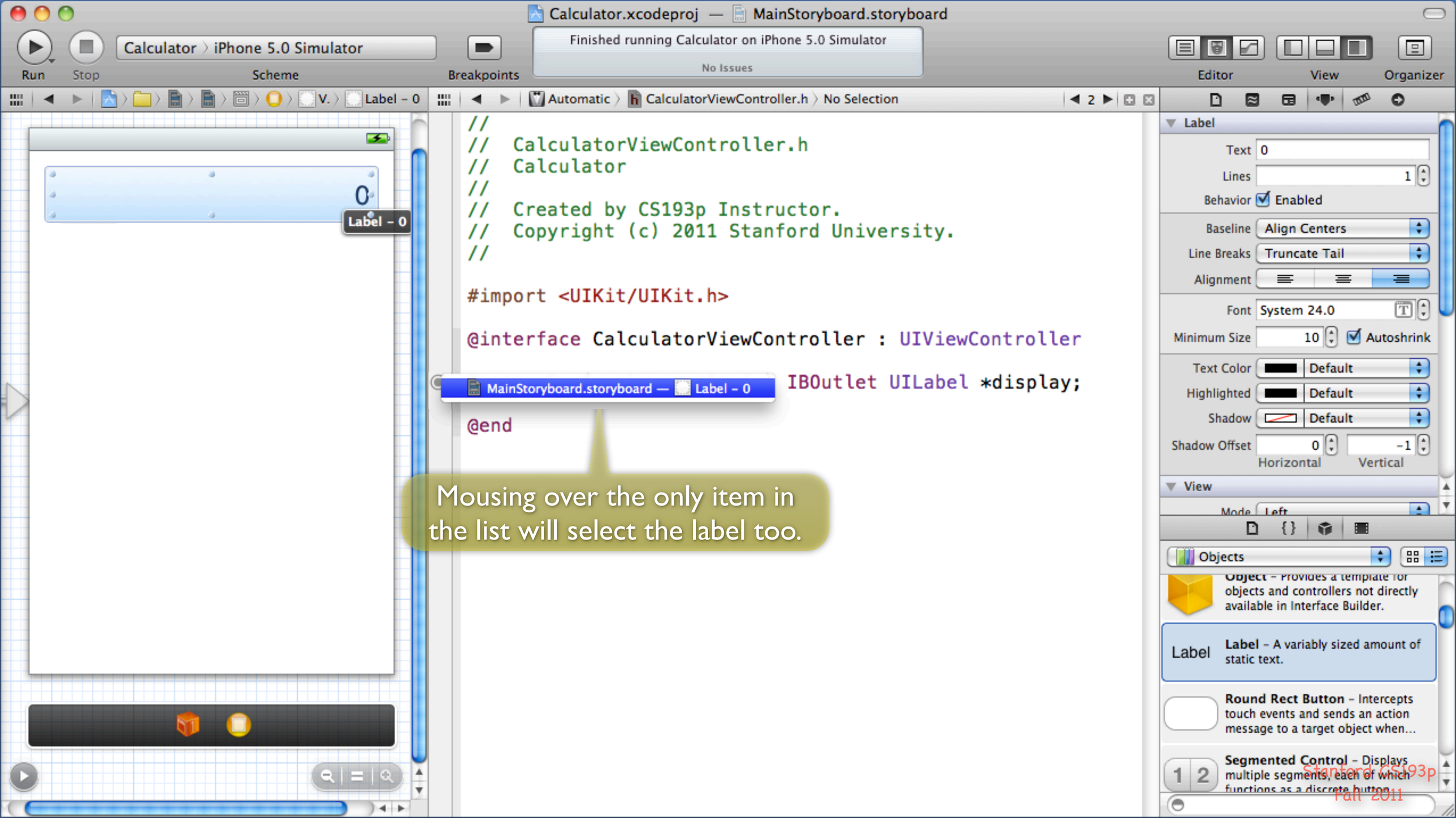
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic 〉 CalculatorViewController.h 〉 No Selection
0
Label – 0
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
MainStoryboard.storyboard — Label – 0
IBOutlet UILabel *display;
@end
Mousing over the only item in the list will select the label too.
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
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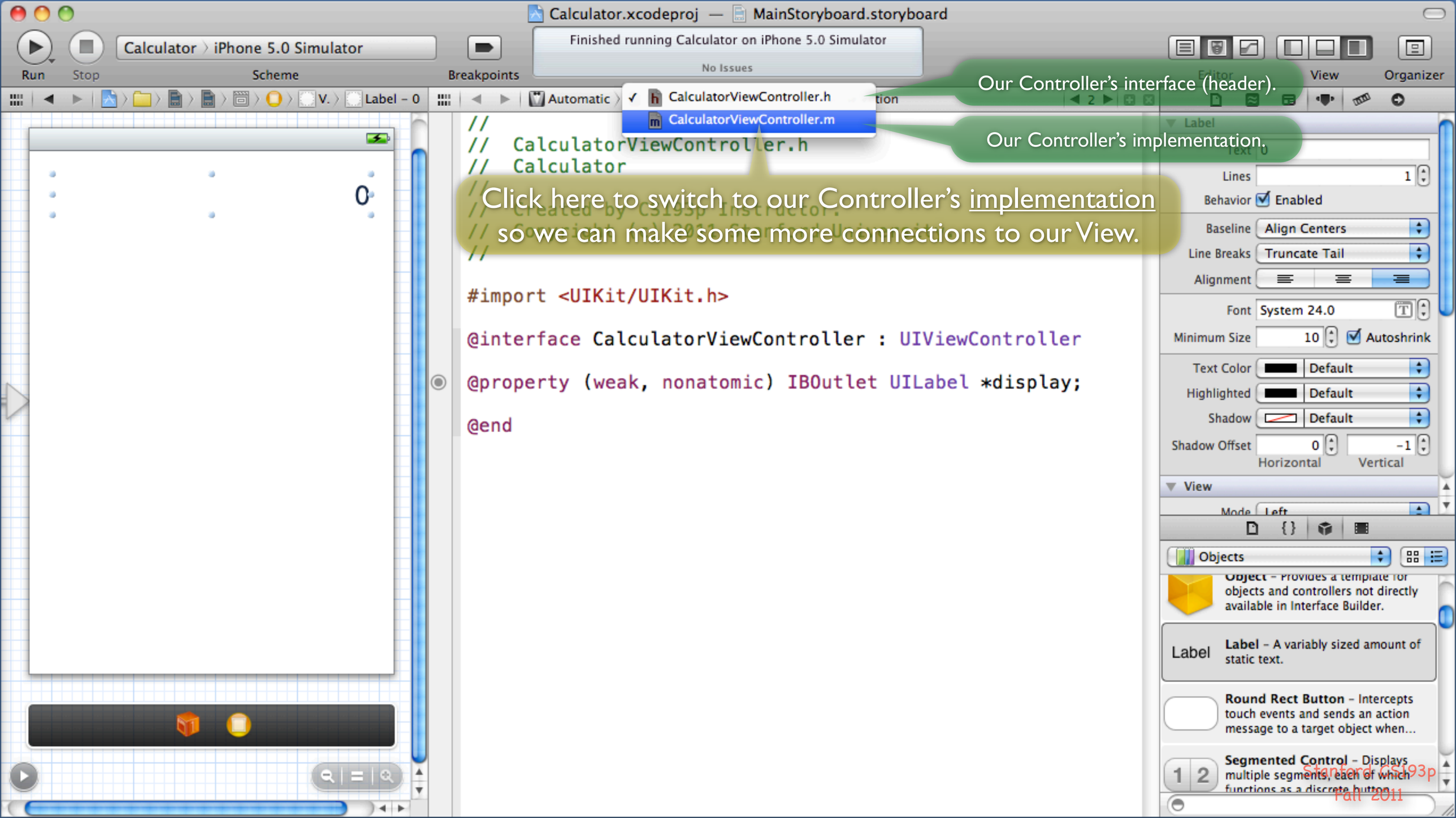
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic
CalculatorViewController.h
CalculatorViewController.m
Our Controller's interface (header).
Our Controller's implementation.
Click here to switch to our Controller's implementation so we can make some more connections to our View.
0
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController : UIViewController
@property (weak, nonatomic) IBOutlet UILabel *display;
@end
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10 Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
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Calculator.xcodeproj — MainStoryboard.storyboard

Run Stop Calculator › iPhone 5.0 Simulator Scheme Breakpoints Finished running Calculator on iPhone 5.0 Simulator Editor View Organizer

Welcome to the implementation (.m file) of your MVC Controller!

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"

@implementation CalculatorViewController

@synthesize display;

- (void)didReceiveMemoryWarning
{
    [super didReceiveMemoryWarning];
    // Release any cached data, images, etc that aren't in
        use.
}

#pragma mark - View lifecycle

- (void)viewDidLoad
{
    [super viewDidLoad];
    // Do any additional setup after loading the view,
        typically from a nib.
}

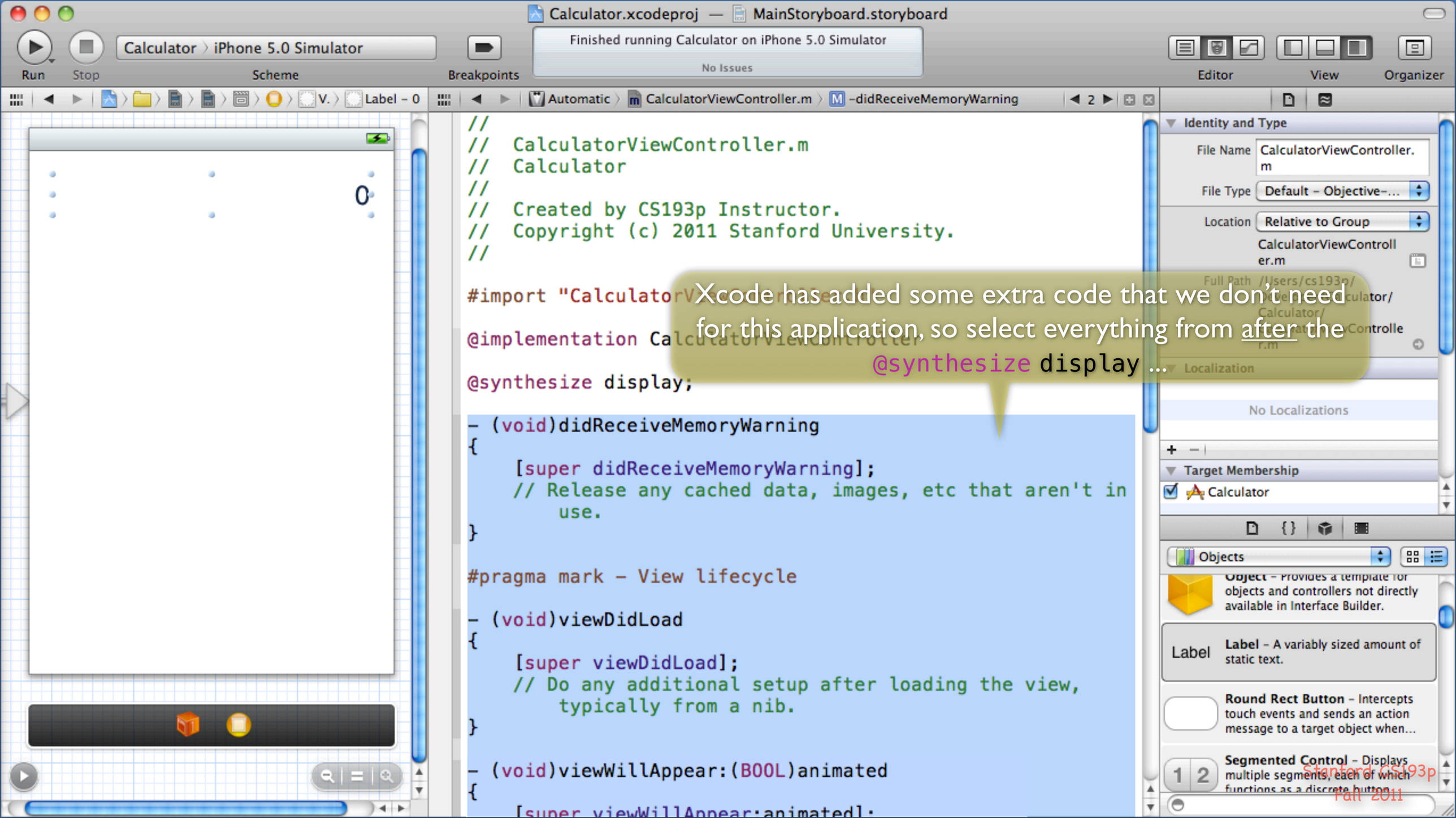
- (void)viewWillAppear:(BOOL)animated
{
    [super viewWillAppear:animated];
```

Notice that the `@implementation` here does not specify the superclass. Only the `@interface` in the .h (header) file does that.

This `@synthesize` is very important. We'll cover it in a moment.

Identity and Type
File Name: CalculatorViewController.m
File Type: Default – Objective-...
Full Path: /Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator

Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic
CalculatorViewController.m
-didReceiveMemoryWarning
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (void)didReceiveMemoryWarning
{
[super didReceiveMemoryWarning];
// Release any cached data, images, etc that aren't in use.
}
#pragma mark - View lifecycle
- (void)viewDidLoad
{
[super viewDidLoad];
// Do any additional setup after loading the view, typically from a nib.
}
- (void)viewWillAppear:(BOOL)animated
{
Xcode has added some extra code that we don't need for this application, so select everything from after the @synthesize display ...
Identity and Type
File Name
CalculatorViewController.m
File Type
Default – Objective-...
Location
Relative to Group
CalculatorViewControll er.m
Full Path
Localization
No Localizations
Target Membership
Calculator
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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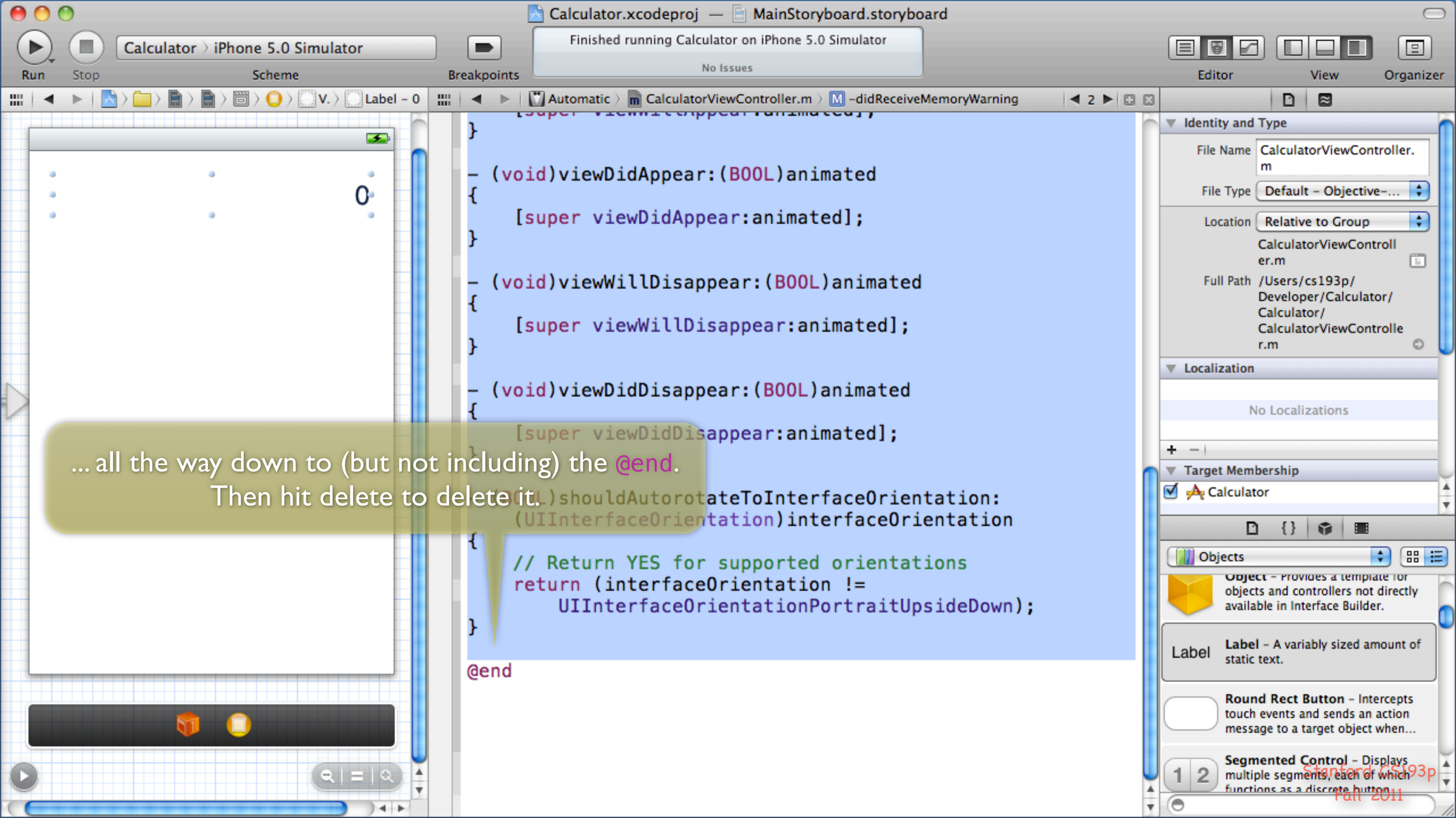
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic 〉 CalculatorViewController.m 〉 -didReceiveMemoryWarning
0
}
- (void)viewDidAppear:(BOOL)animated
{
[super viewDidAppear:animated];
}
- (void)viewWillDisappear:(BOOL)animated
{
[super viewWillDisappear:animated];
}
- (void)viewDidDisappear:(BOOL)animated
{
[super viewDidDisappear:animated];
}
(UIInterfaceOrientation)interfaceOrientation
{
// Return YES for supported orientations
return (interfaceOrientation !=
UIInterfaceOrientationPortraitUpsideDown);
}
@end
... all the way down to (but not including) the @end.
Then hit delete to delete it.
Identity and Type
File Name
CalculatorViewController.m
File Type
Default – Objective-...
Location
Relative to Group
CalculatorViewController.m
Full Path
/Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
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Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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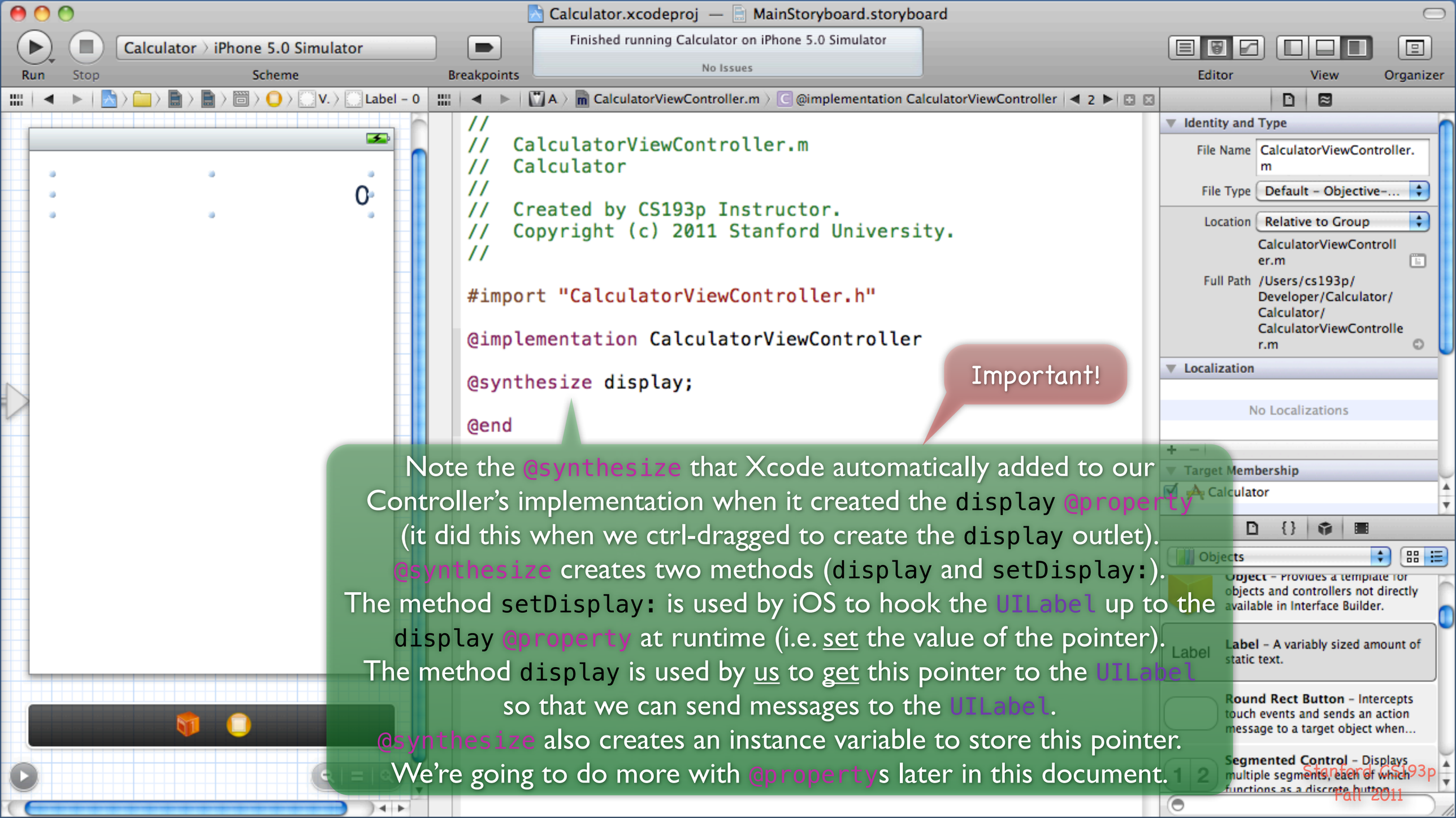
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
CalculatorViewController.m
@implementation CalculatorViewController
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
@end
Important!
Identity and Type
File Name
CalculatorViewController.m
File Type
Default – Objective-...
Location
Relative to Group
Full Path
/Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator
Objects
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button
Note the @synthesize that Xcode automatically added to our Controller's implementation when it created the display @property (it did this when we ctrl-dragged to create the display outlet).
@synthesize creates two methods (display and setDisplay:).
The method setDisplay: is used by iOS to hook the UILabel up to the display @property at runtime (i.e. set the value of the pointer).
The method display is used by us to get this pointer to the UILabel so that we can send messages to the UILabel.
@synthesize also creates an instance variable to store this pointer.
We're going to do more with @propertys later in this document.
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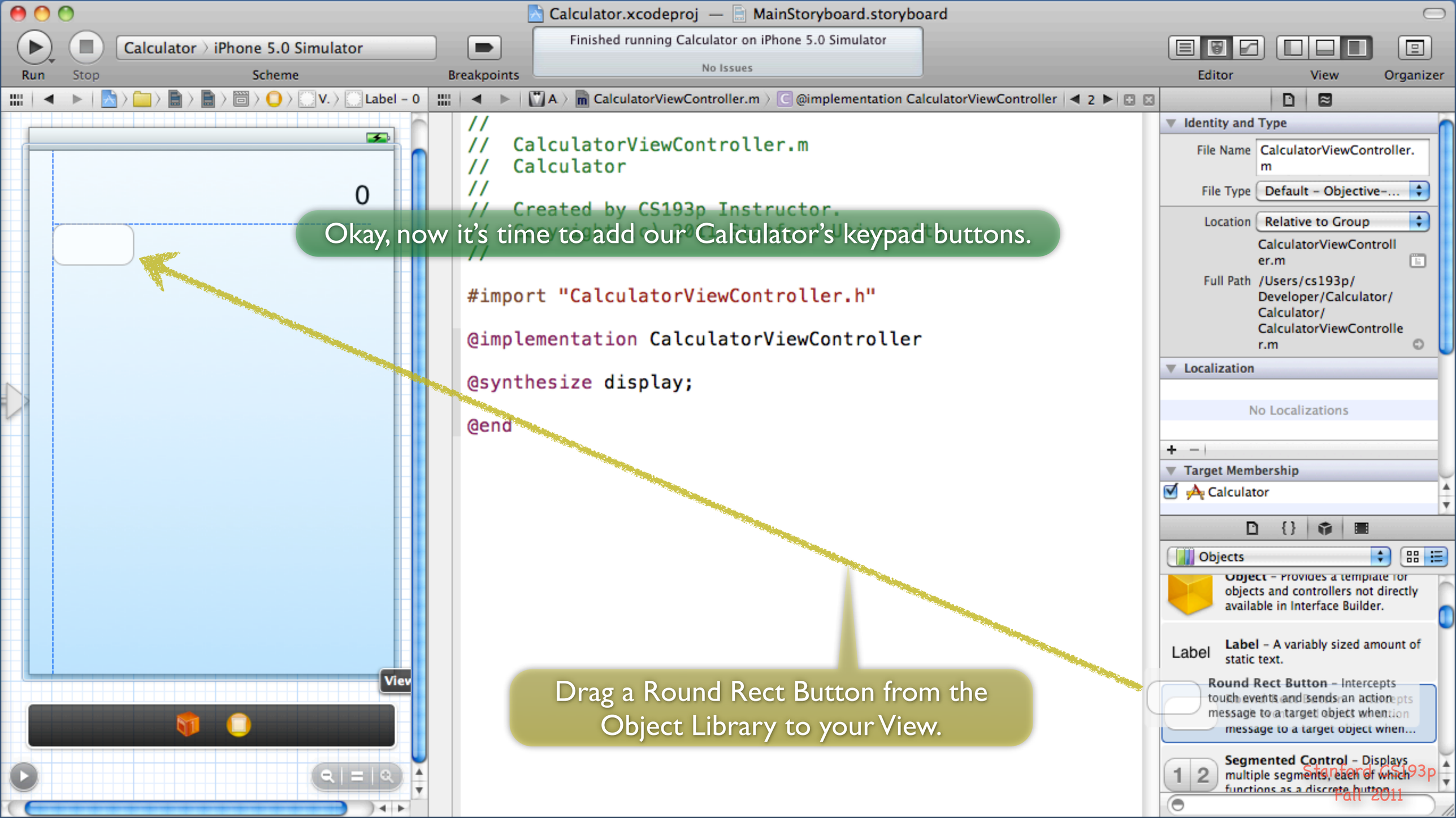
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
CalculatorViewController.m
@implementation CalculatorViewController
0
Okay, now it's time to add our Calculator's keypad buttons.
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
@end
Drag a Round Rect Button from the Object Library to your View.
Identity and Type
File Name
CalculatorViewController.m
File Type
Default – Objective-...
Location
Relative to Group
CalculatorViewController.m
Full Path
/Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
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Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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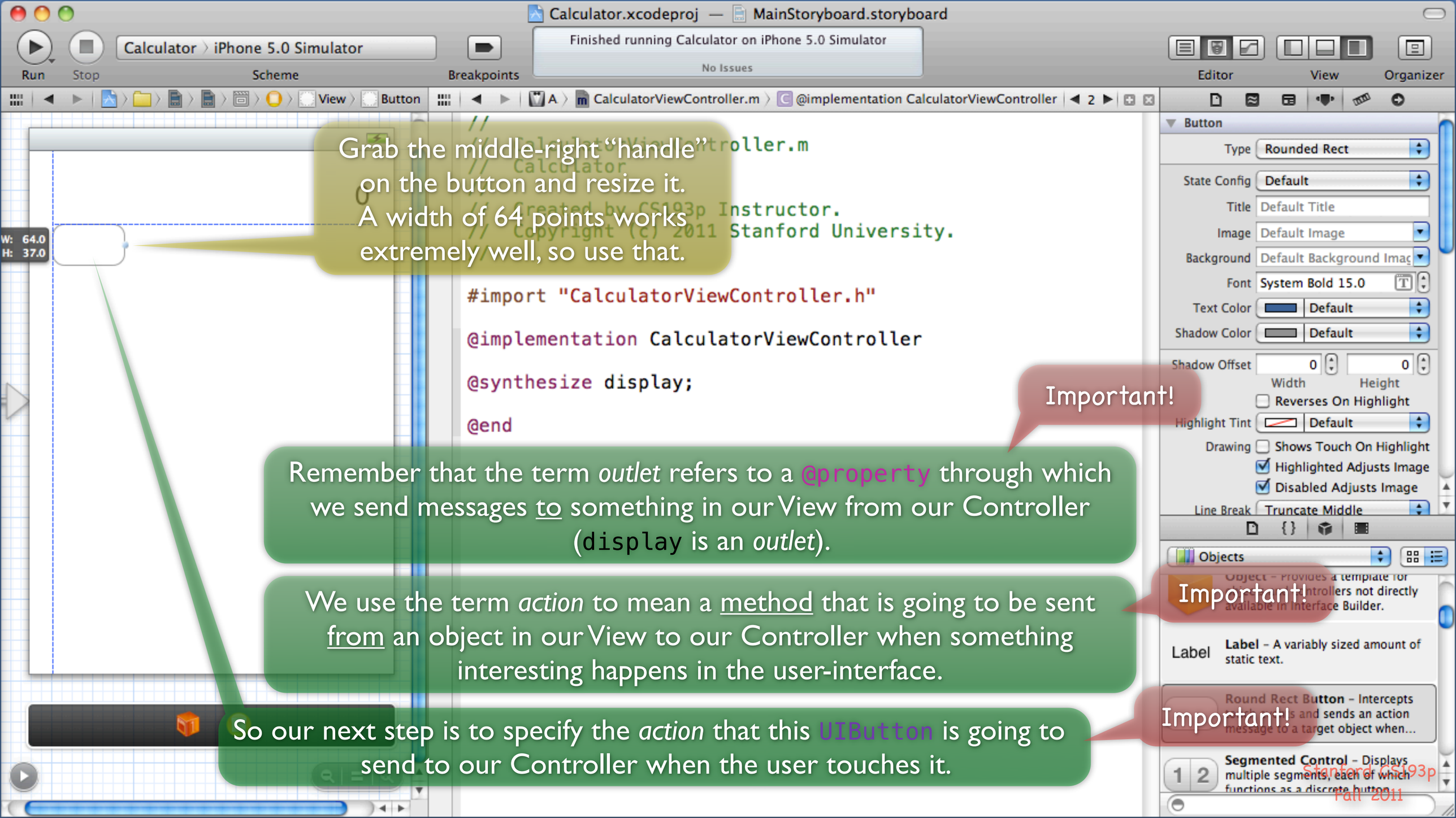
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
A › CalculatorViewController.m › @implementation CalculatorViewController
2
W: 64.0
H: 37.0
Grab the middle-right "handle" on the button and resize it. A width of 64 points works extremely well, so use that.
//
// CalculatorViewController.m
// Calculator
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Important!
Remember that the term outlet refers to a @property through which we send messages to something in our View from our Controller (display is an outlet).
Objects
Important!
We use the term action to mean a method that is going to be sent from an object in our View to our Controller when something interesting happens in the user-interface.
Label – A variably sized amount of static text.
Important!
So our next step is to specify the action that this UIButton is going to send to our Controller when the user touches it.
Segmented Control – Displays multiple segments, each of which
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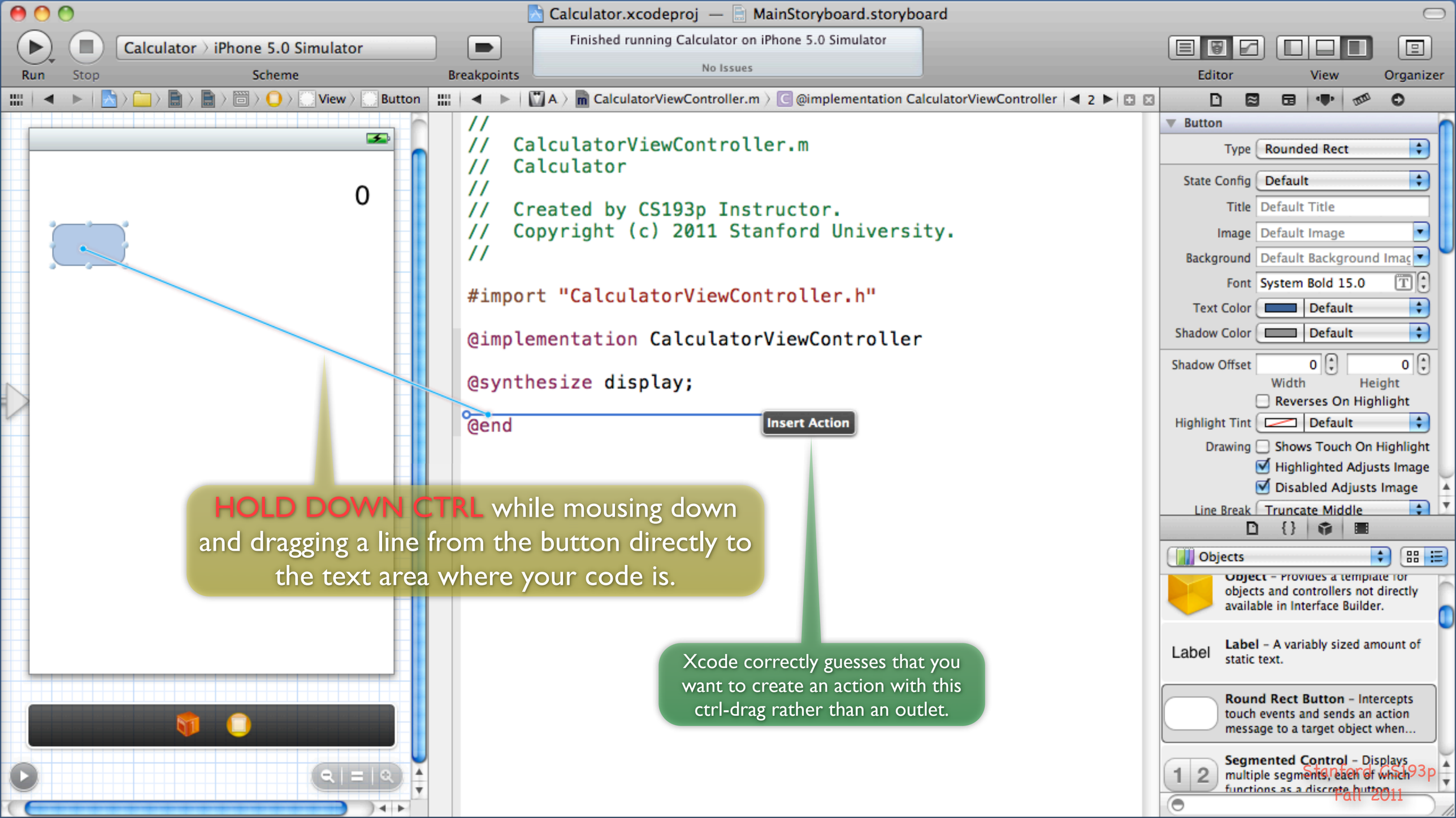
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
A › CalculatorViewController.m › @implementation CalculatorViewController
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
@end
Insert Action
HOLD DOWN CTRL while mousing down and dragging a line from the button directly to the text area where your code is.
Xcode correctly guesses that you want to create an action with this ctrl-drag rather than an outlet.
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
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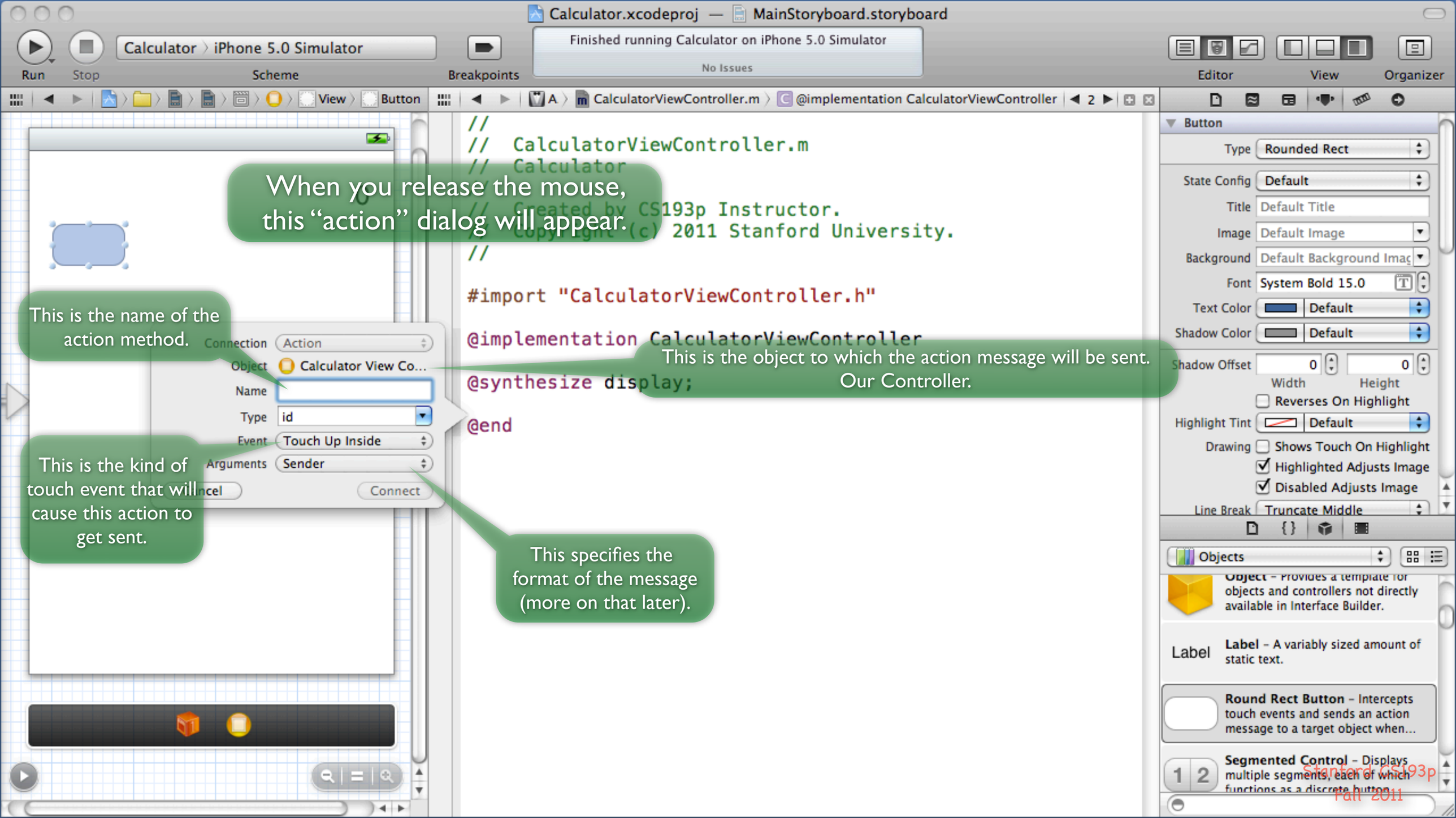
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View 〉 Button
A 〉 CalculatorViewController.m 〉 @implementation CalculatorViewController 2
When you release the mouse, this "action" dialog will appear.
This is the name of the action method.
Connection Action
Object Calculator View Co...
Name
Type id
Event Touch Up Inside
Arguments Sender
Cancel
Connect
This is the kind of touch event that will cause this action to get sent.
This is the object to which the action message will be sent. Our Controller.
This specifies the format of the message (more on that later).
//
// CalculatorViewController.m
// Calculator
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
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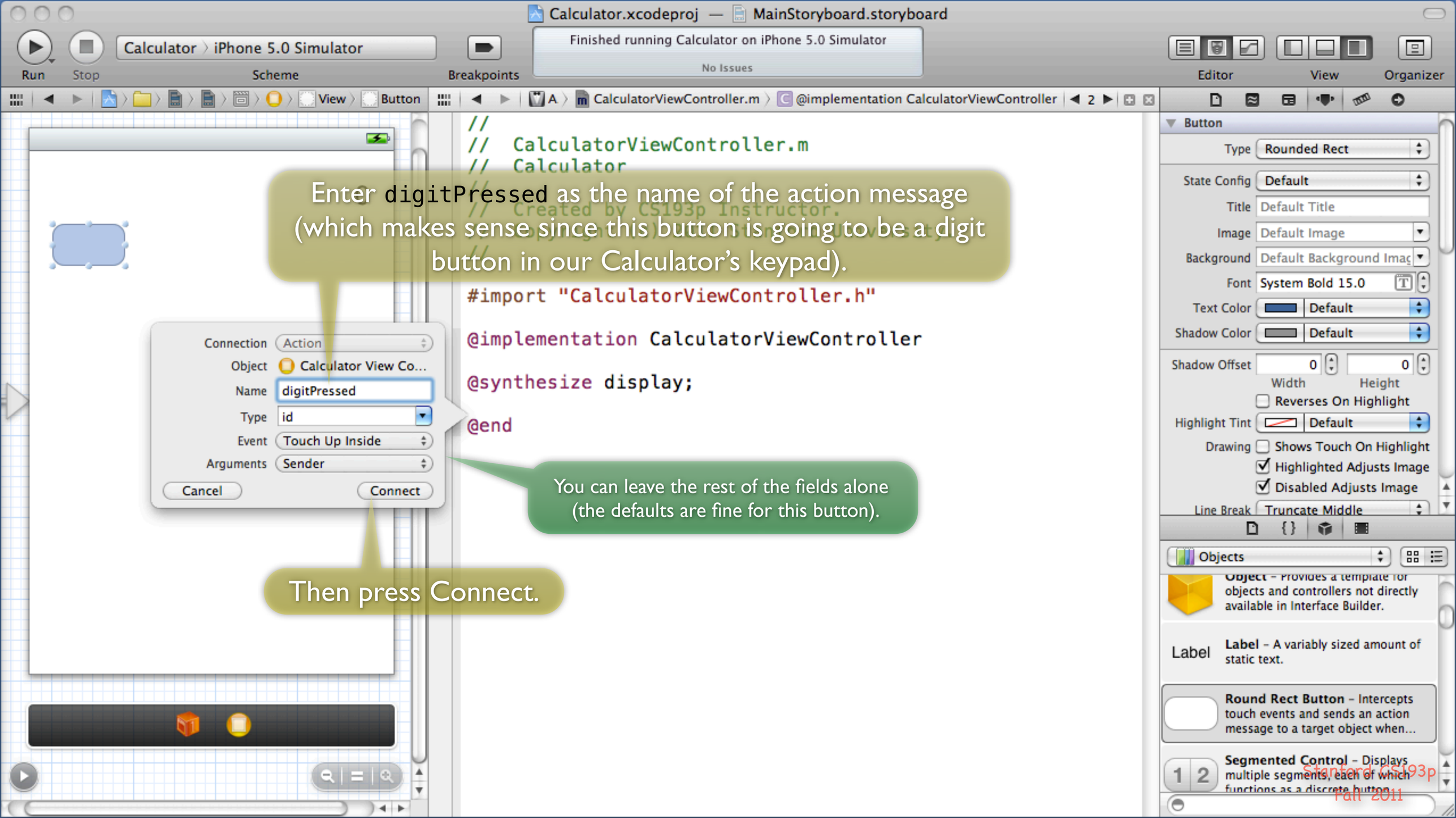
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
A › CalculatorViewController.m › @implementation CalculatorViewController
2
//
// CalculatorViewController.m
// Calculator
// Created by CS193p Instructor.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
@end
Connection Action
Object Calculator View Co...
Name digitPressed
Type id
Event Touch Up Inside
Arguments Sender
Cancel
Connect
Enter digitPressed as the name of the action message (which makes sense since this button is going to be a digit button in our Calculator's keypad).
You can leave the rest of the fields alone (the defaults are fine for this button).
Then press Connect.
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
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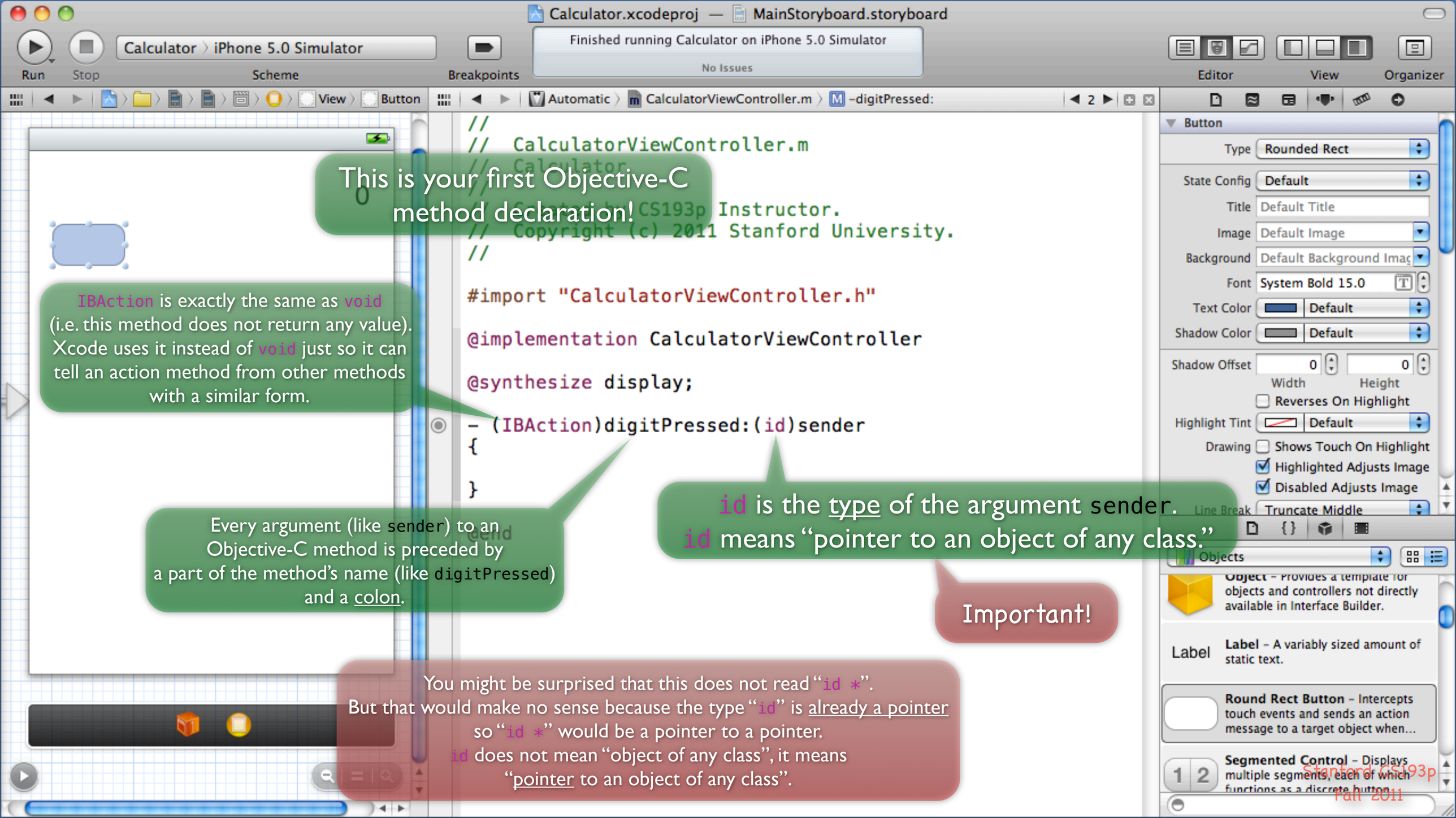
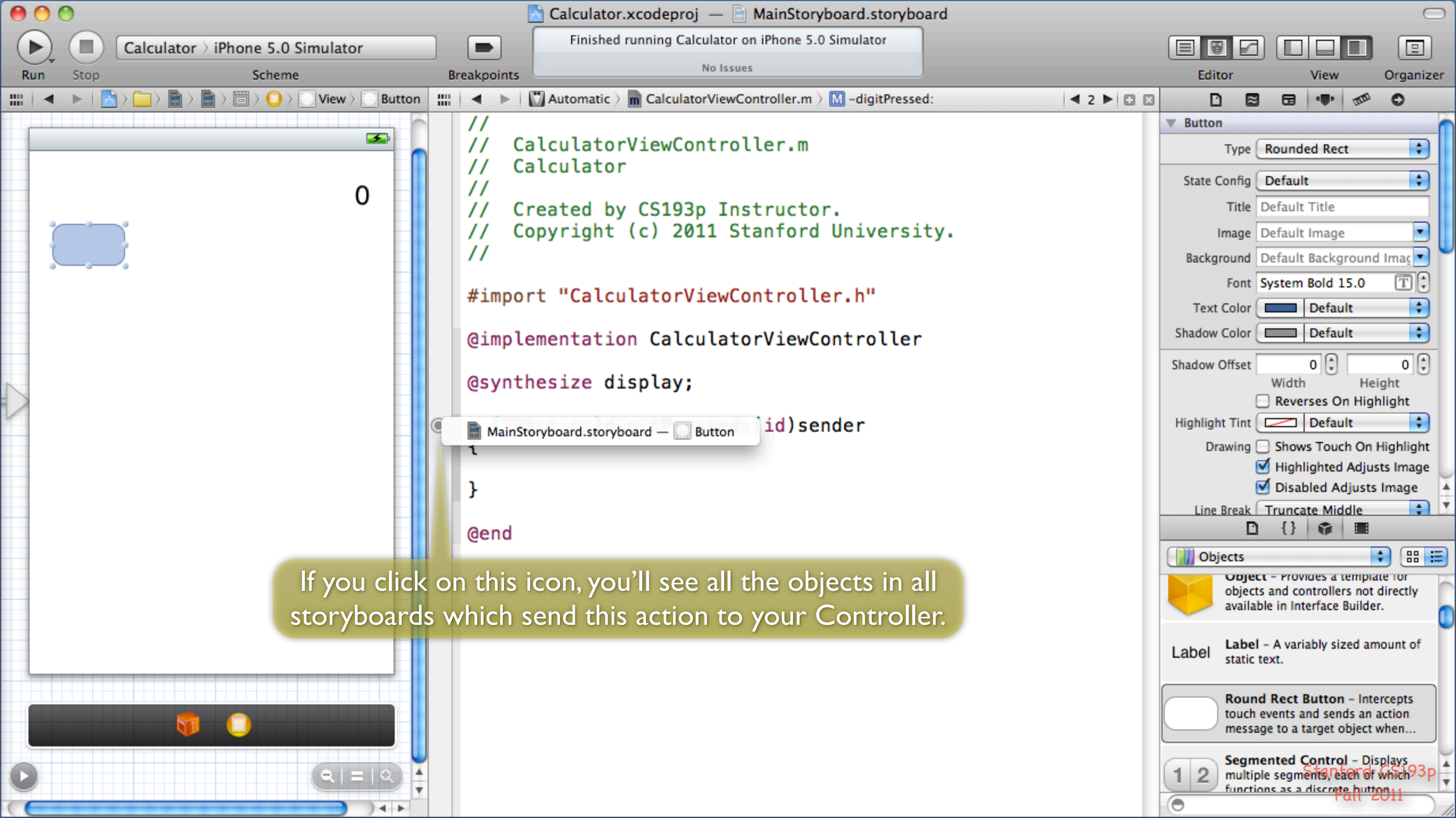

Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View 〉 Button
Automatic 〉 CalculatorViewController.m 〉 -digitPressed:
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(id)sender
{
}
@end
This is your first Objective-C method declaration!
IBAction is exactly the same as void (i.e. this method does not return any value). Xcode uses it instead of void just so it can tell an action method from other methods with a similar form.
Every argument (like sender) to an Objective-C method is preceded by a part of the method's name (like digitPressed) and a colon.
id is the type of the argument sender.
id means "pointer to an object of any class."
Important!
You might be surprised that this does not read "id *".
But that would make no sense because the type "id" is already a pointer so "id *" would be a pointer to a pointer.
id does not mean "object of any class", it means "pointer to an object of any class".
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button
Stanford CS193p
Fall 2011

Okay, now every time this button is touched, `digitPressed:` is going to be sent to our Controller with the `UIButton` itself as the message's `sender` argument.

Important!

Similar to an outlet, you can mouse over this little icon and see which object(s) in your View send(s) this message. Notice how the button highlights.


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View 〉 Button
Automatic 〉 CalculatorViewController.m 〉 -digitPressed:
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
MainStoryboard.storyboard — Button
id)sender
{
}
@end
If you click on this icon, you'll see all the objects in all storyboards which send this action to your Controller.
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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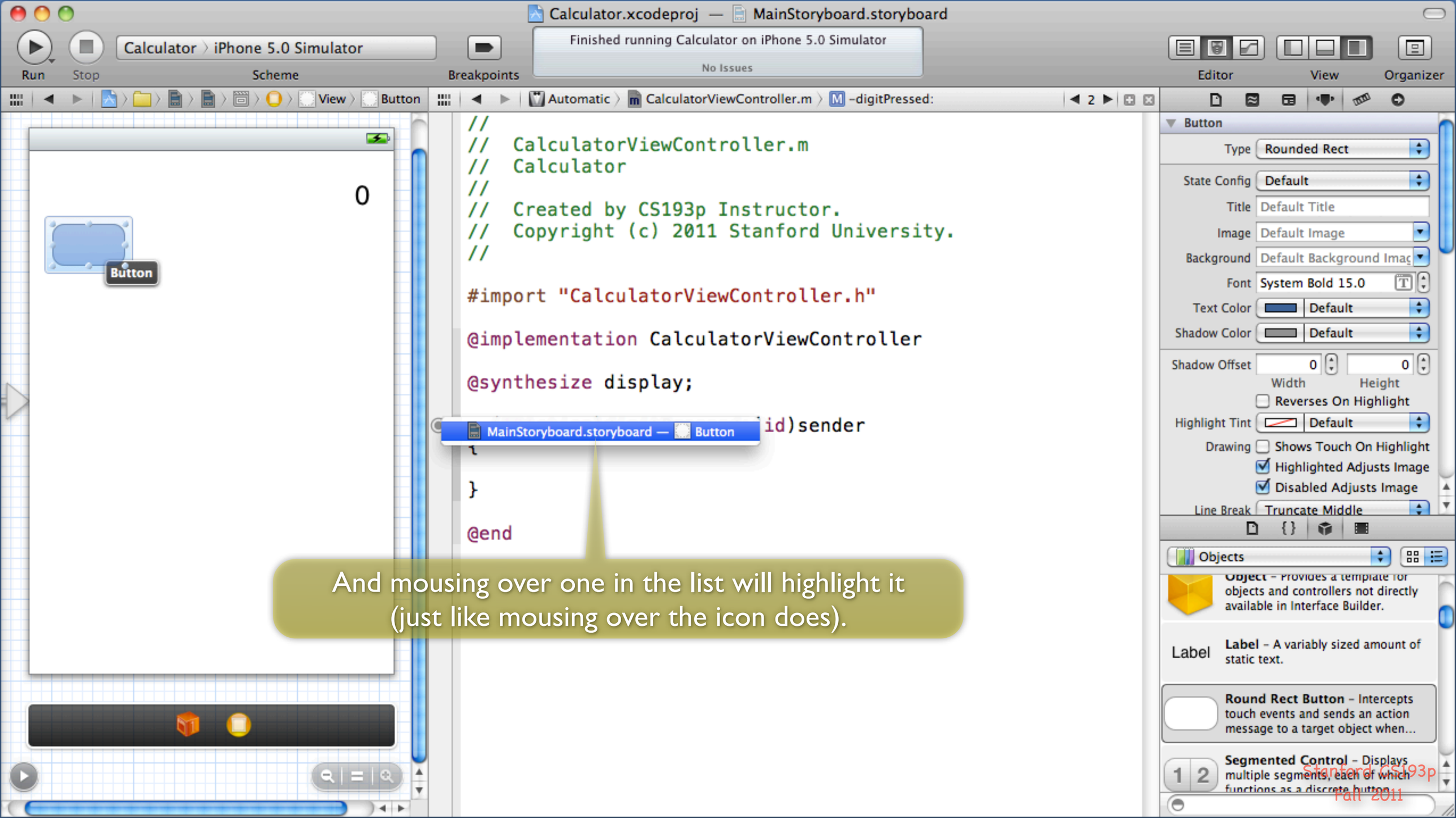
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -digitPressed:
0
Button
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
MainStoryboard.storyboard — Button
id)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
And mousing over one in the list will highlight it
(just like mousing over the icon does).
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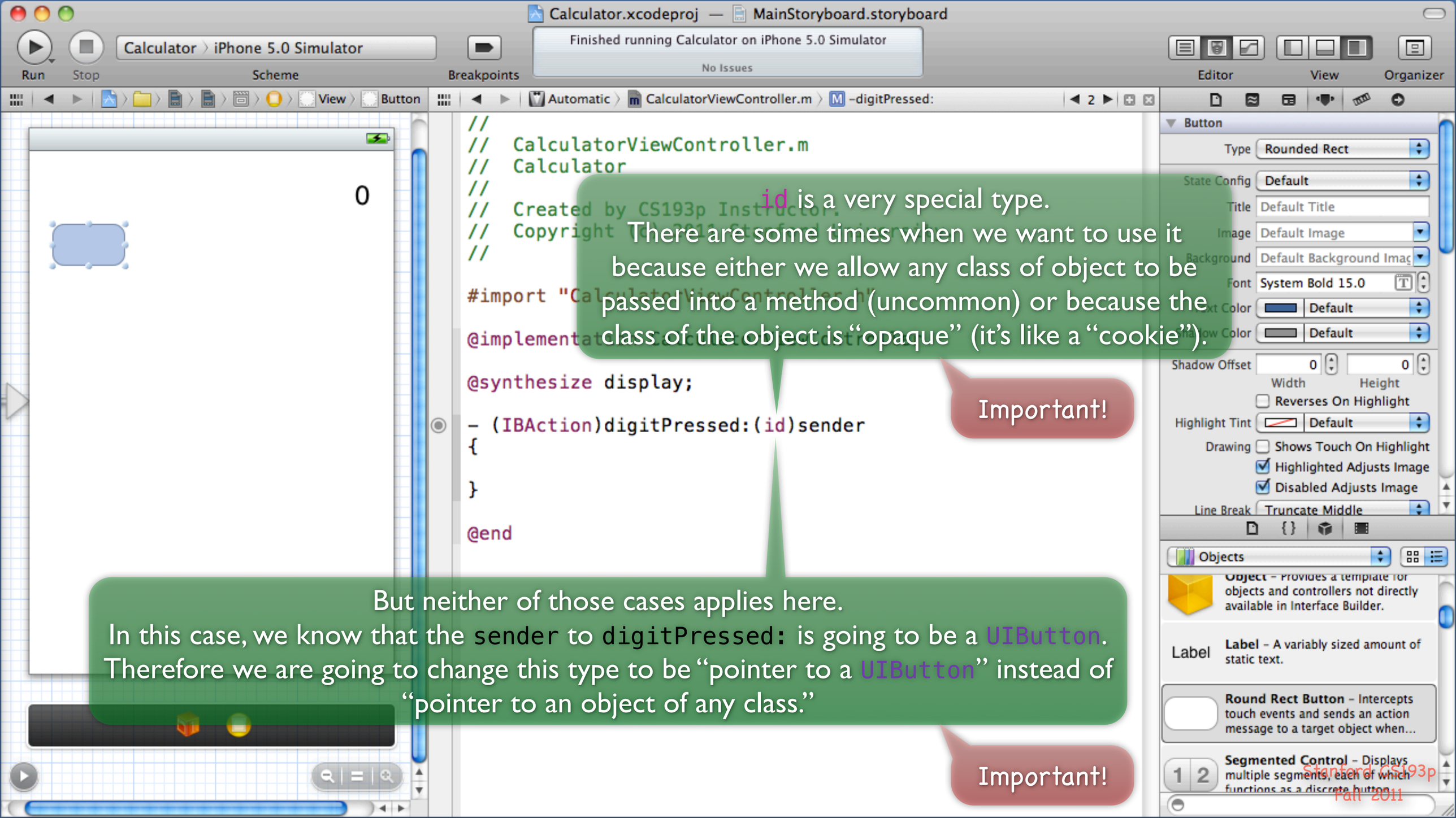
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -digitPressed:
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(id)sender
{
}
@end
id is a very special type.
There are some times when we want to use it because either we allow any class of object to be passed into a method (uncommon) or because the class of the object is "opaque" (it's like a "cookie").
Important!
But neither of those cases applies here.
In this case, we know that the sender to digitPressed: is going to be a UIButton.
Therefore we are going to change this type to be "pointer to a UIButton" instead of "pointer to an object of any class."
Important!
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Default
Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
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Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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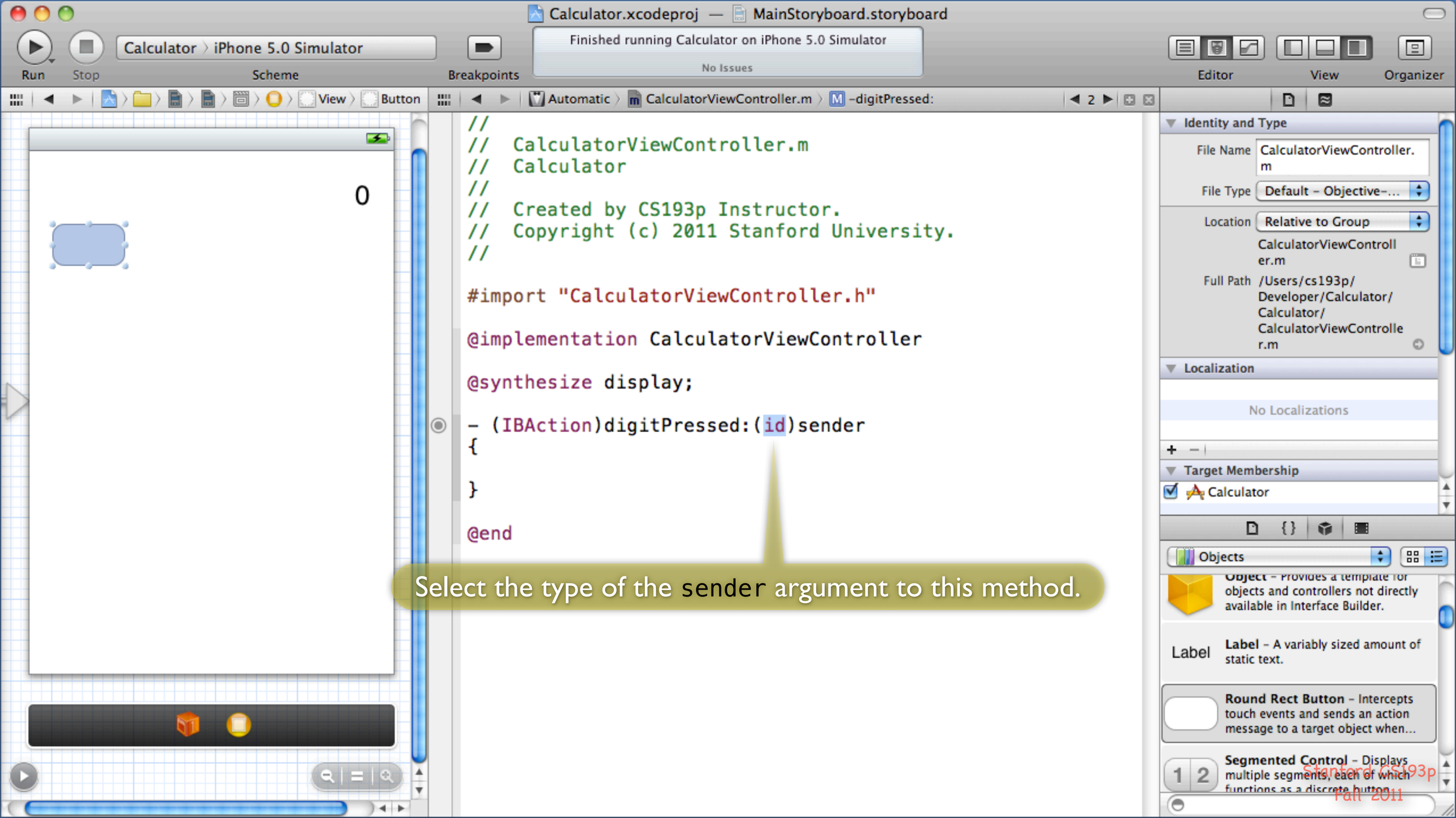
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -digitPressed:
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(id)sender
{
}
@end
Select the type of the sender argument to this method.
Identity and Type
File Name CalculatorViewController.m
File Type Default – Objective-…
Location Relative to Group
CalculatorViewController.m
Full Path /Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when…
Segmented Control – Displays multiple segments, each of which
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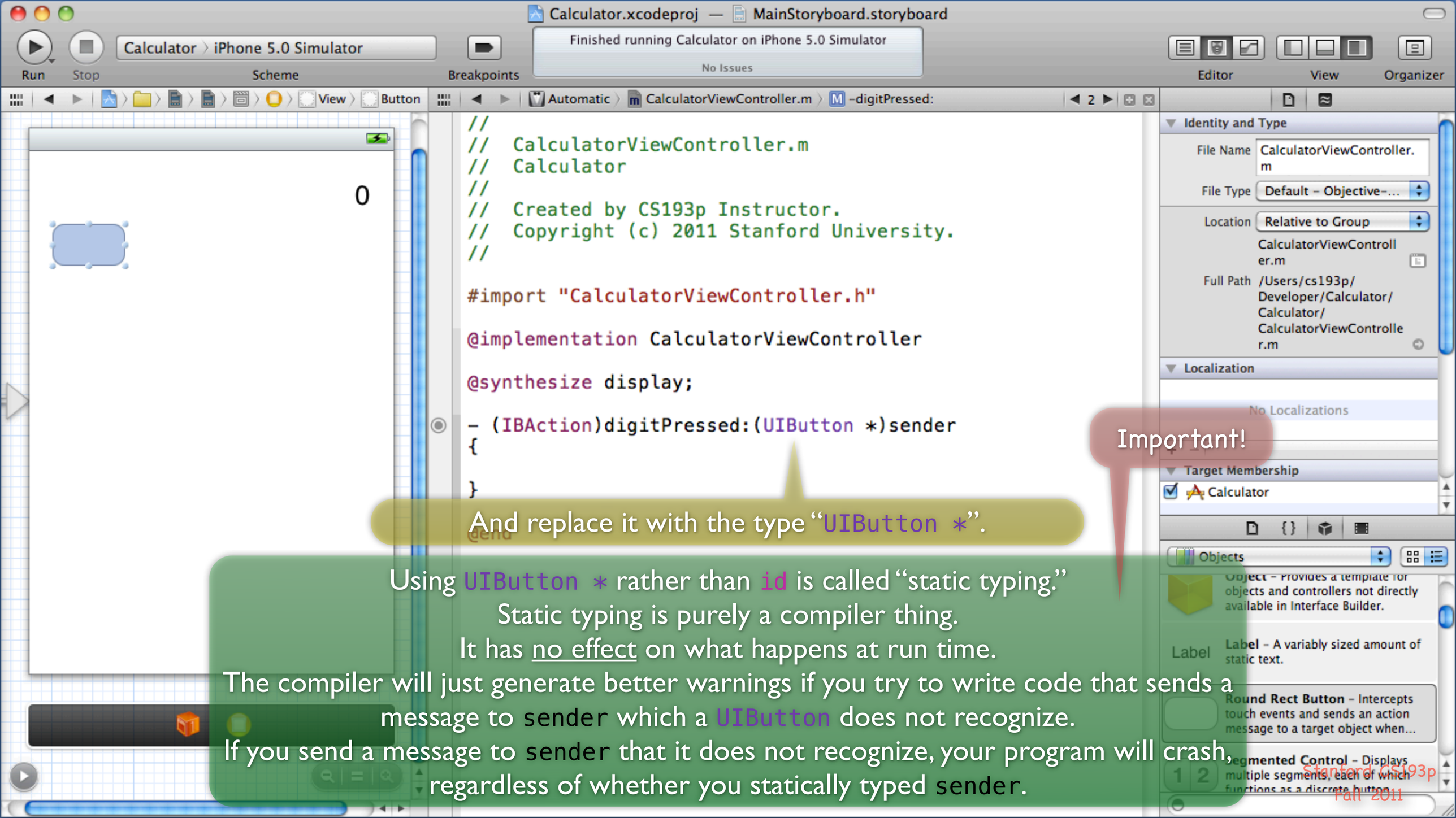


Important!

And replace it with the type "UIButton *".

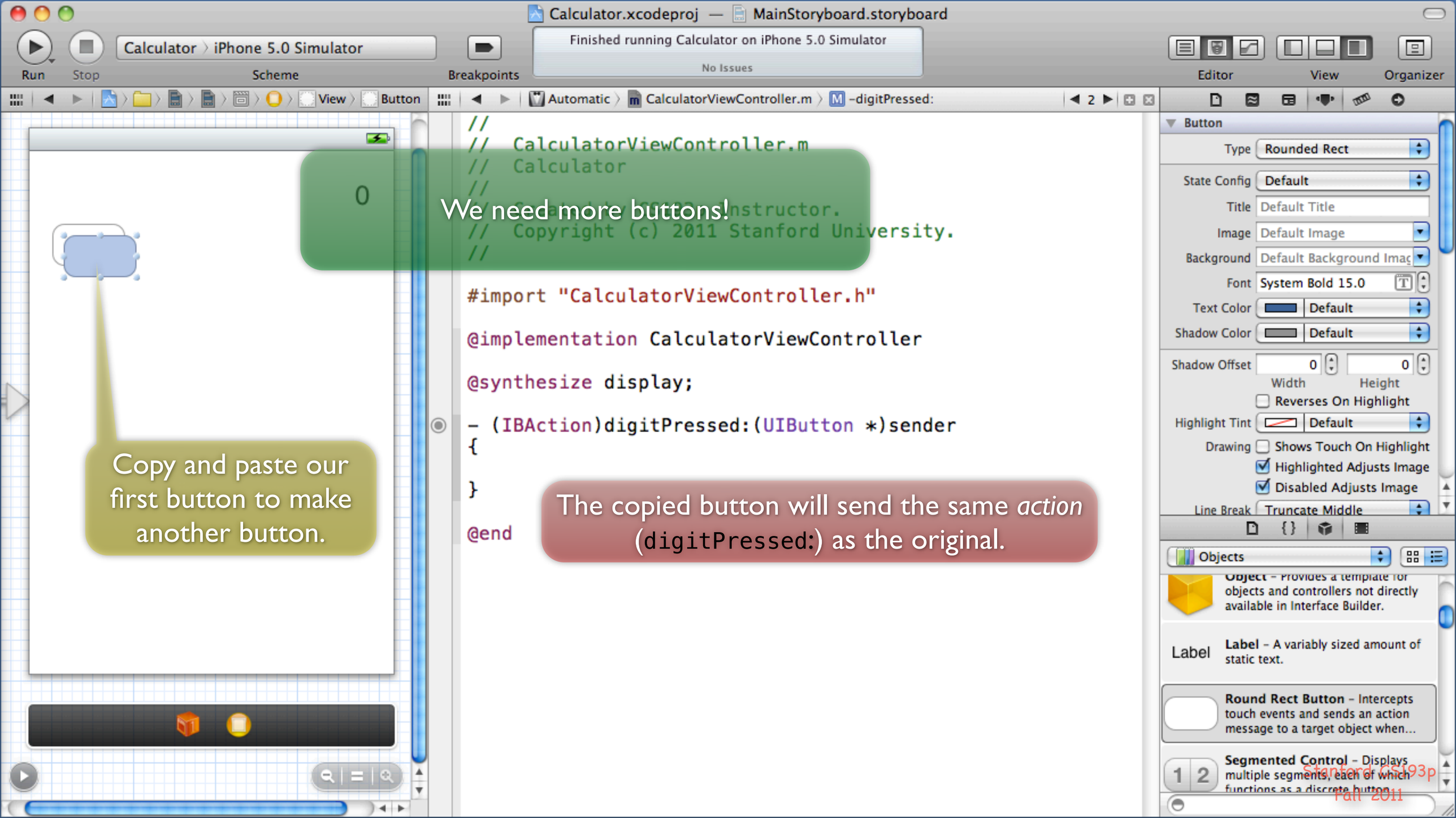
Using UIButton * rather than id is called "static typing."

Static typing is purely a compiler thing.

It has no effect on what happens at run time.

The compiler will just generate better warnings if you try to write code that sends a message to sender which a UIButton does not recognize.

If you send a message to sender that it does not recognize, your program will crash, regardless of whether you statically typed sender.


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View 〉 Button
Automatic 〉 CalculatorViewController.m 〉 -digitPressed:
0
We need more buttons!
Copy and paste our first button to make another button.
//
// CalculatorViewController.m
// Calculator
//
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
The copied button will send the same action (digitPressed:) as the original.
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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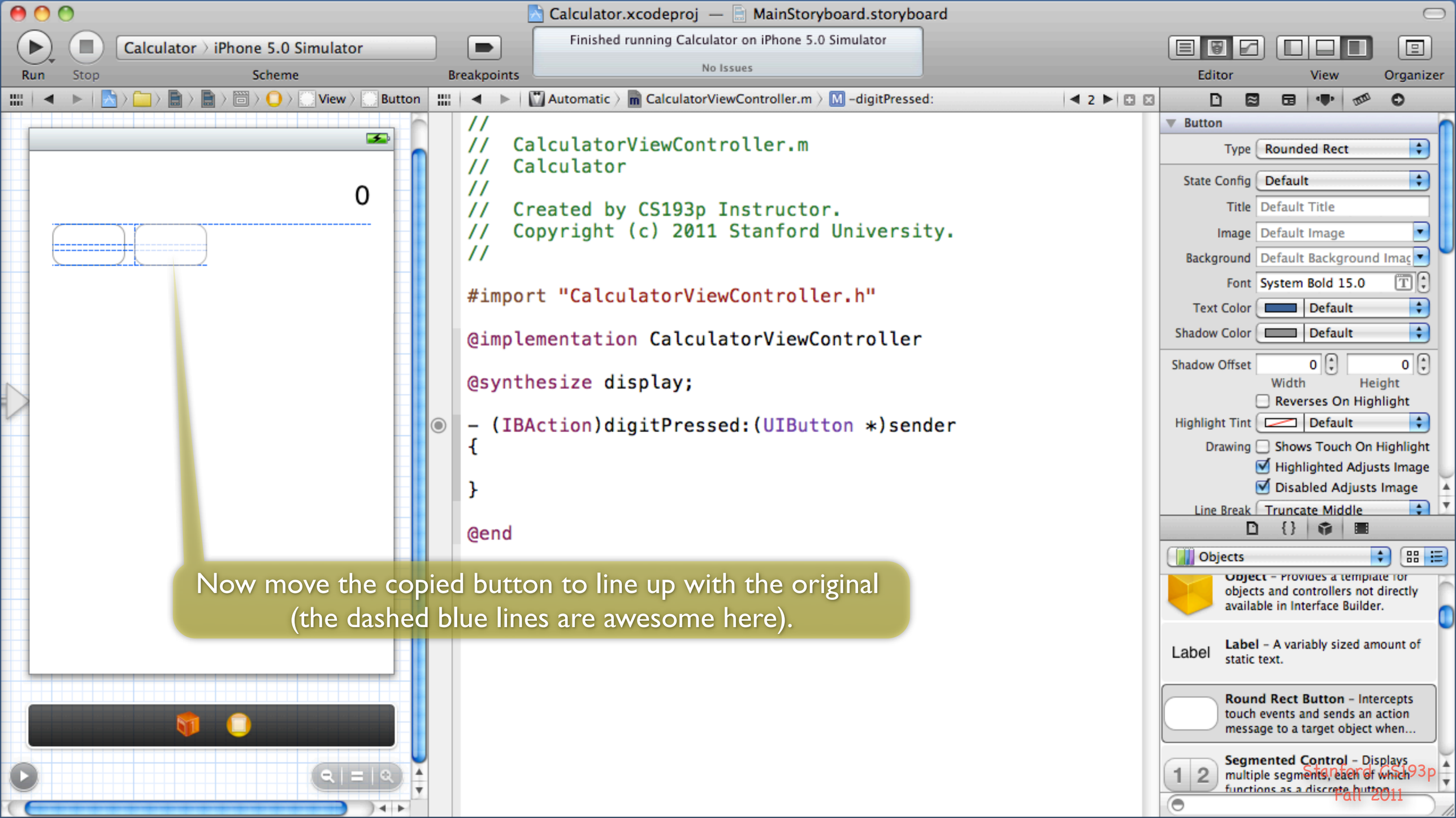
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -digitPressed:
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
Now move the copied button to line up with the original (the dashed blue lines are awesome here).
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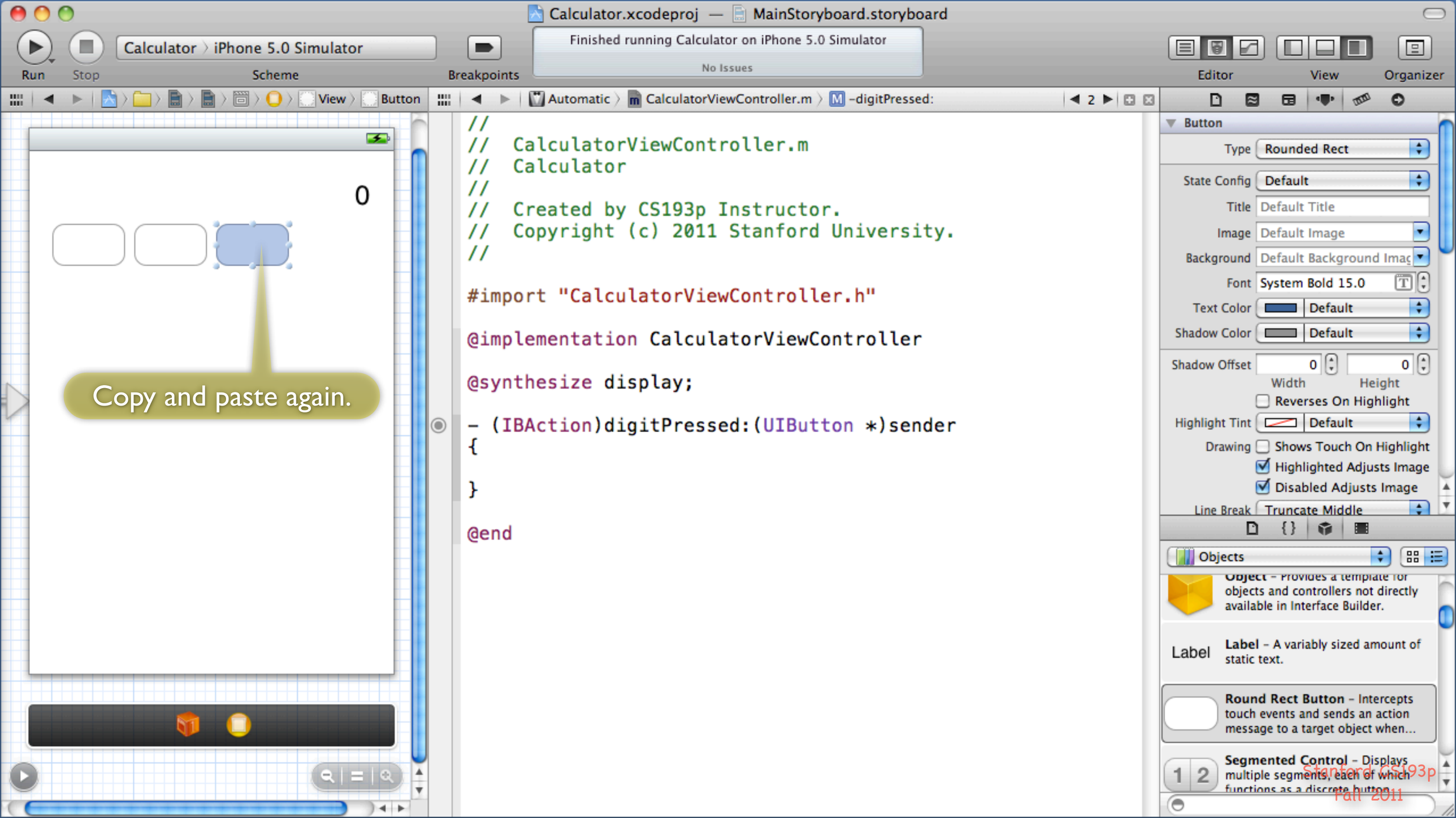
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -digitPressed:
0
Copy and paste again.
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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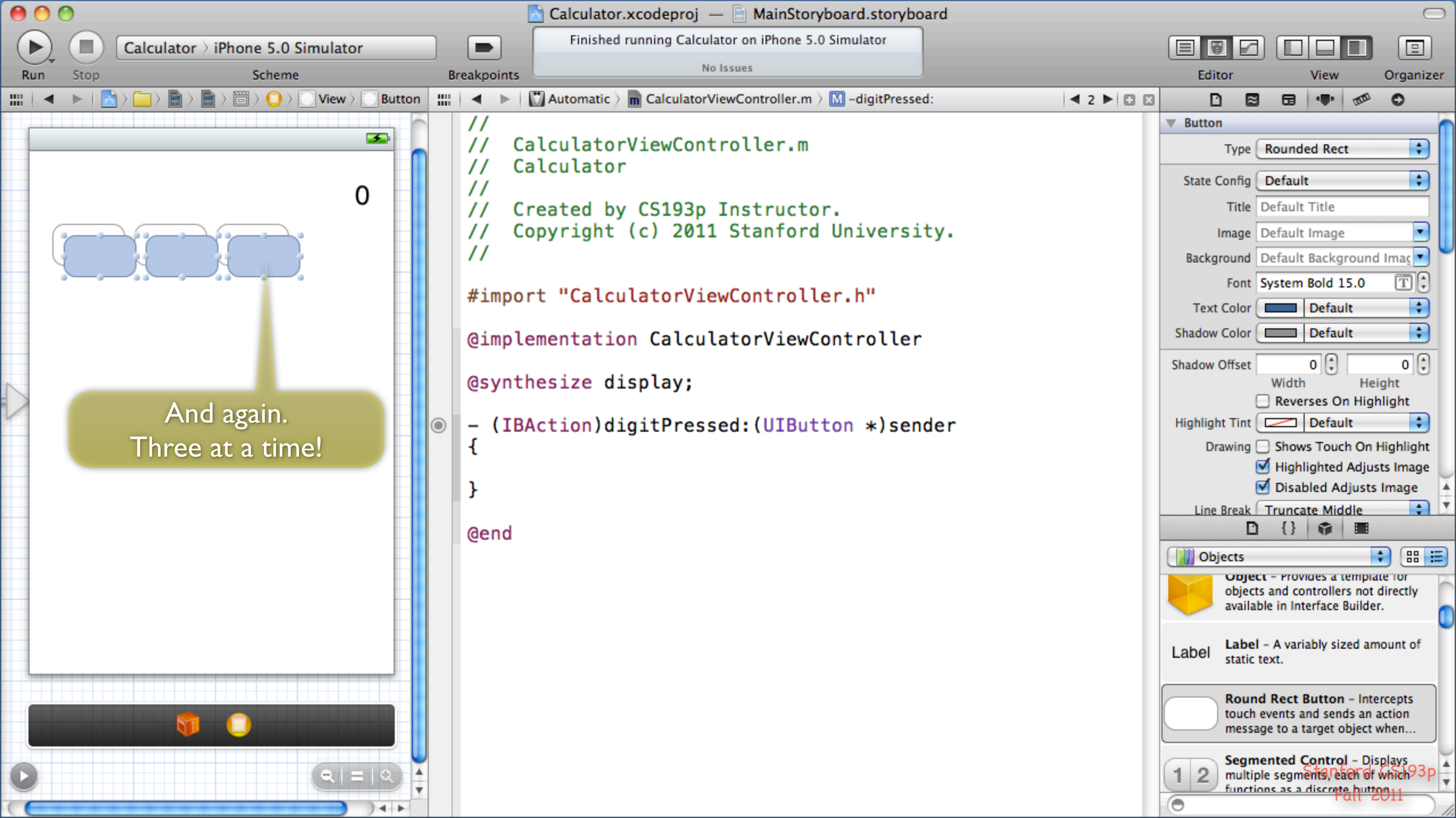
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View 〉 Button
Automatic 〉 CalculatorViewController.m 〉 -digitPressed:
2
0
And again.
Three at a time!
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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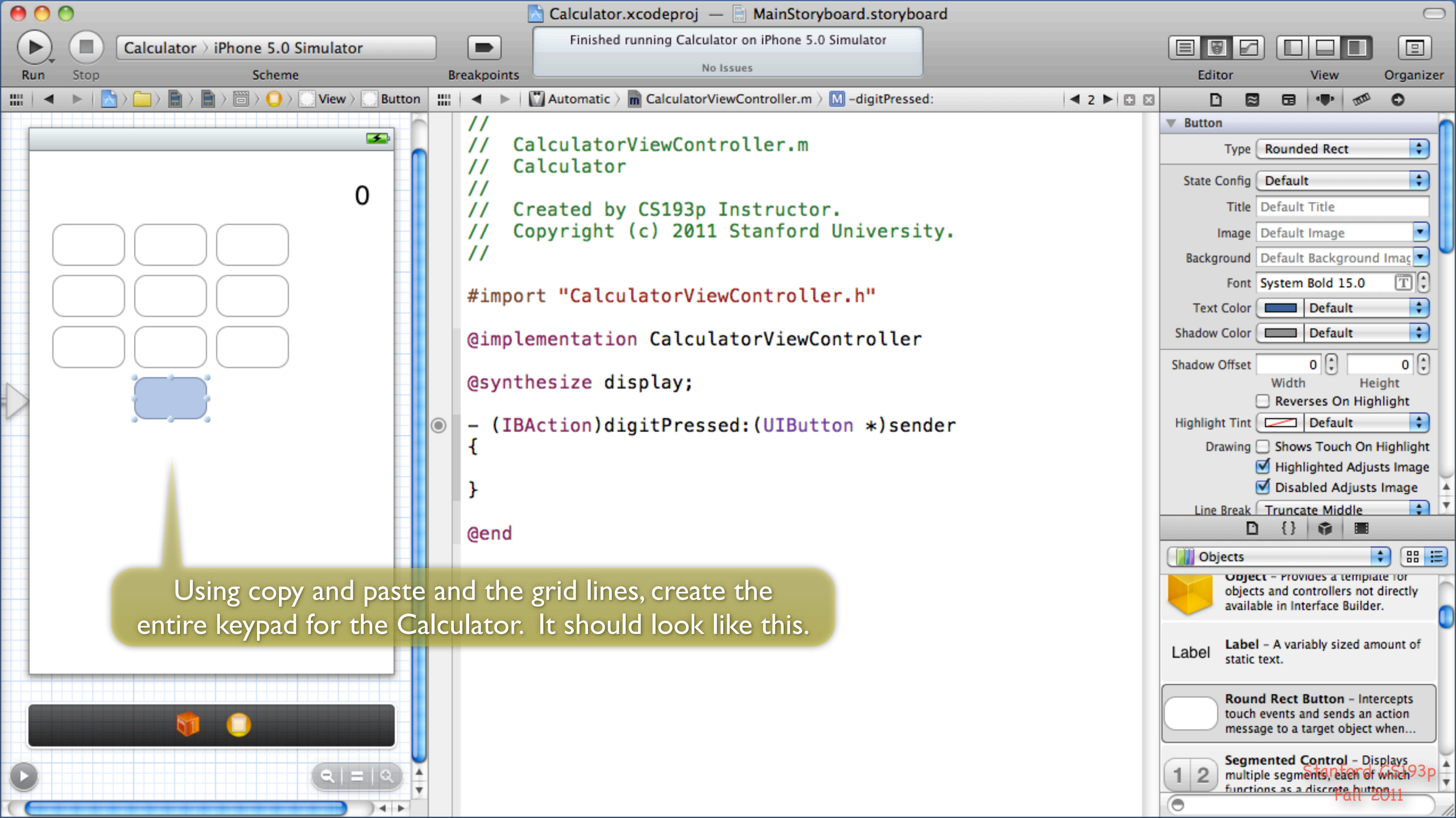
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View 〉 Button
Automatic 〉 CalculatorViewController.m 〉 -digitPressed:
2
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
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Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
Using copy and paste and the grid lines, create the entire keypad for the Calculator. It should look like this.
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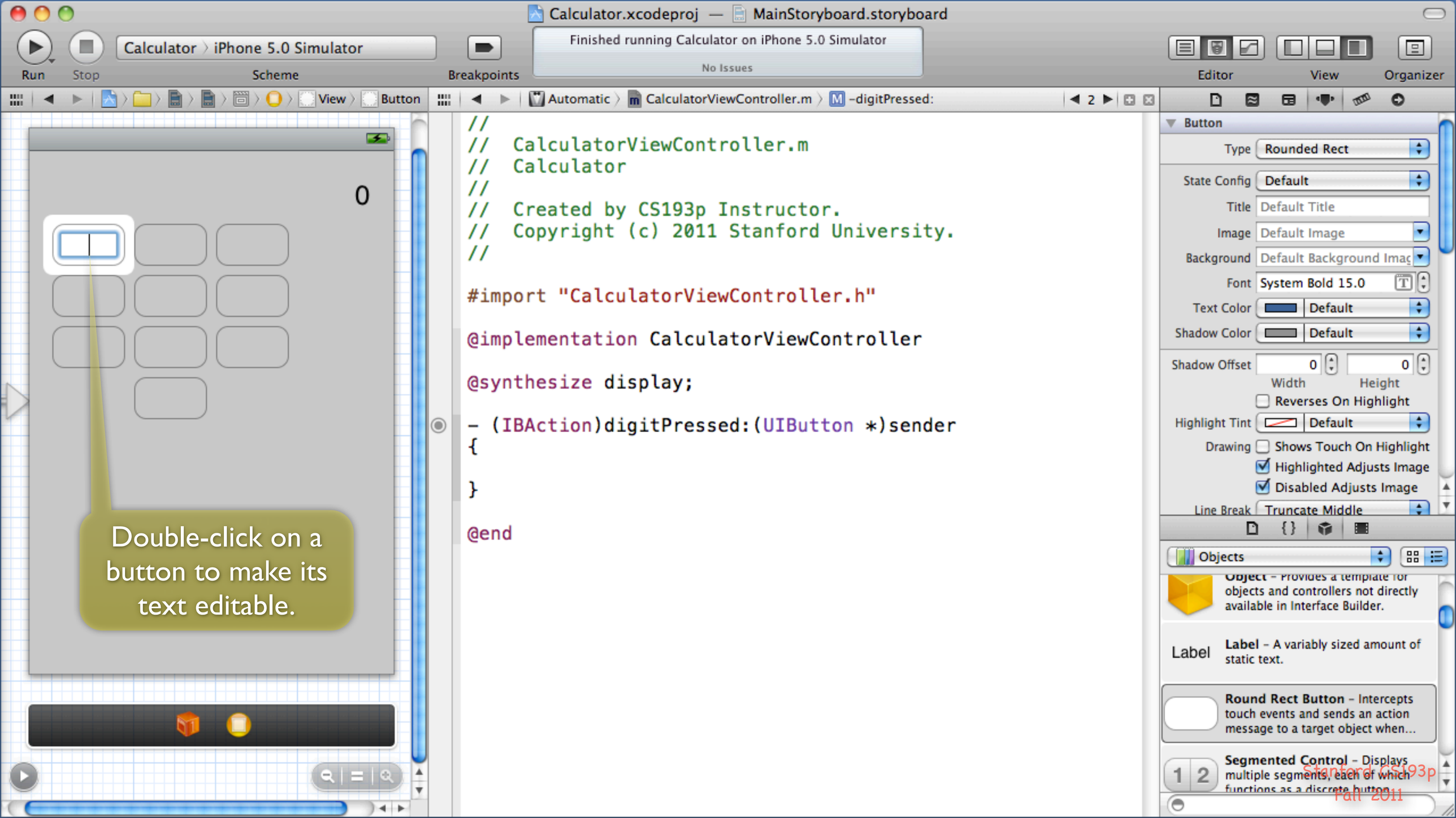
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -digitPressed:
0
Double-click on a button to make its text editable.
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
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Round Rect Button – Intercepts touch events and sends an action message to a target object when...
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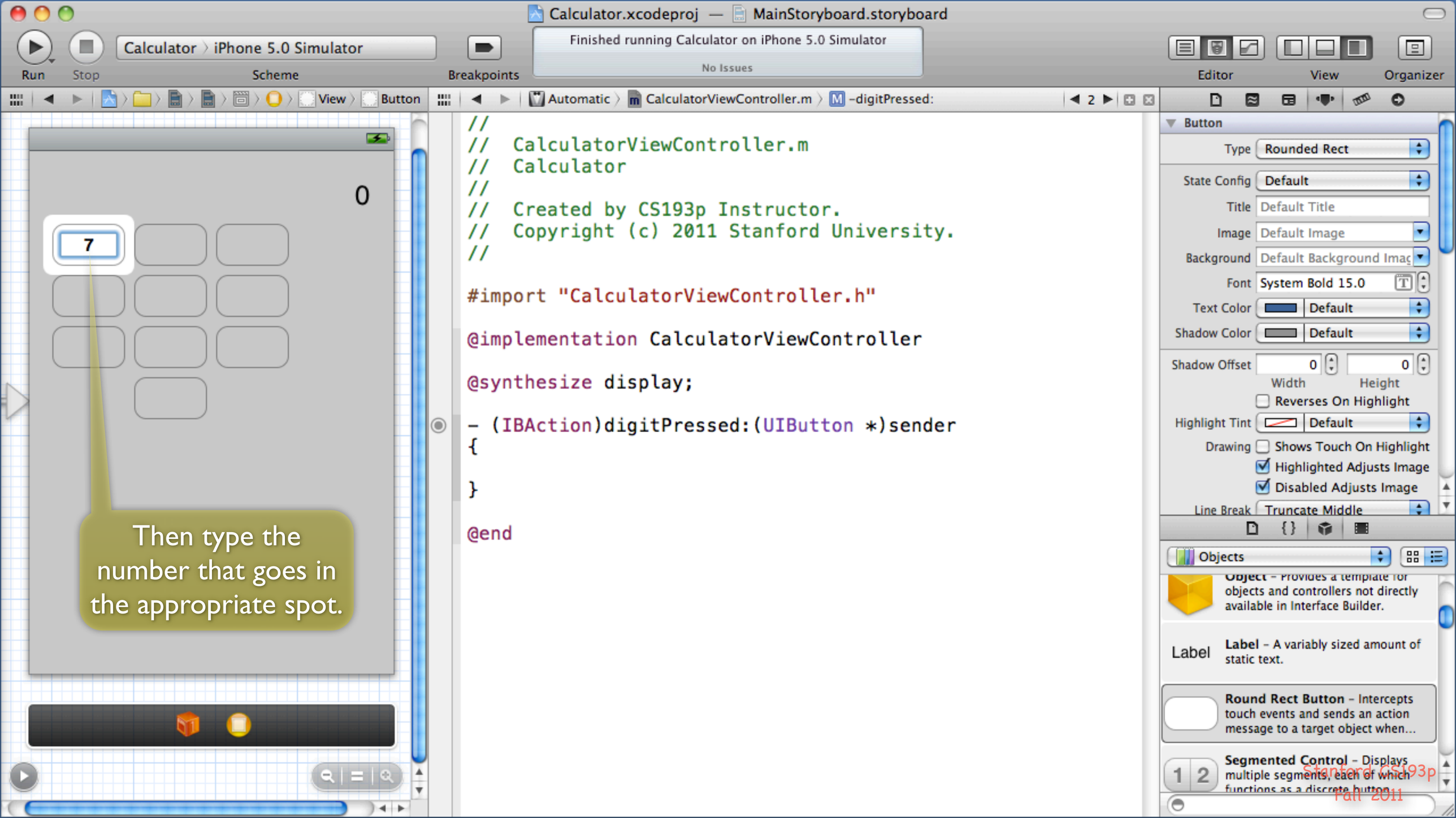
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -digitPressed:
0
7
Then type the number that goes in the appropriate spot.
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
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Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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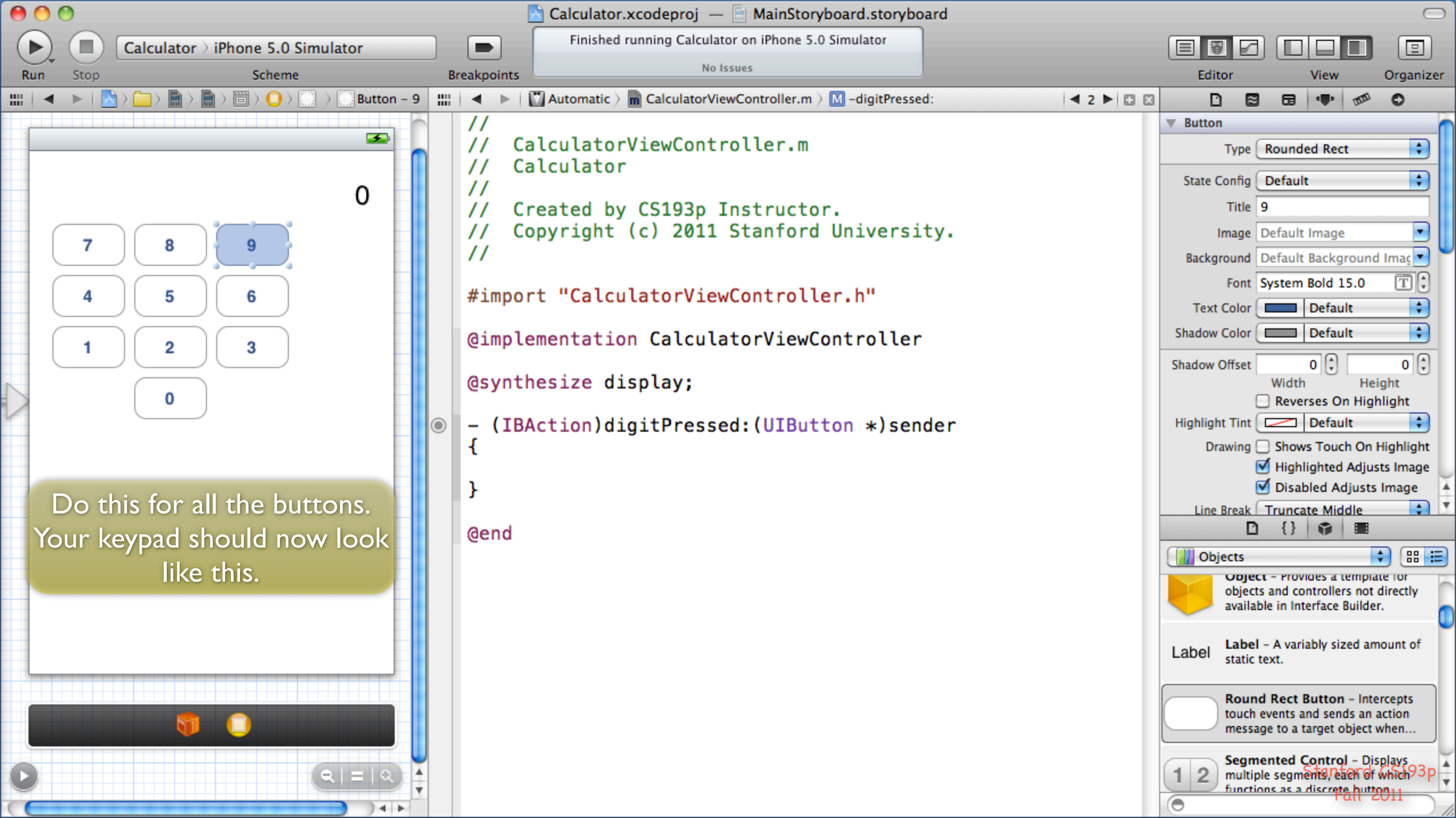
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Button – 9
Automatic › CalculatorViewController.m › -digitPressed:
0
7
8
9
4
5
6
1
2
3
0
Do this for all the buttons. Your keypad should now look like this.
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title 9
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
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Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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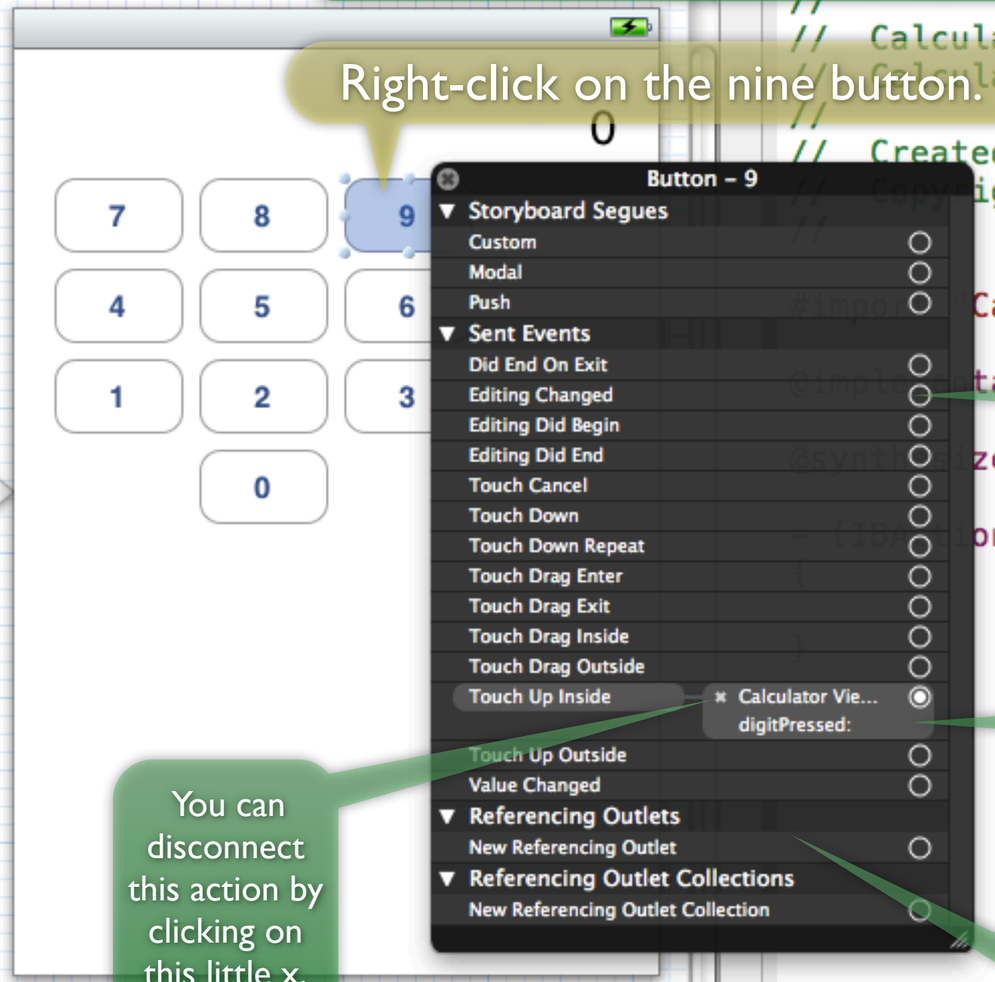
When you start building more complicated user-interfaces,
it will be very important to be able to see your outlet and action connections.
You can do this by right-clicking on any object in your MVC's View.

Right-click on the nine button.



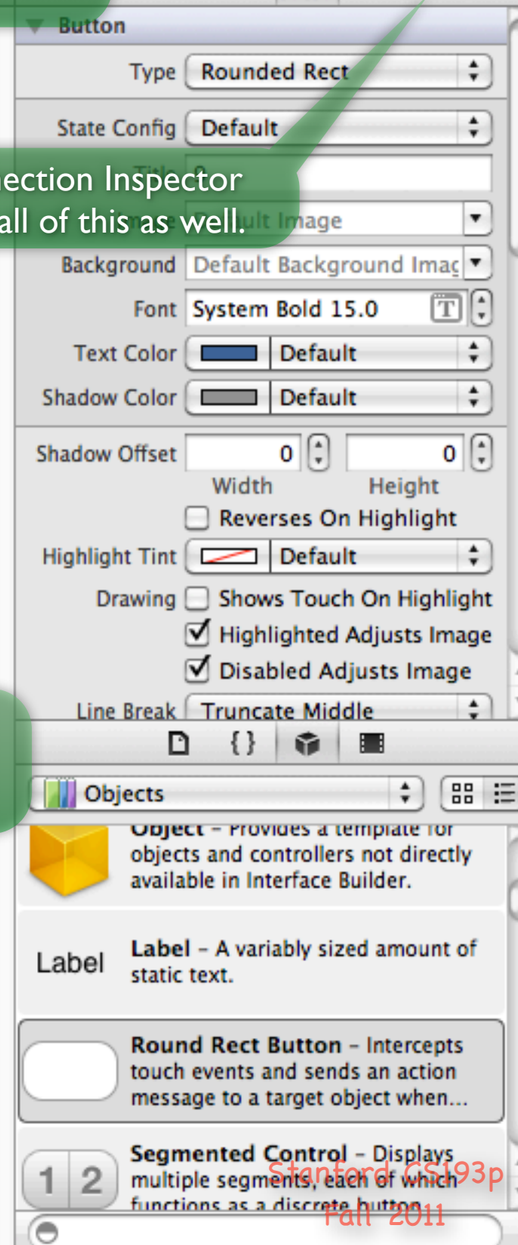

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"

@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
```



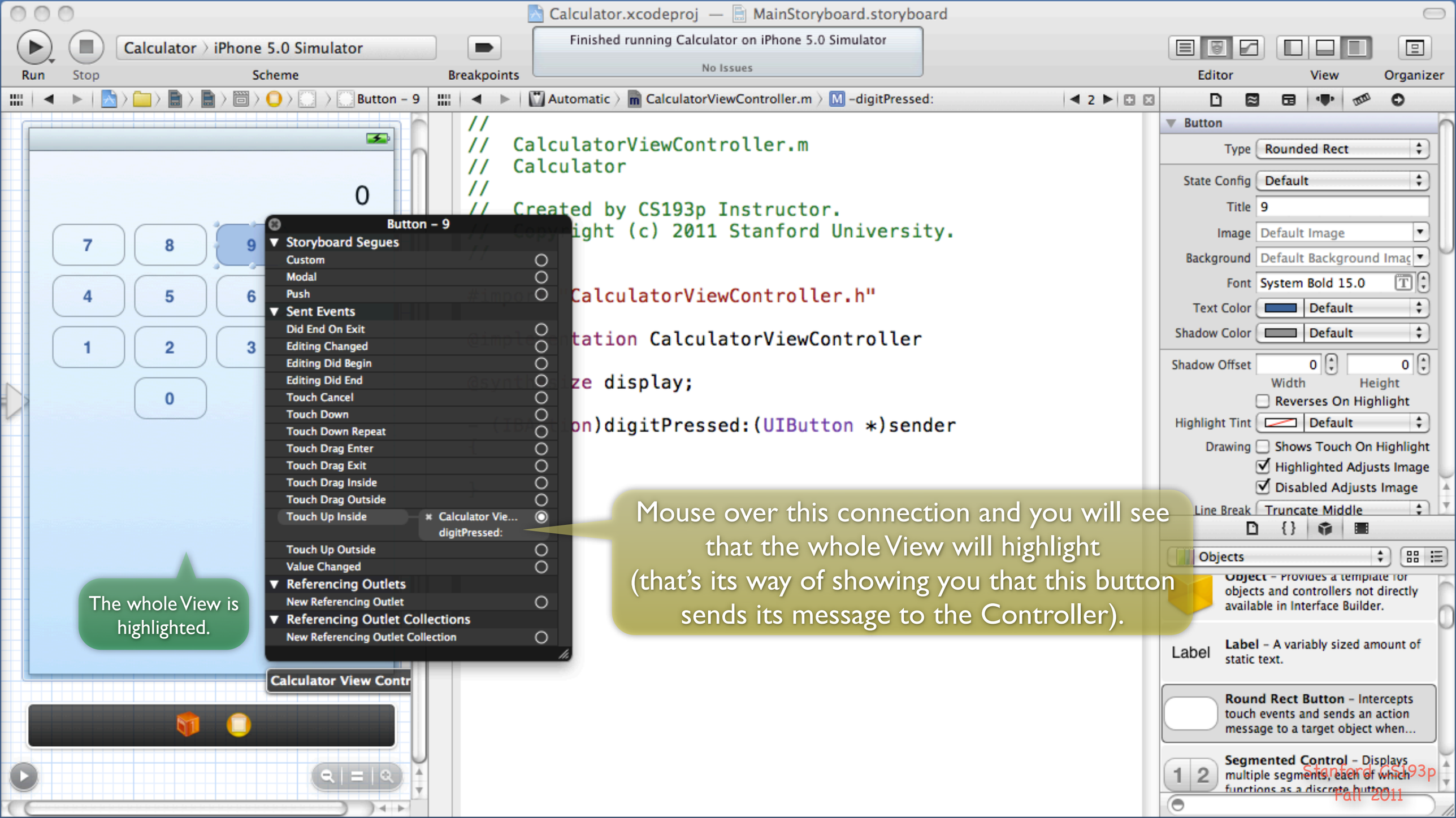
The Connection Inspector will show all of this as well.

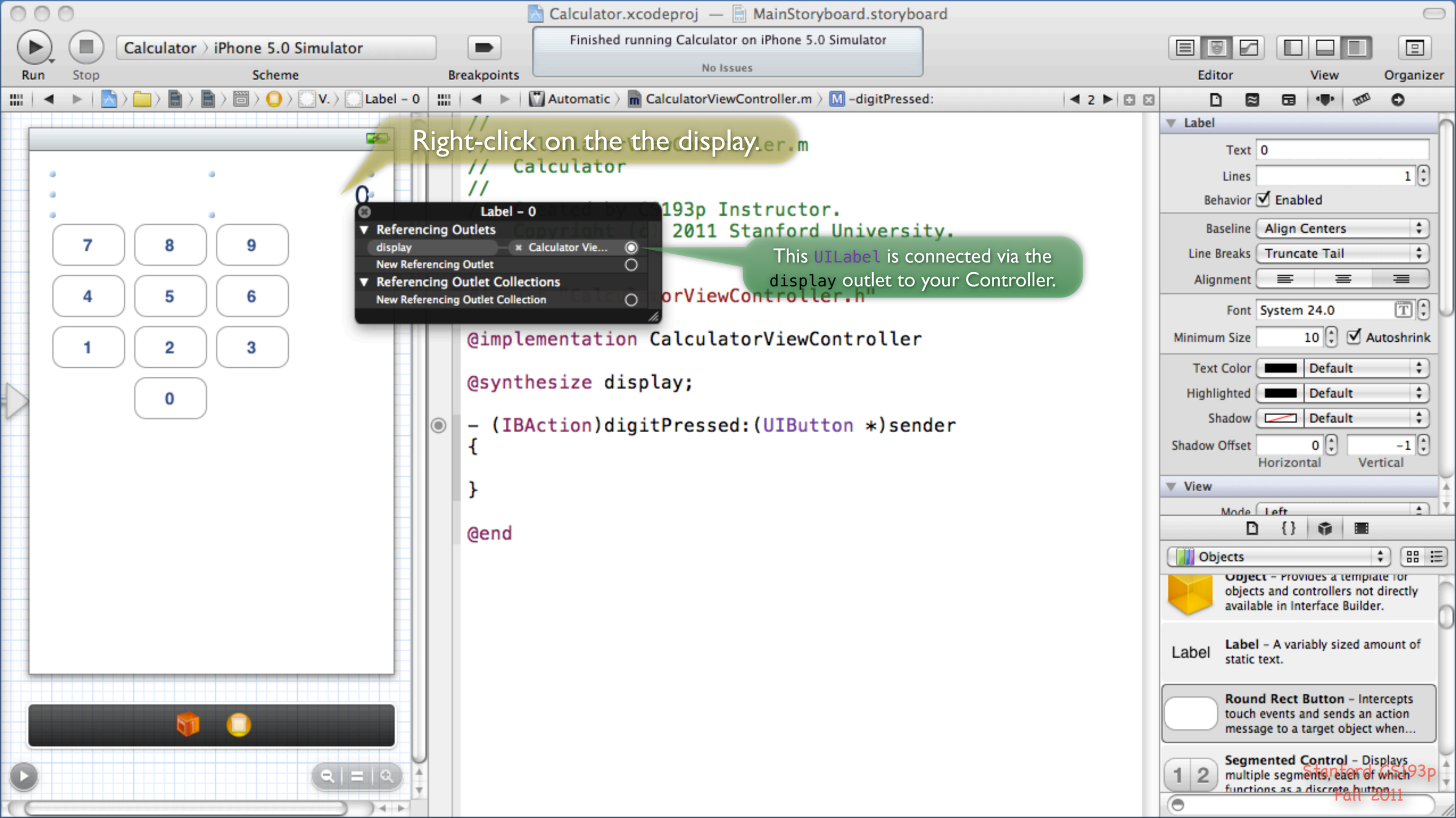
You can ctrl-drag from these little circles to make connections too.

This shows that the 9 button sends `digitPressed:` to Calculator View Controller (your Controller) when a touch lifts up inside its borders.

You can disconnect this action by clicking on this little x.

There are no outlets which point to this button.


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Button – 9
Automatic › CalculatorViewController.m › -digitPressed:
0
7
8
9
4
5
6
1
2
3
0
Button – 9
Storyboard Segues
Custom
Modal
Push
Sent Events
Did End On Exit
Editing Changed
Editing Did Begin
Editing Did End
Touch Cancel
Touch Down
Touch Down Repeat
Touch Drag Enter
Touch Drag Exit
Touch Drag Inside
Touch Drag Outside
Touch Up Inside
Calculator Vie...
digitPressed:
Touch Up Outside
Value Changed
Referencing Outlets
New Referencing Outlet
Referencing Outlet Collections
New Referencing Outlet Collection
Calculator View Contr
The whole View is highlighted.
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// ight (c) 2011 Stanford University.
//
CalculatorViewController.h"
tation CalculatorViewController
ze display;
on)digitPressed:(UIButton *)sender
Mouse over this connection and you will see that the whole View will highlight (that's its way of showing you that this button sends its message to the Controller).
Button
Type Rounded Rect
State Config Default
Title 9
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic
CalculatorViewController.m
-digitPressed:
Right-click on the the display.
7
8
9
4
5
6
1
2
3
0
Label – 0
Referencing Outlets
display
Calculator Vie...
New Referencing Outlet
Referencing Outlet Collections
New Referencing Outlet Collection
This UILabel is connected via the display outlet to your Controller.
//
// Calculator
//
Copyright (c) 2011 Stanford University.
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button
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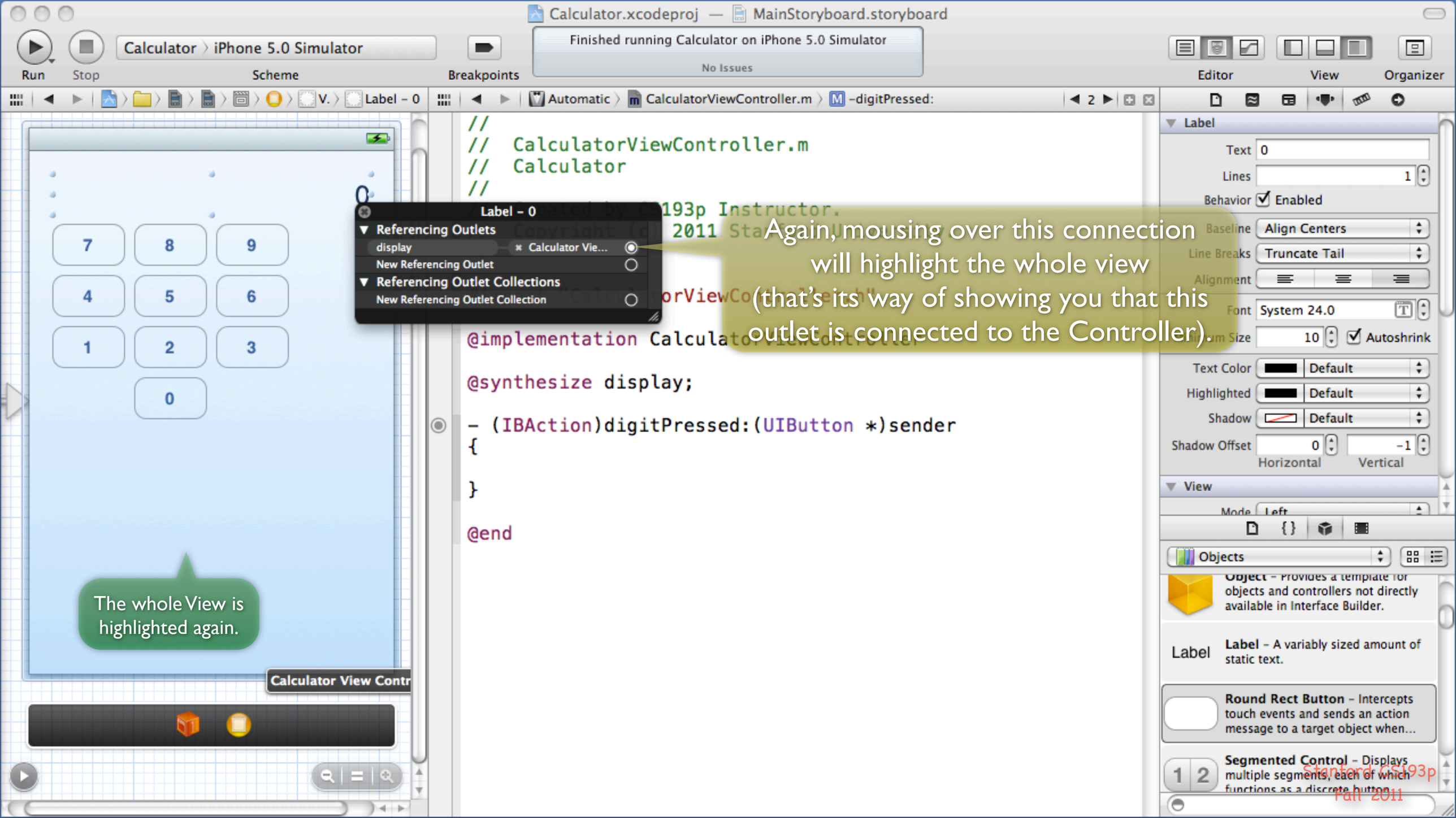
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Label – 0
Automatic › CalculatorViewController.m › -digitPressed:
7 8 9
4 5 6
1 2 3
0
Label – 0
Referencing Outlets
display
Calculator Vie...
New Referencing Outlet
Referencing Outlet Collections
New Referencing Outlet Collection
//
// CalculatorViewController.m
// Calculator
//
193p Instructor.
2011 Sta
@implementation Calculator
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
Again, mousing over this connection will highlight the whole view (that's its way of showing you that this outlet is connected to the Controller).
The whole View is highlighted again.
Calculator View Contr
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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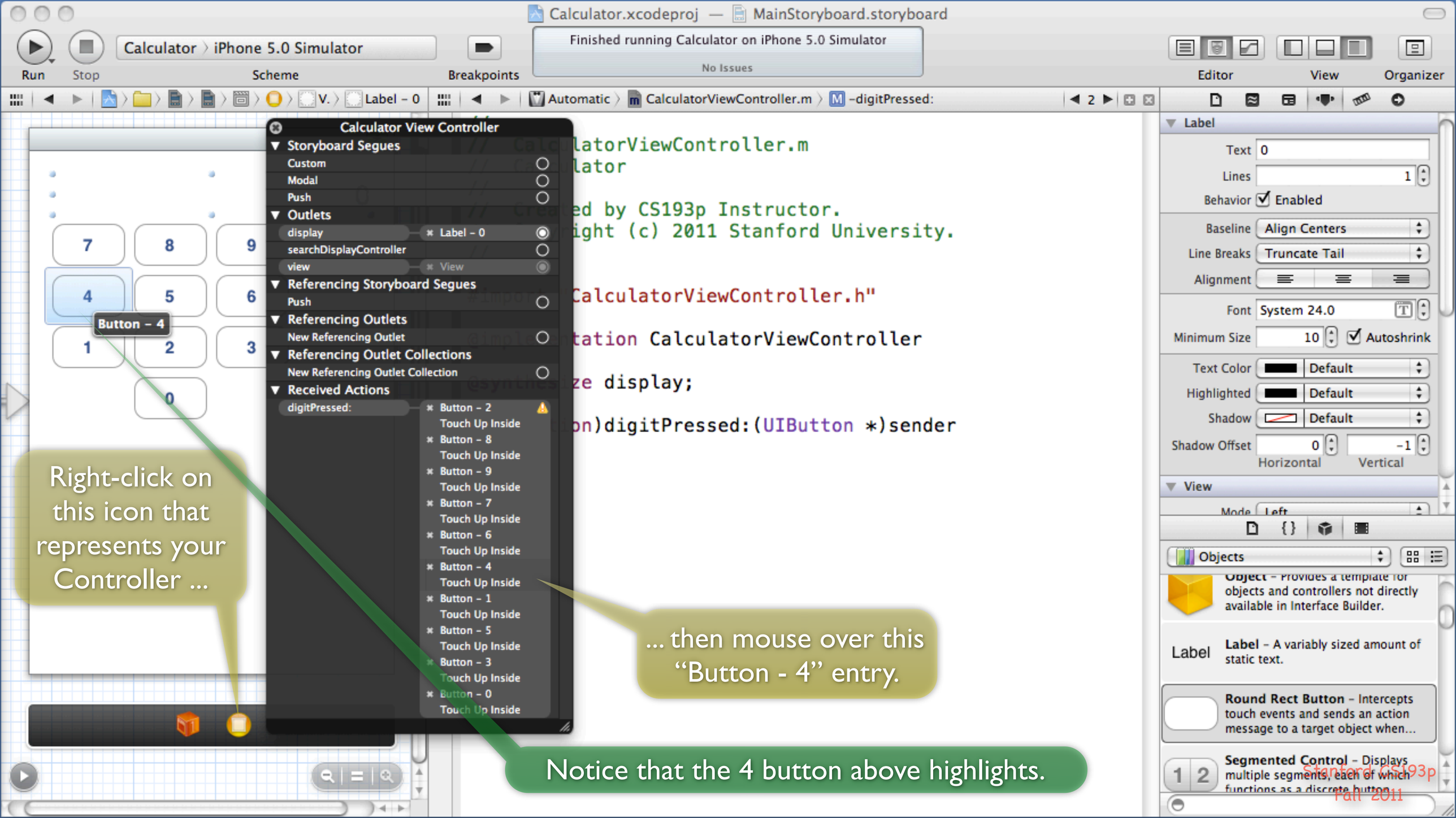
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator View Controller
Storyboard Segues
Custom
Modal
Push
Outlets
display
Label – 0
searchDisplayController
view
View
Referencing Storyboard Segues
Push
Referencing Outlets
New Referencing Outlet
Referencing Outlet Collections
New Referencing Outlet Collection
Received Actions
digitPressed:
Button – 2
Touch Up Inside
Button – 8
Touch Up Inside
Button – 9
Touch Up Inside
Button – 7
Touch Up Inside
Button – 6
Touch Up Inside
Button – 4
Touch Up Inside
Button – 1
Touch Up Inside
Button – 5
Touch Up Inside
Button – 3
Touch Up Inside
Button – 0
Touch Up Inside
Button – 4
7
8
9
4
5
6
1
2
3
0
Right-click on this icon that represents your Controller ...
... then mouse over this "Button - 4" entry.
Notice that the 4 button above highlights.
latorViewController.m
lator
ed by CS193p Instructor.
ight (c) 2011 Stanford University.
CalculatorViewController.h"
tation CalculatorViewController
ze display;
on)digitPressed:(UIButton *)sender
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button
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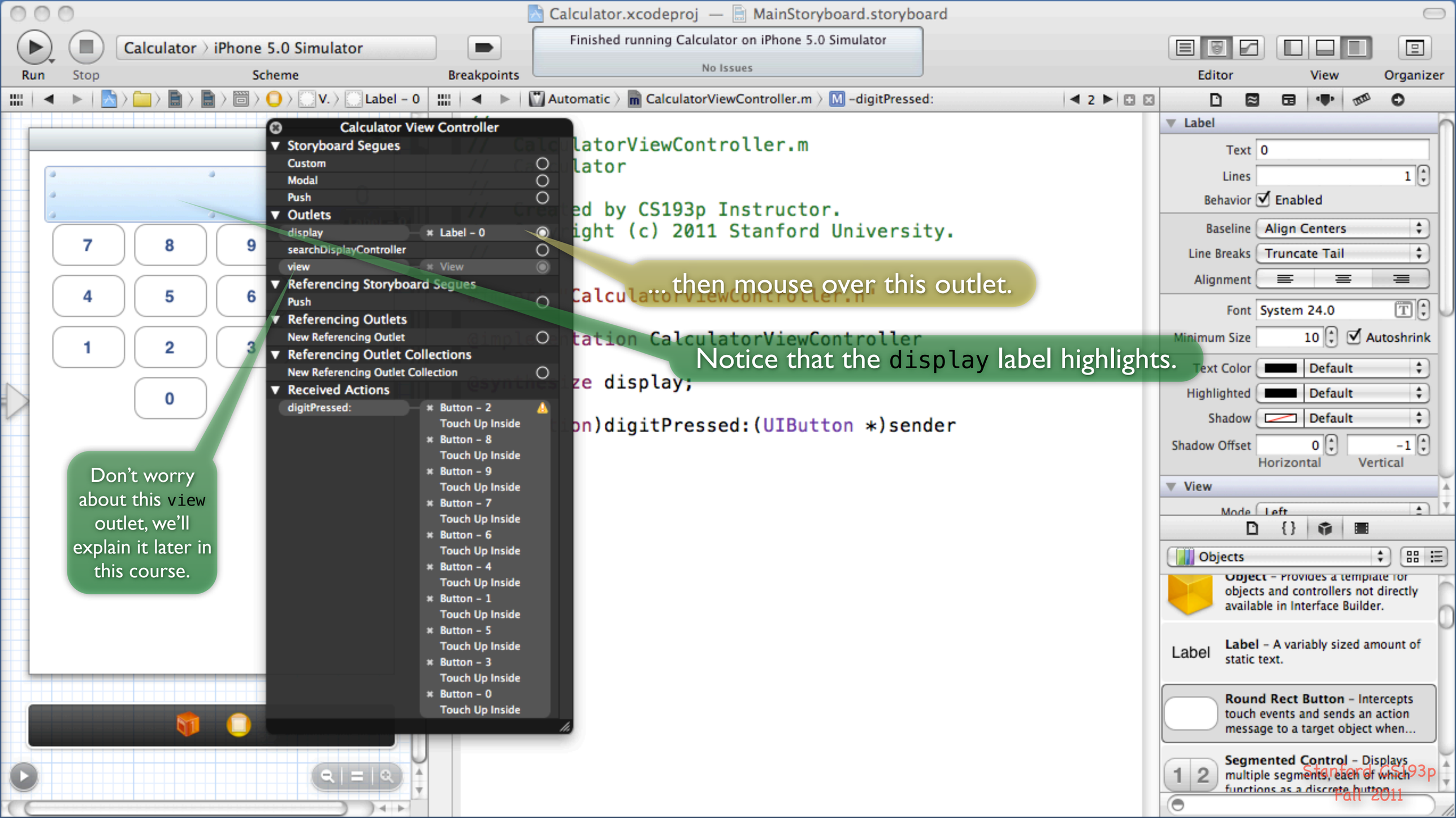
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator View Controller
Storyboard Segues
Custom
Modal
Push
Outlets
display
Label – 0
searchDisplayController
view
View
Referencing Storyboard Segues
Push
Referencing Outlets
New Referencing Outlet
Referencing Outlet Collections
New Referencing Outlet Collection
Received Actions
digitPressed:
Button – 2
Touch Up Inside
Button – 8
Touch Up Inside
Button – 9
Touch Up Inside
Button – 7
Touch Up Inside
Button – 6
Touch Up Inside
Button – 4
Touch Up Inside
Button – 1
Touch Up Inside
Button – 5
Touch Up Inside
Button – 3
Touch Up Inside
Button – 0
Touch Up Inside
7
8
9
4
5
6
1
2
3
0
Don't worry about this view outlet, we'll explain it later in this course.
... then mouse over this outlet.
Notice that the display label highlights.
latorViewController.m
lator
ed by CS193p Instructor.
ight (c) 2011 Stanford University.
CalculatorViewController.h
tation CalculatorViewController
ze display;
on)digitPressed:(UIButton *)sender
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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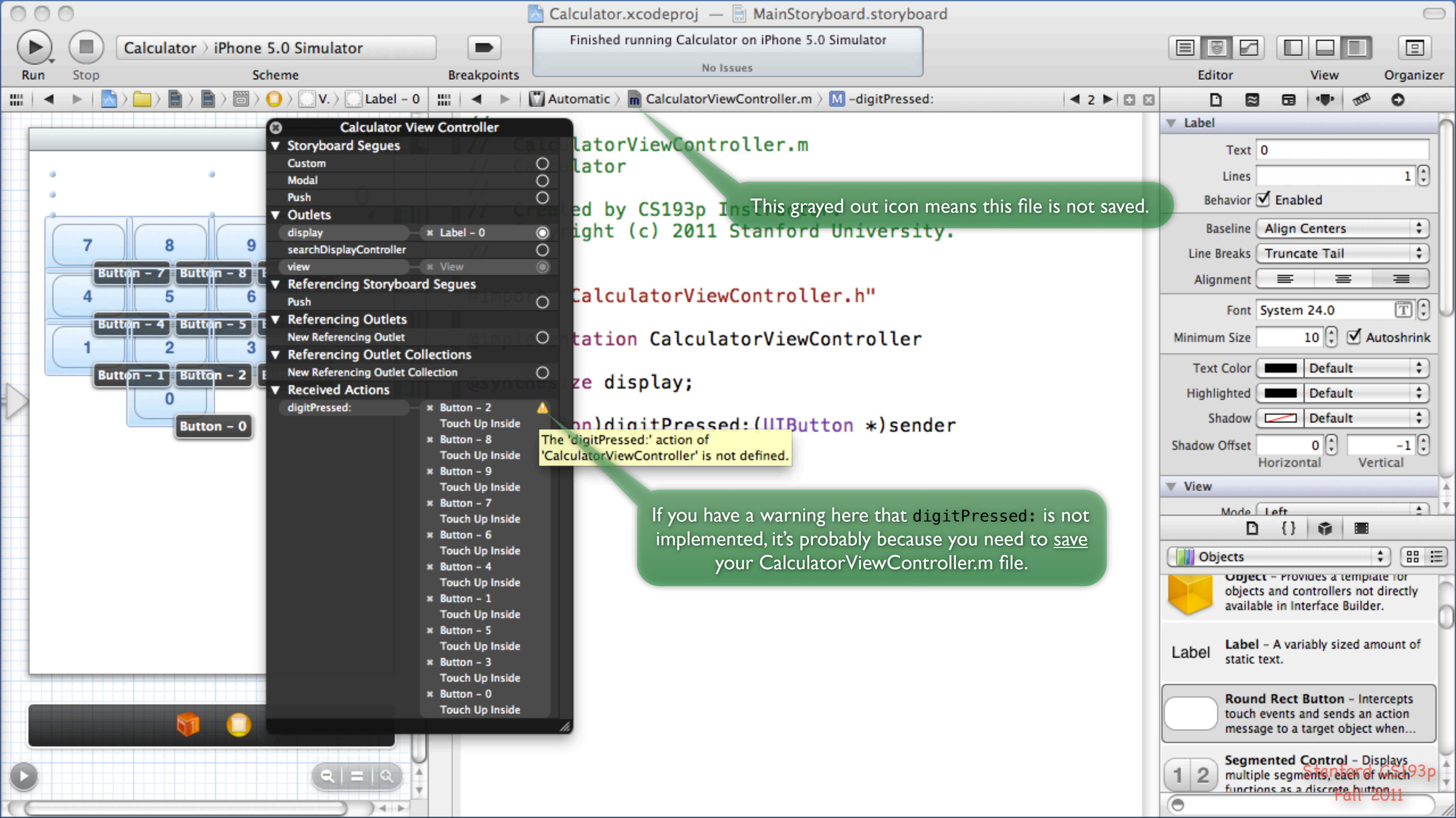
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator View Controller
Storyboard Segues
Custom
Modal
Push
Outlets
display
Label – 0
searchDisplayController
view
View
Referencing Storyboard Segues
Push
Referencing Outlets
New Referencing Outlet
Referencing Outlet Collections
New Referencing Outlet Collection
Received Actions
digitPressed:
Button – 2
Touch Up Inside
Button – 8
Touch Up Inside
Button – 9
Touch Up Inside
Button – 7
Touch Up Inside
Button – 6
Touch Up Inside
Button – 4
Touch Up Inside
Button – 1
Touch Up Inside
Button – 5
Touch Up Inside
Button – 3
Touch Up Inside
Button – 0
Touch Up Inside
The 'digitPressed:' action of 'CalculatorViewController' is not defined.
This grayed out icon means this file is not saved.
If you have a warning here that digitPressed: is not implemented, it's probably because you need to save your CalculatorViewController.m file.
Label
Text 0
Lines 1
Behavior Enabled
Baseline Align Centers
Line Breaks Truncate Tail
Alignment
Font System 24.0
Minimum Size 10
Autoshrink
Text Color Default
Highlighted Default
Shadow Default
Shadow Offset 0 -1
Horizontal
Vertical
View
Mode Left
Objects
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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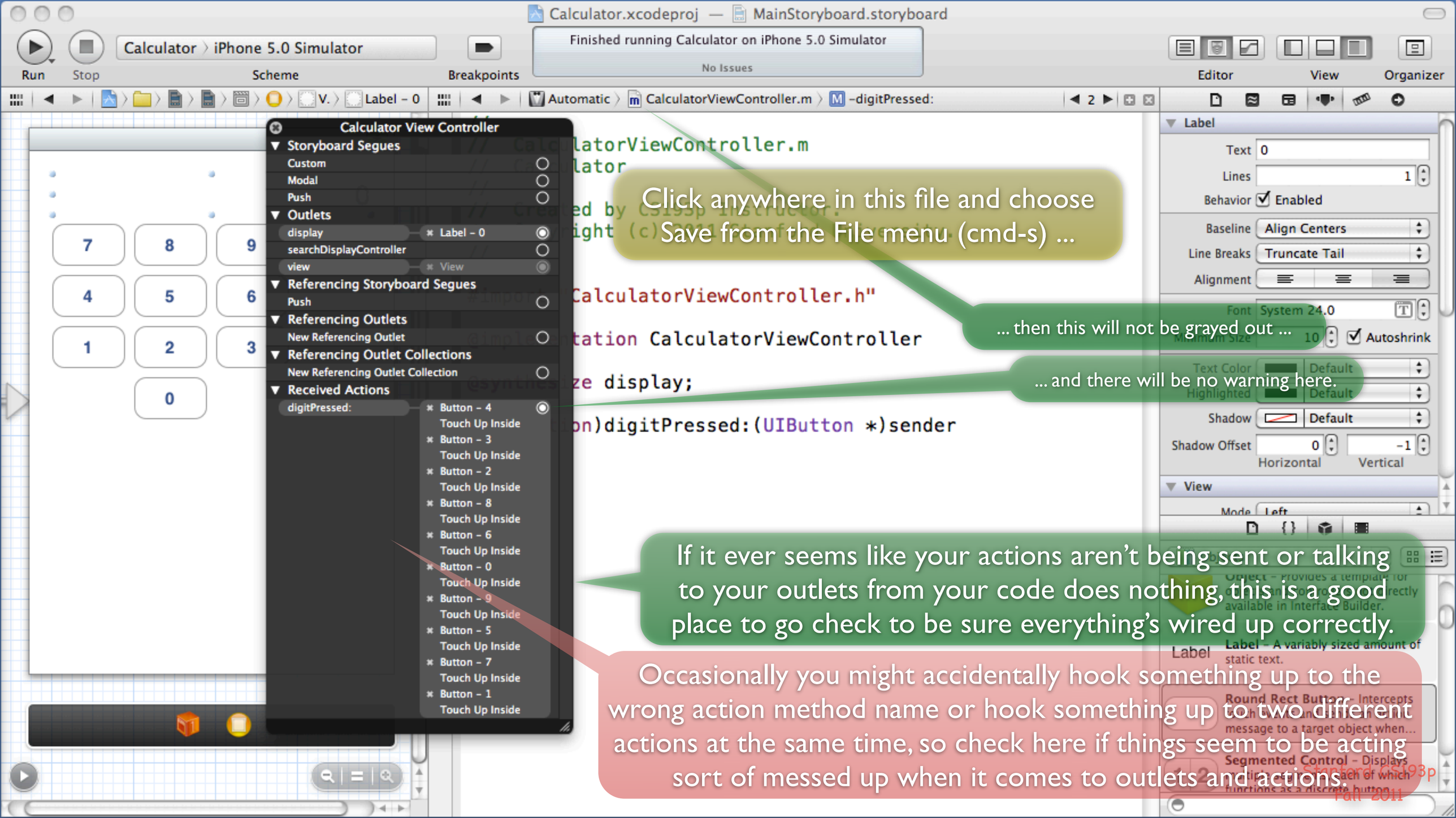
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculator View Controller
Storyboard Segues
Custom
Modal
Push
Outlets
display
Label – 0
searchDisplayController
view
View
Referencing Storyboard Segues
Push
Referencing Outlets
New Referencing Outlet
Referencing Outlet Collections
New Referencing Outlet Collection
Received Actions
digitPressed:
Button – 4
Touch Up Inside
Button – 3
Button – 2
Button – 8
Button – 6
Button – 0
Button – 9
Button – 5
Button – 7
Button – 1
7
8
9
4
5
6
1
2
3
0
Label
Text
Lines
Behavior
Enabled
Baseline
Align Centers
Line Breaks
Truncate Tail
Alignment
Font
System 24.0
Autoshrink
Text Color
Default
Highlighted
Shadow
Shadow Offset
Horizontal
Vertical
View
Mode
Left
Label – A variably sized amount of static text.
Round Rect Button – Intercepts
Segmented Control – Displays
Click anywhere in this file and choose Save from the File menu (cmd-s) ...
... then this will not be grayed out ...
... and there will be no warning here.
If it ever seems like your actions aren't being sent or talking to your outlets from your code does nothing, this is a good place to go check to be sure everything's wired up correctly.
Occasionally you might accidentally hook something up to the wrong action method name or hook something up to two different actions at the same time, so check here if things seem to be acting sort of messed up when it comes to outlets and actions.
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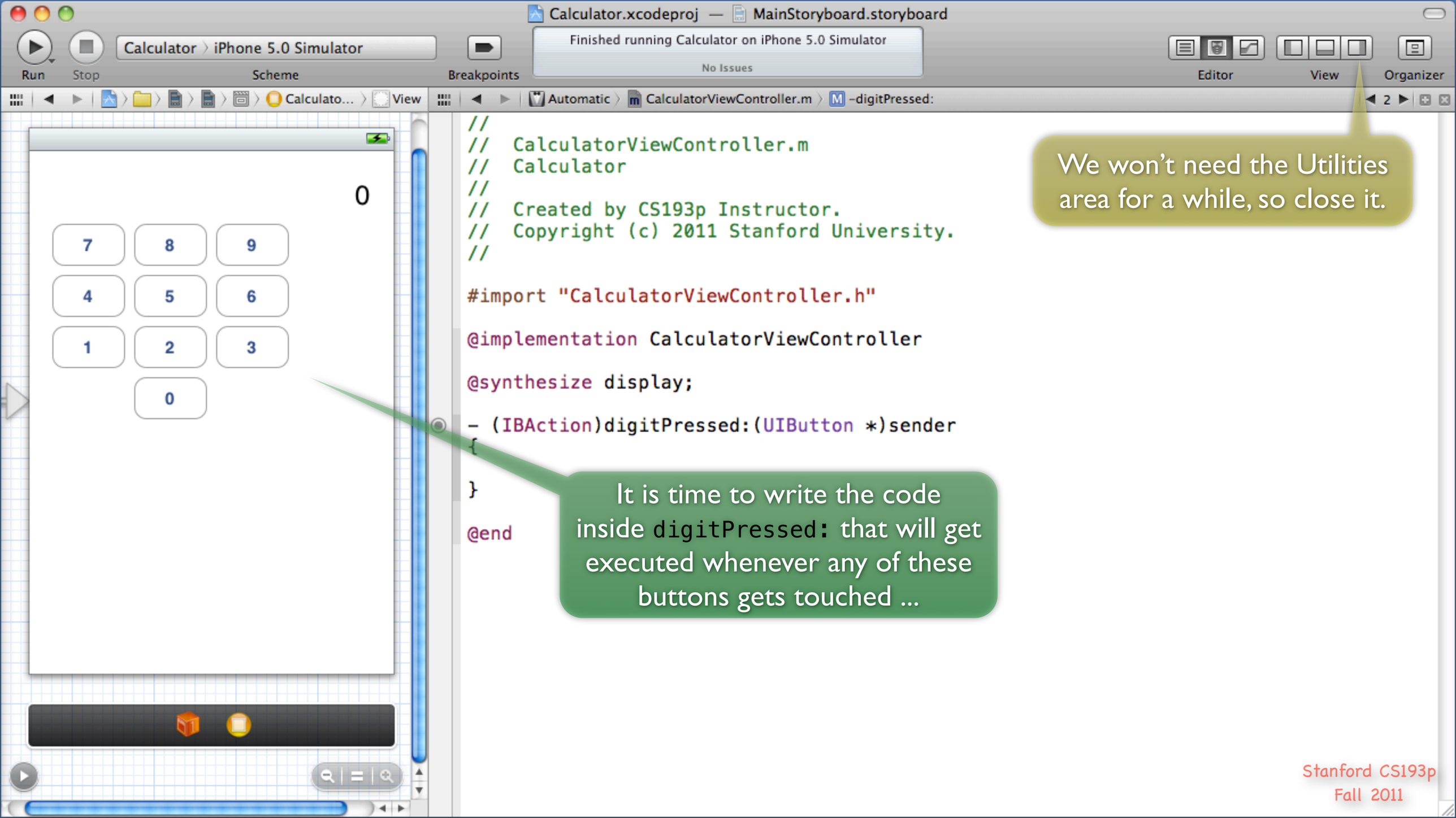
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-digitPressed:
0
7
8
9
4
5
6
1
2
3
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
}
@end
We won't need the Utilities area for a while, so close it.
It is time to write the code inside digitPressed: that will get executed whenever any of these buttons gets touched ...
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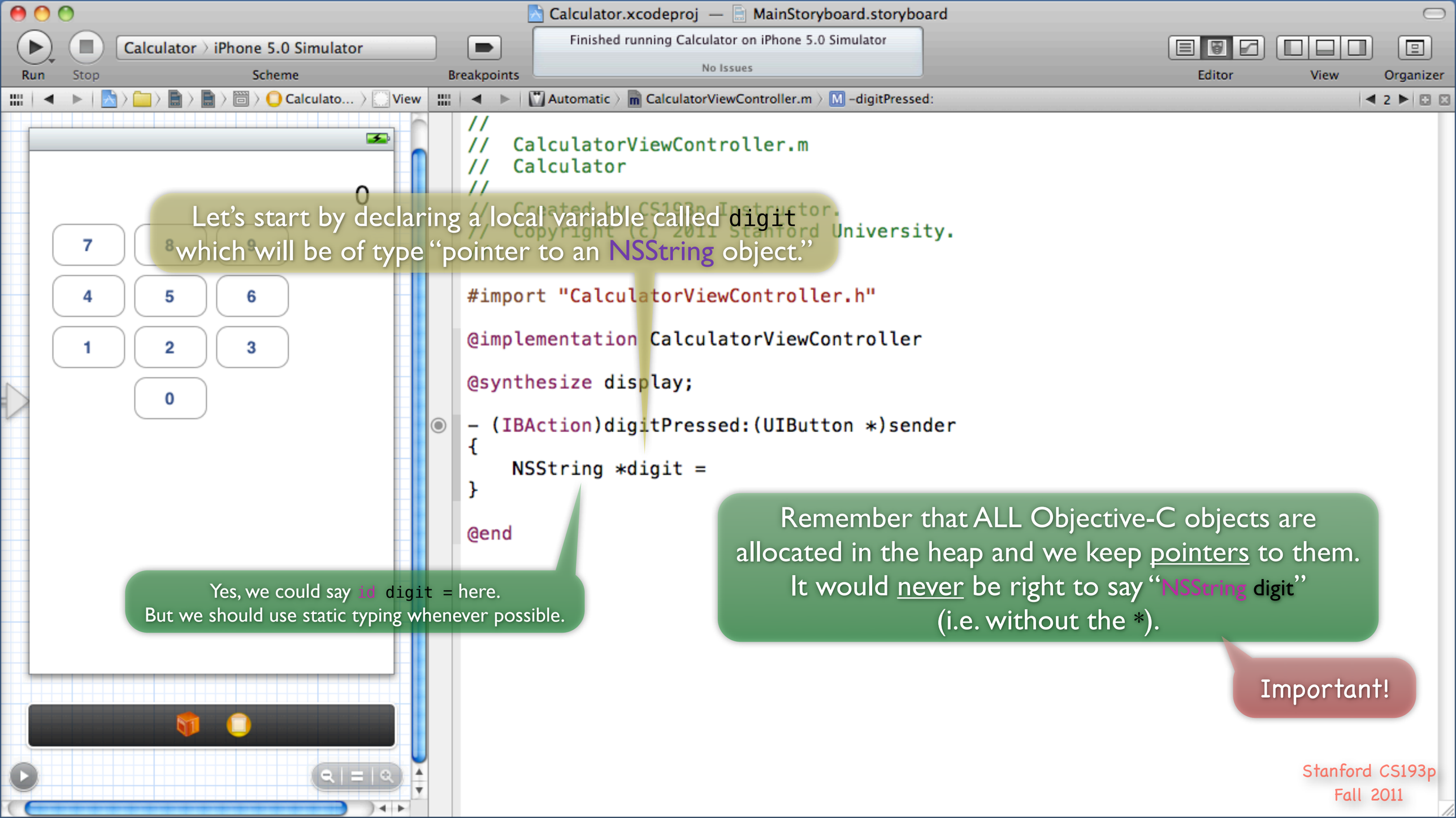
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-digitPressed:
0
7
8
9
4
5
6
1
2
3
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit =
}
@end
Let's start by declaring a local variable called digit which will be of type "pointer to an NSString object."
Yes, we could say id digit = here.
But we should use static typing whenever possible.
Remember that ALL Objective-C objects are allocated in the heap and we keep pointers to them. It would never be right to say "NSString digit" (i.e. without the *).
Important!
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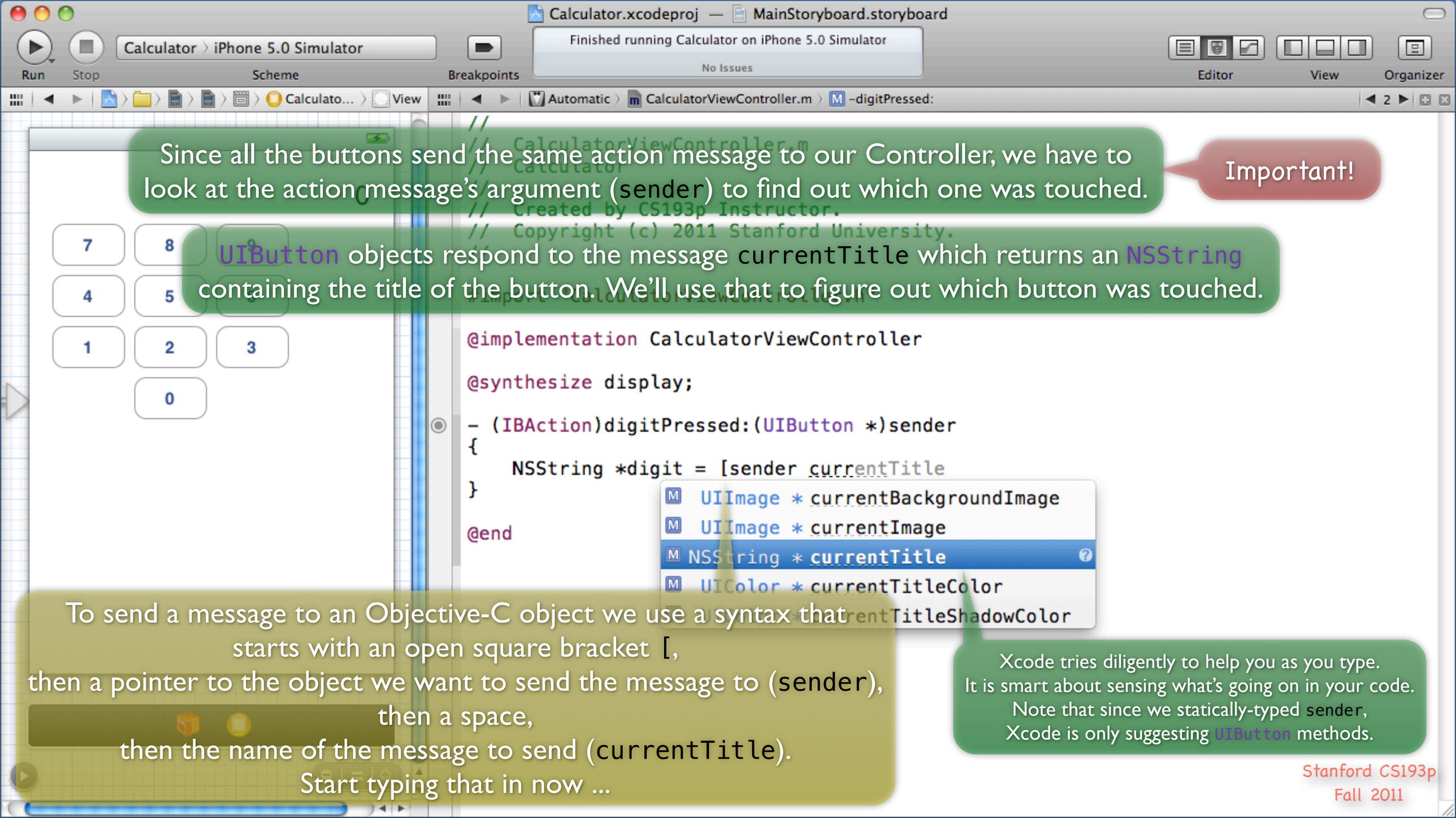
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-digitPressed:
Since all the buttons send the same action message to our Controller, we have to look at the action message's argument (sender) to find out which one was touched.
Important!
UIButton objects respond to the message currentTitle which returns an NSString containing the title of the button. We'll use that to figure out which button was touched.
7
8
4
5
1
2
3
0
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle
}
@end
UIImage * currentBackgroundImage
UIImage * currentImage
NSString * currentTitle
UIColor * currentTitleColor
To send a message to an Objective-C object we use a syntax that
starts with an open square bracket [,
then a pointer to the object we want to send the message to (sender),
then a space,
then the name of the message to send (currentTitle).
Start typing that in now ...
Xcode tries diligently to help you as you type.
It is smart about sensing what's going on in your code.
Note that since we statically-typed sender,
Xcode is only suggesting UIButton methods.
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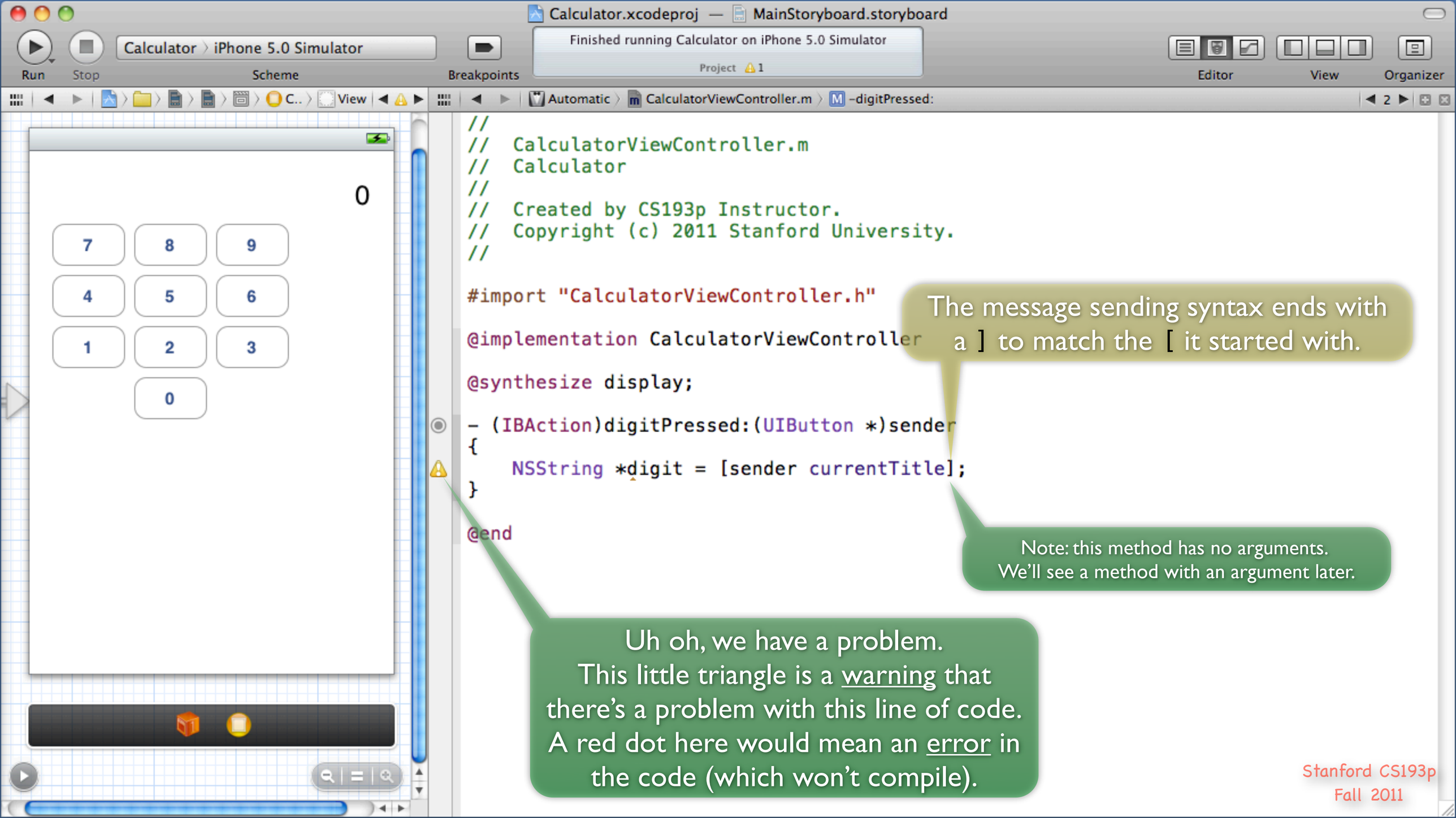
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project ⚠1
Editor
View
Organizer
Automatic › CalculatorViewController.m › -digitPressed:
0
7
8
9
4
5
6
1
2
3
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
}
@end
The message sending syntax ends with a] to match the [it started with.
Note: this method has no arguments.
We'll see a method with an argument later.
Uh oh, we have a problem.
This little triangle is a warning that there's a problem with this line of code.
A red dot here would mean an error in the code (which won't compile).
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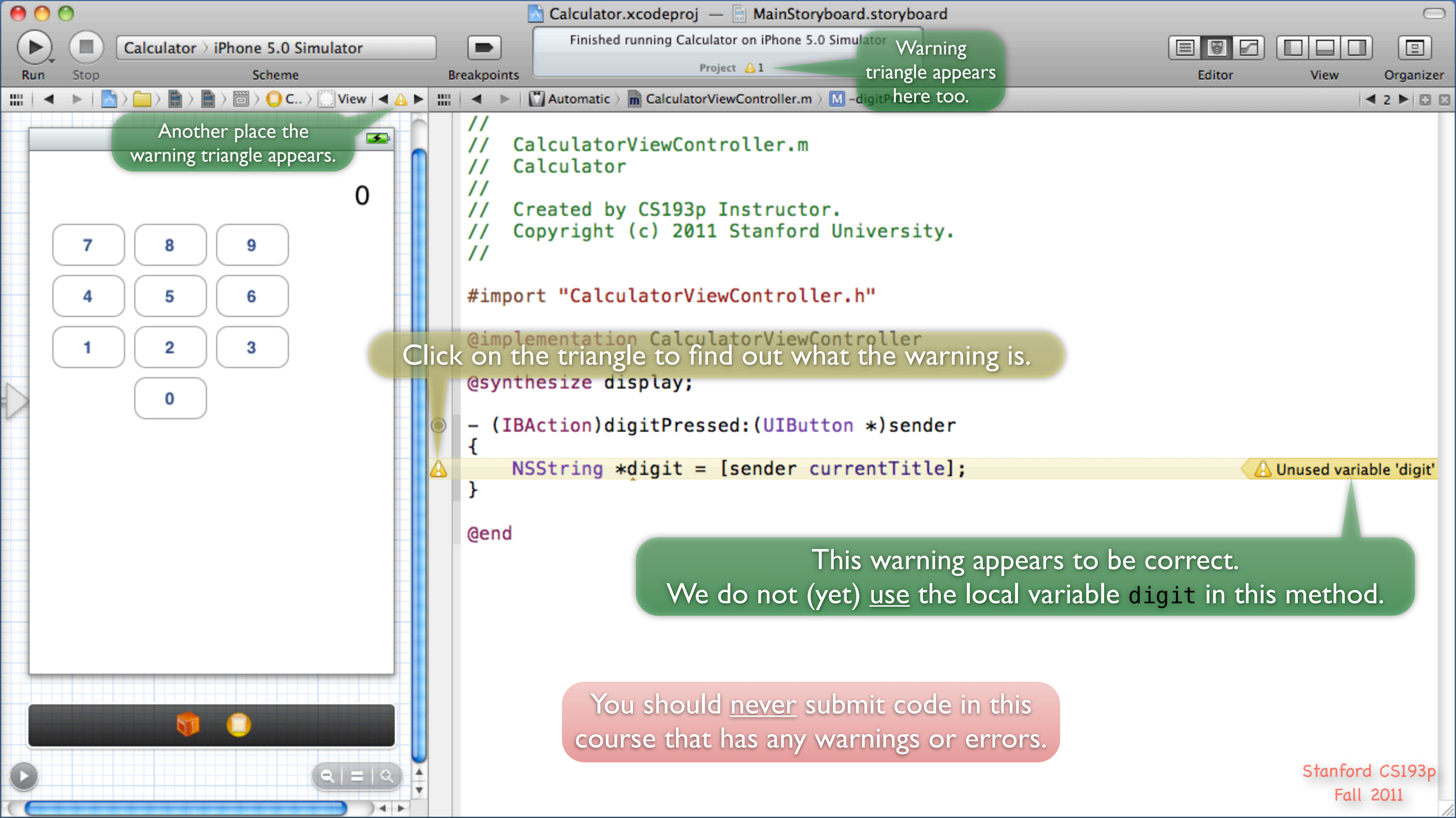
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project 1
Warning triangle appears here too.
Editor
View
Organizer
Another place the warning triangle appears.
0
7
8
9
4
5
6
1
2
3
0
Automatic
CalculatorViewController.m
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
Click on the triangle to find out what the warning is.
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
Unused variable 'digit'
}
@end
This warning appears to be correct.
We do not (yet) use the local variable digit in this method.
You should never submit code in this course that has any warnings or errors.
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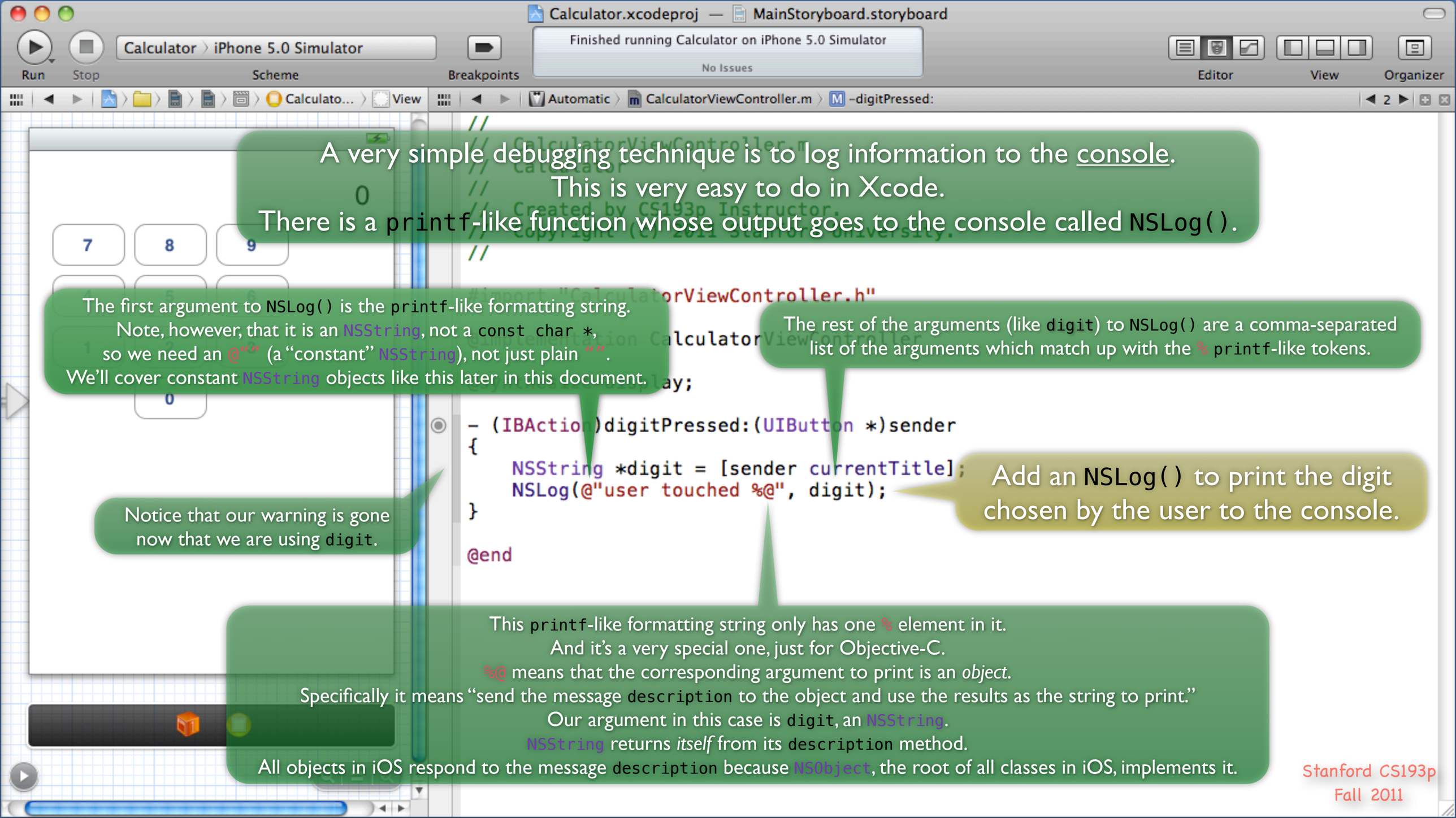
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Automatic › CalculatorViewController.m › -digitPressed:
A very simple debugging technique is to log information to the console.
This is very easy to do in Xcode.
There is a printf-like function whose output goes to the console called NSLog().
The first argument to NSLog() is the printf-like formatting string.
Note, however, that it is an NSString, not a const char *,
so we need an @"" (a "constant" NSString), not just plain "".
We'll cover constant NSString objects like this later in this document.
The rest of the arguments (like digit) to NSLog() are a comma-separated list of the arguments which match up with the % printf-like tokens.
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
NSLog(@"user touched %@", digit);
}
@end
Add an NSLog() to print the digit chosen by the user to the console.
Notice that our warning is gone now that we are using digit.
This printf-like formatting string only has one % element in it.
And it's a very special one, just for Objective-C.
%@ means that the corresponding argument to print is an object.
Specifically it means "send the message description to the object and use the results as the string to print."
Our argument in this case is digit, an NSString.
NSString returns itself from its description method.
All objects in iOS respond to the message description because NSObject, the root of all classes in iOS, implements it.
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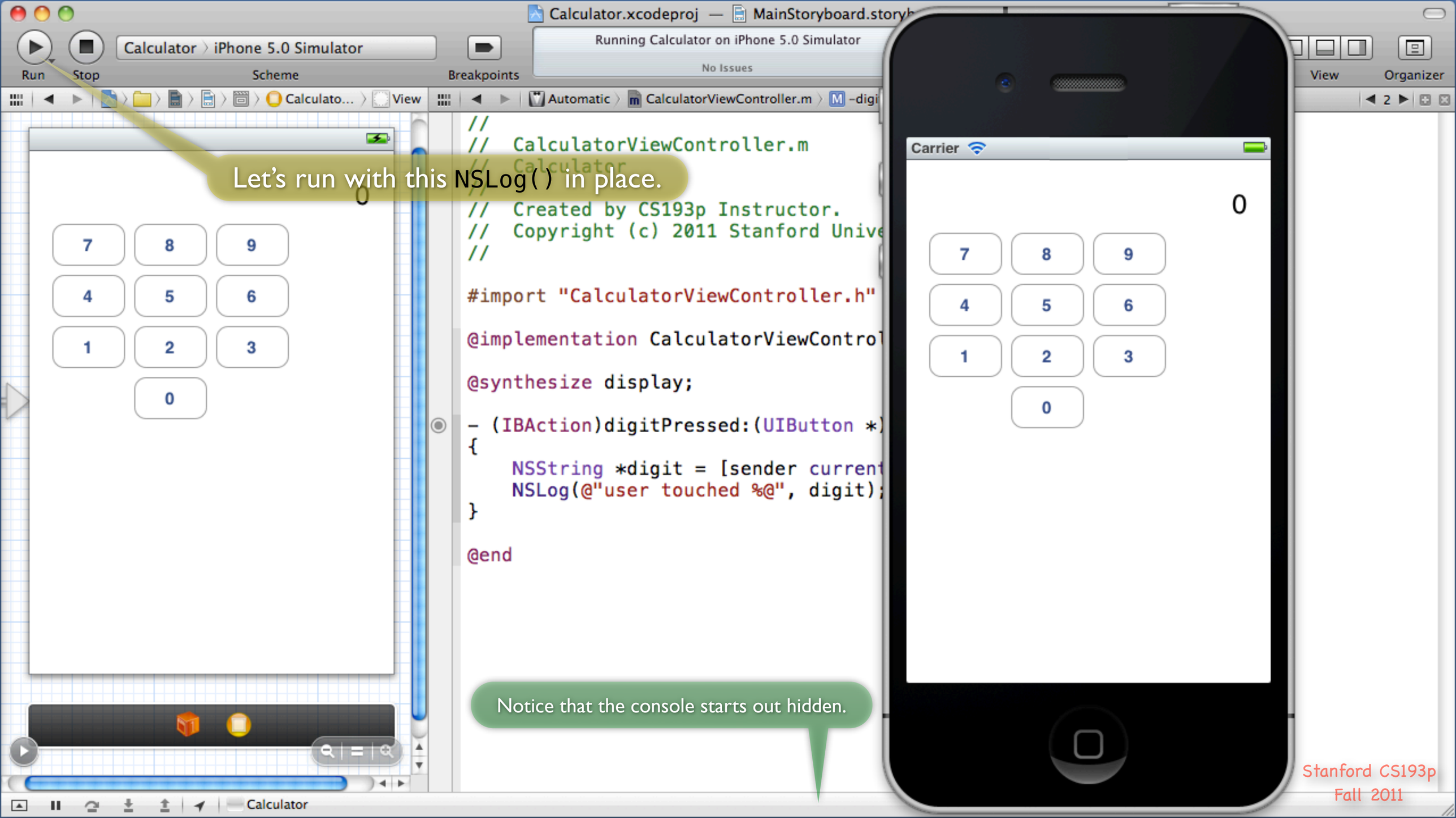
Calculator.xcodeproj — MainStoryboard.storyb
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Running Calculator on iPhone 5.0 Simulator
No Issues
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-digi
2
Let's run with this NSLog() in place.
0
7
8
9
4
5
6
1
2
3
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford Unive
//
#import "CalculatorViewController.h"
@implementation CalculatorViewContro
@synthesize display;
- (IBAction)digitPressed:(UIButton *)
{
NSString *digit = [sender current
NSLog(@"user touched %@", digit);
}
@end
Carrier
0
7
8
9
4
5
6
1
2
3
0
Notice that the console starts out hidden.
Calculator
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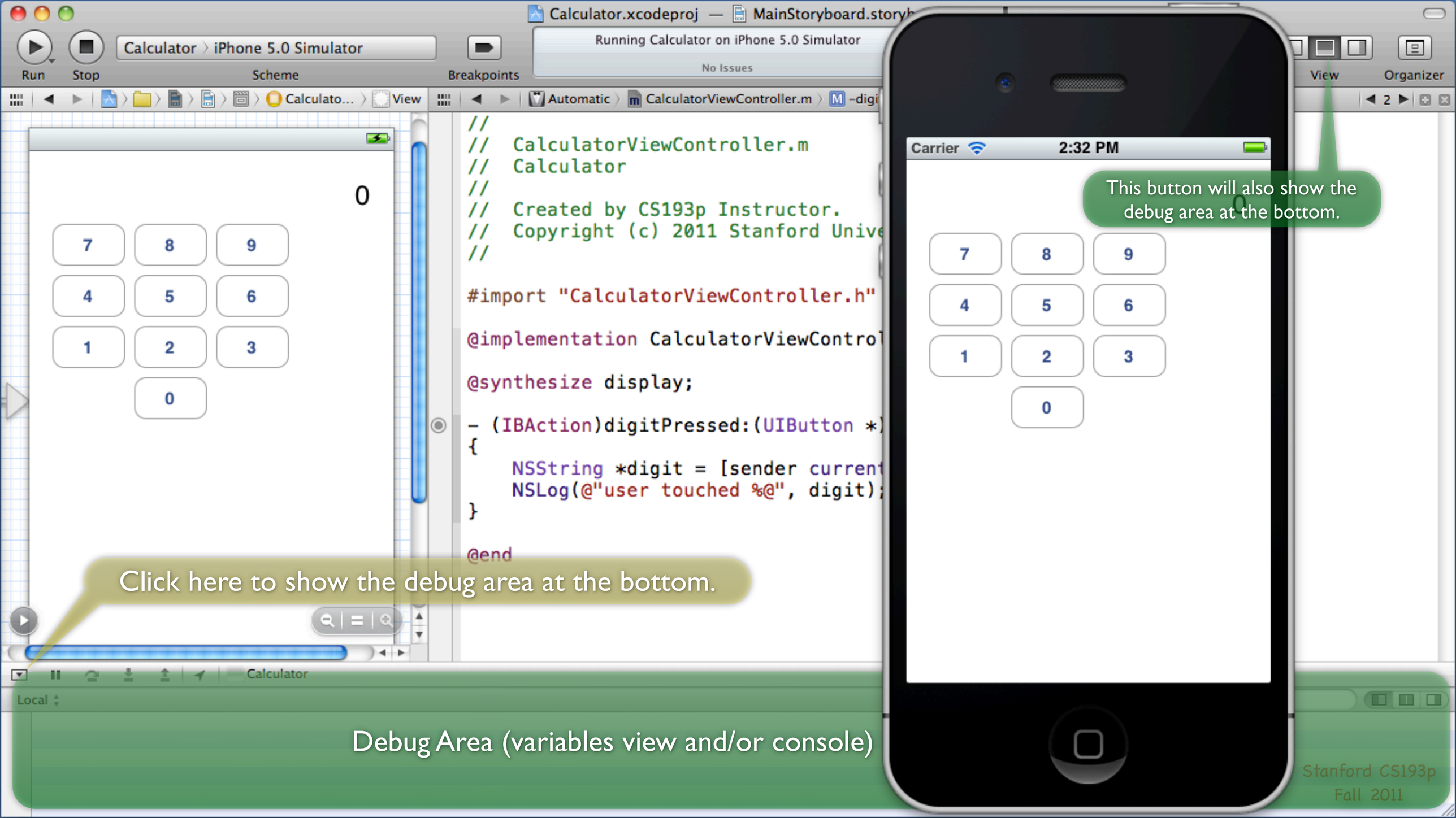
Calculator.xcodeproj — MainStoryboard.storyb
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Running Calculator on iPhone 5.0 Simulator
No Issues
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-digi
0
7
8
9
4
5
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//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford Unive
//
#import "CalculatorViewController.h"
@implementation CalculatorViewContro
@synthesize display;
- (IBAction)digitPressed:(UIButton *)
{
NSString *digit = [sender current
NSLog(@"user touched %@", digit);
}
@end
Click here to show the debug area at the bottom.
Calculator
Local
Debug Area (variables view and/or console)
Carrier
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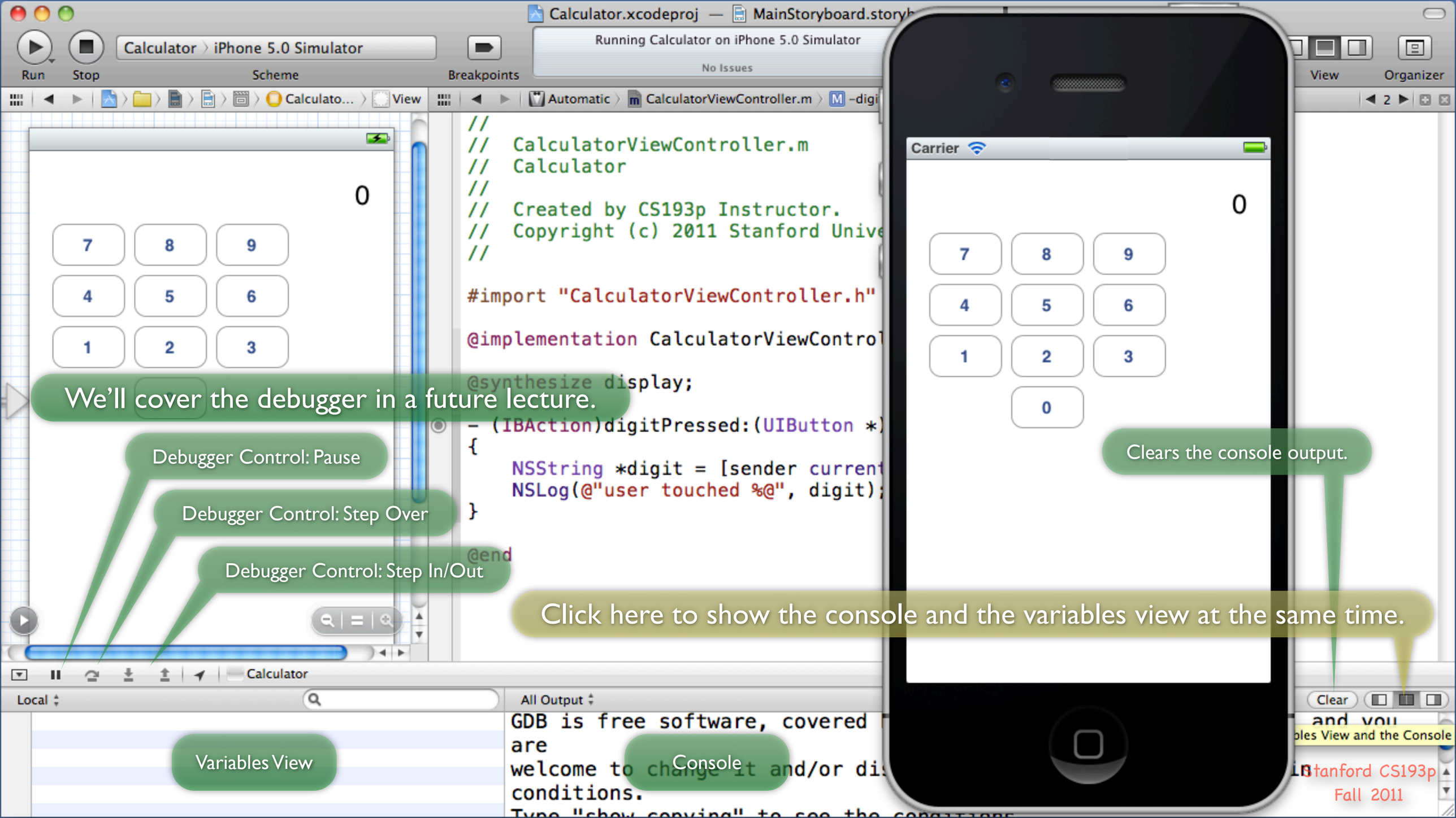
This button will also show the debug area at the bottom.
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyb
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Calculator › iPhone 5.0 Simulator
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Running Calculator on iPhone 5.0 Simulator
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@synthesize display;
- (IBAction)digitPressed:(UIButton *)
{
NSString *digit = [sender current
NSLog(@"user touched %@", digit);
}
@end
We'll cover the debugger in a future lecture.
Debugger Control: Pause
Debugger Control: Step Over
Debugger Control: Step In/Out
Calculator
Carrier
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Clears the console output.
Click here to show the console and the variables view at the same time.
Local
All Output
Clear
GDB is free software, covered
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welcome to change it and/or dis
conditions.
Variables View
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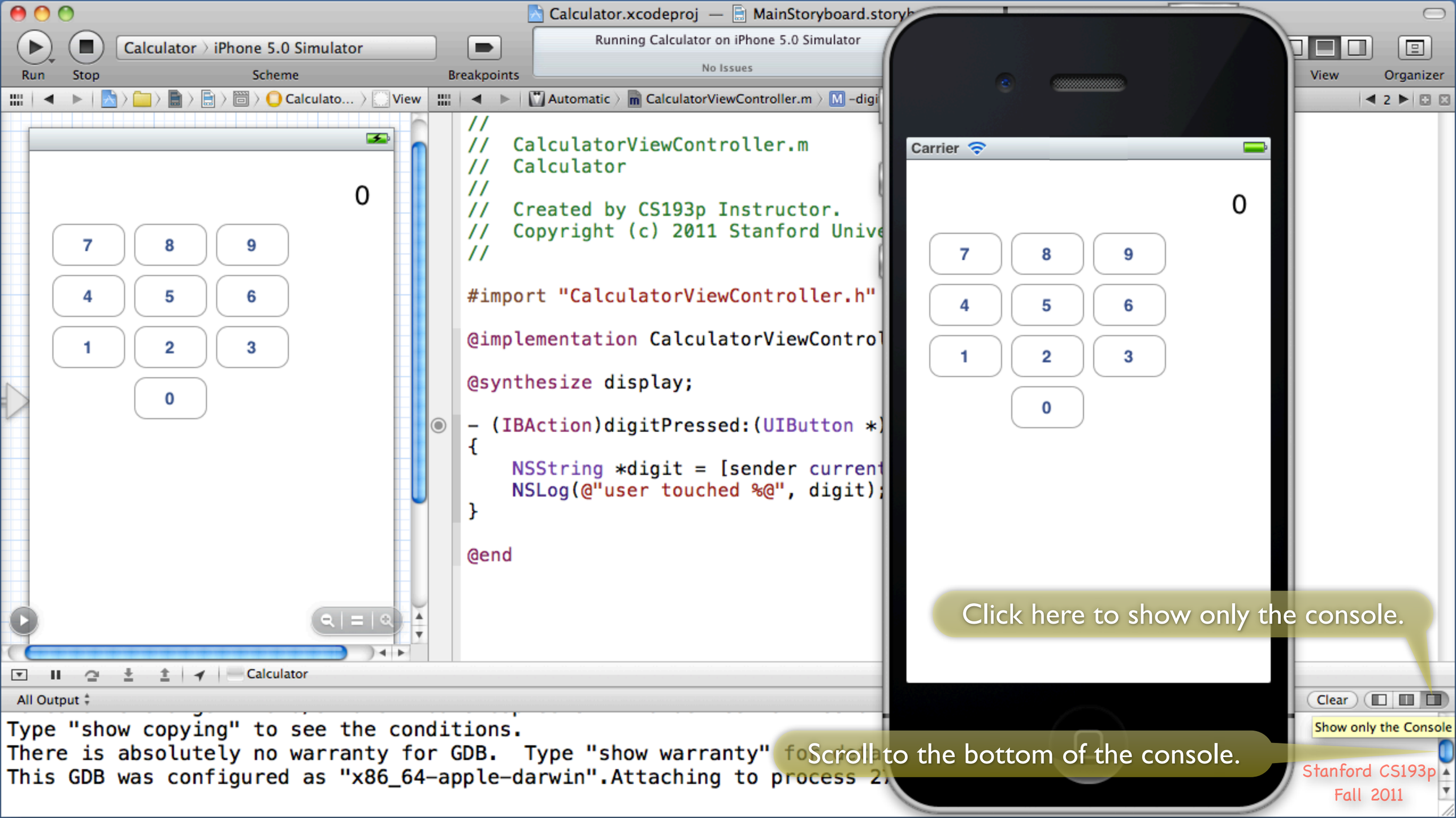
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyb
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Calculator › iPhone 5.0 Simulator
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Running Calculator on iPhone 5.0 Simulator
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// Calculator
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// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford Unive
//
#import "CalculatorViewController.h"
@implementation CalculatorViewContro
@synthesize display;
- (IBAction)digitPressed:(UIButton *)
{
NSString *digit = [sender current
NSLog(@"user touched %@", digit);
}
@end
Calculator
All Output
Clear
Show only the Console
Type "show copying" to see the conditions.
There is absolutely no warranty for GDB. Type "show warranty" fo
This GDB was configured as "x86_64-apple-darwin".Attaching to process 2
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Click here to show only the console.
Scroll to the bottom of the console.
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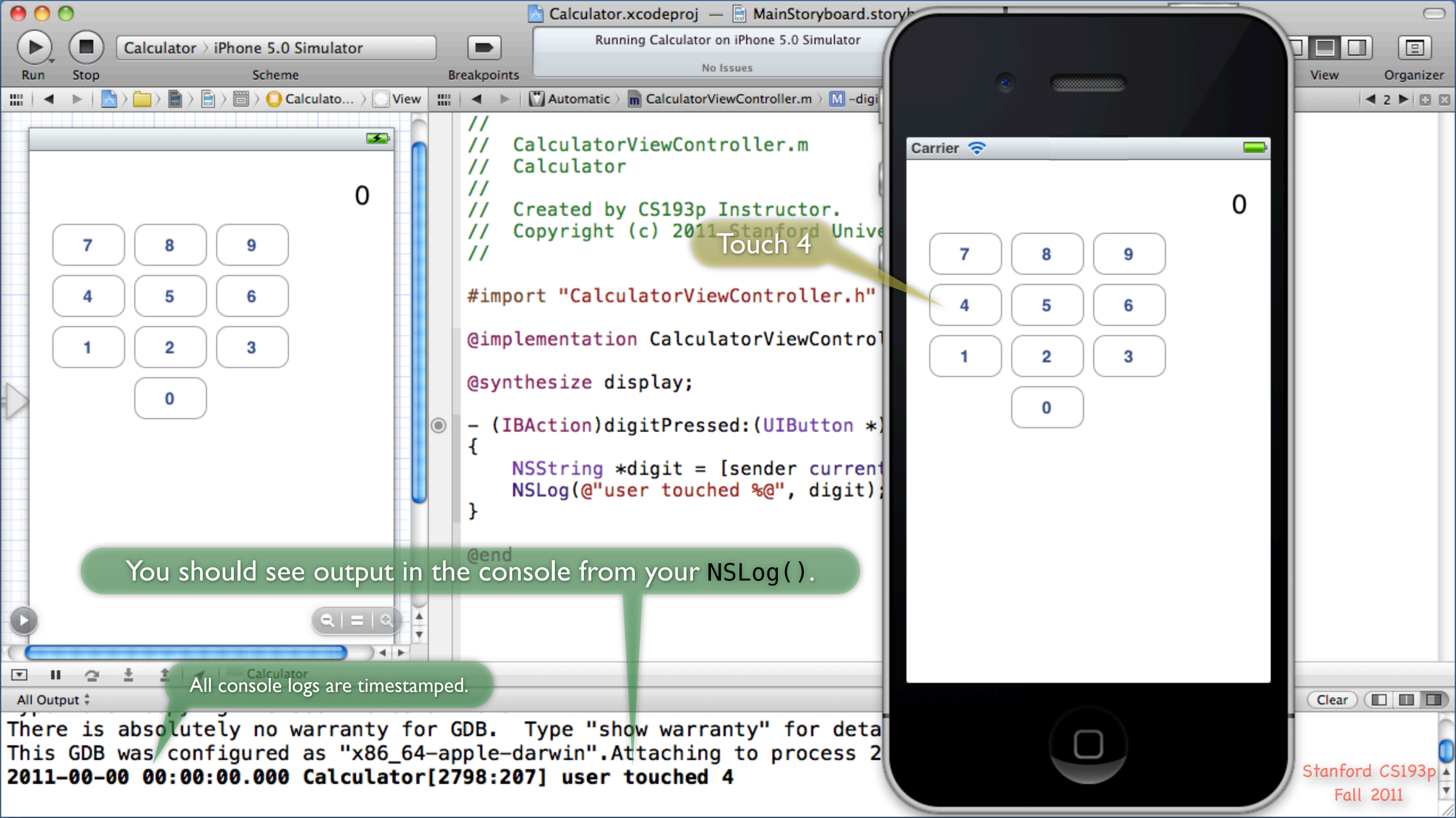
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyb
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Calculator › iPhone 5.0 Simulator
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Breakpoints
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// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford Unive
//
#import "CalculatorViewController.h"
@implementation CalculatorViewControl
@synthesize display;
- (IBAction)digitPressed:(UIButton *)
{
NSString *digit = [sender current
NSLog(@"user touched %@", digit);
}
@end
Touch 4
Carrier
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You should see output in the console from your NSLog().
All console logs are timestamped.
Calculator
All Output
Clear
There is absolutely no warranty for GDB. Type "show warranty" for deta
This GDB was configured as "x86_64-apple-darwin".Attaching to process 2
2011-00-00 00:00:00.000 Calculator[2798:207] user touched 4
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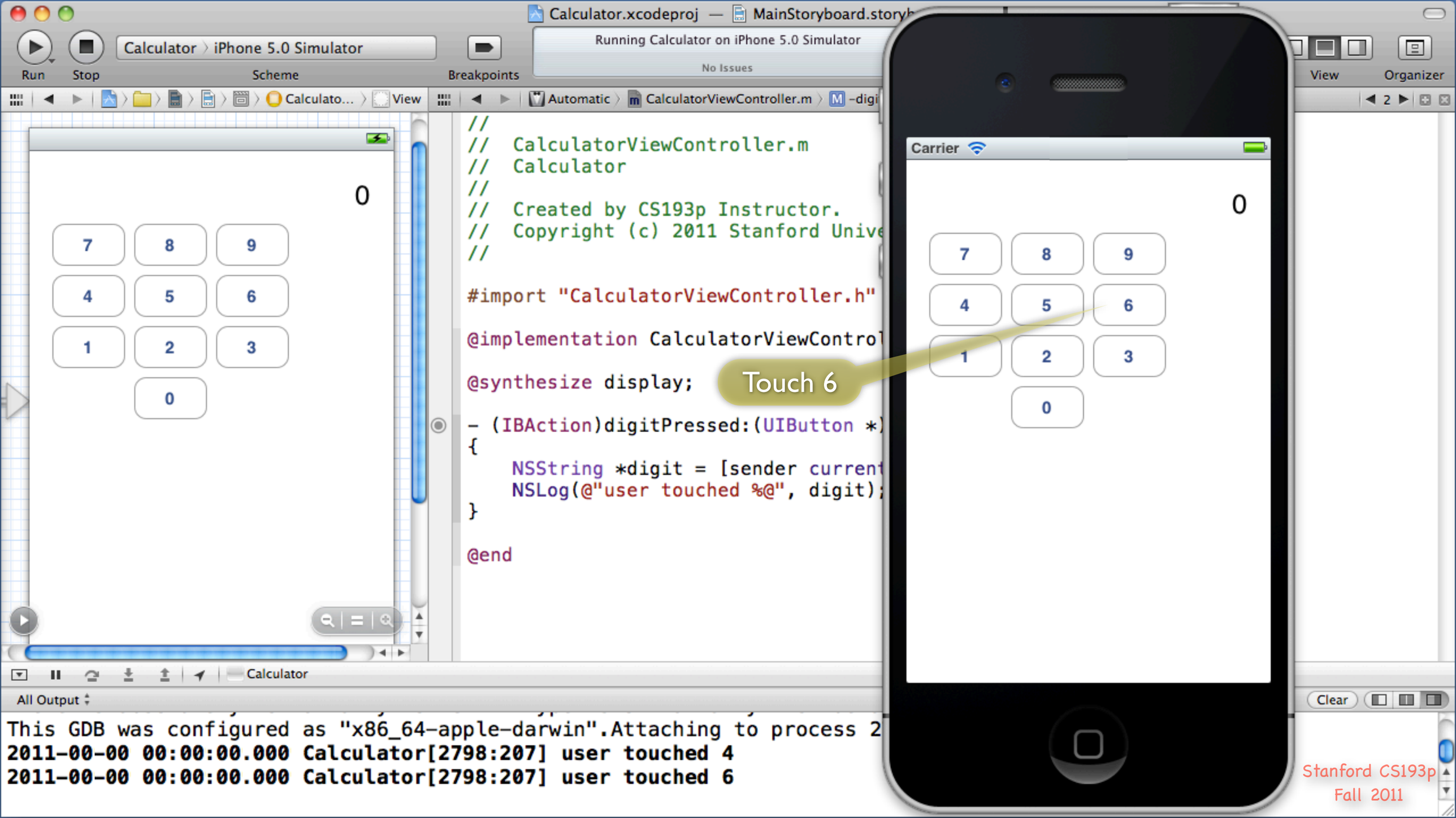
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyb
Run
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Calculator › iPhone 5.0 Simulator
Scheme
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Running Calculator on iPhone 5.0 Simulator
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//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford Unive
//
#import "CalculatorViewController.h"
@implementation CalculatorViewControl
@synthesize display;
- (IBAction)digitPressed:(UIButton *)
{
NSString *digit = [sender current
NSLog(@"user touched %@", digit);
}
@end
Calculator
All Output
Clear
This GDB was configured as "x86_64-apple-darwin".Attaching to process 2
2011-00-00 00:00:00.000 Calculator[2798:207] user touched 4
2011-00-00 00:00:00.000 Calculator[2798:207] user touched 6
Carrier
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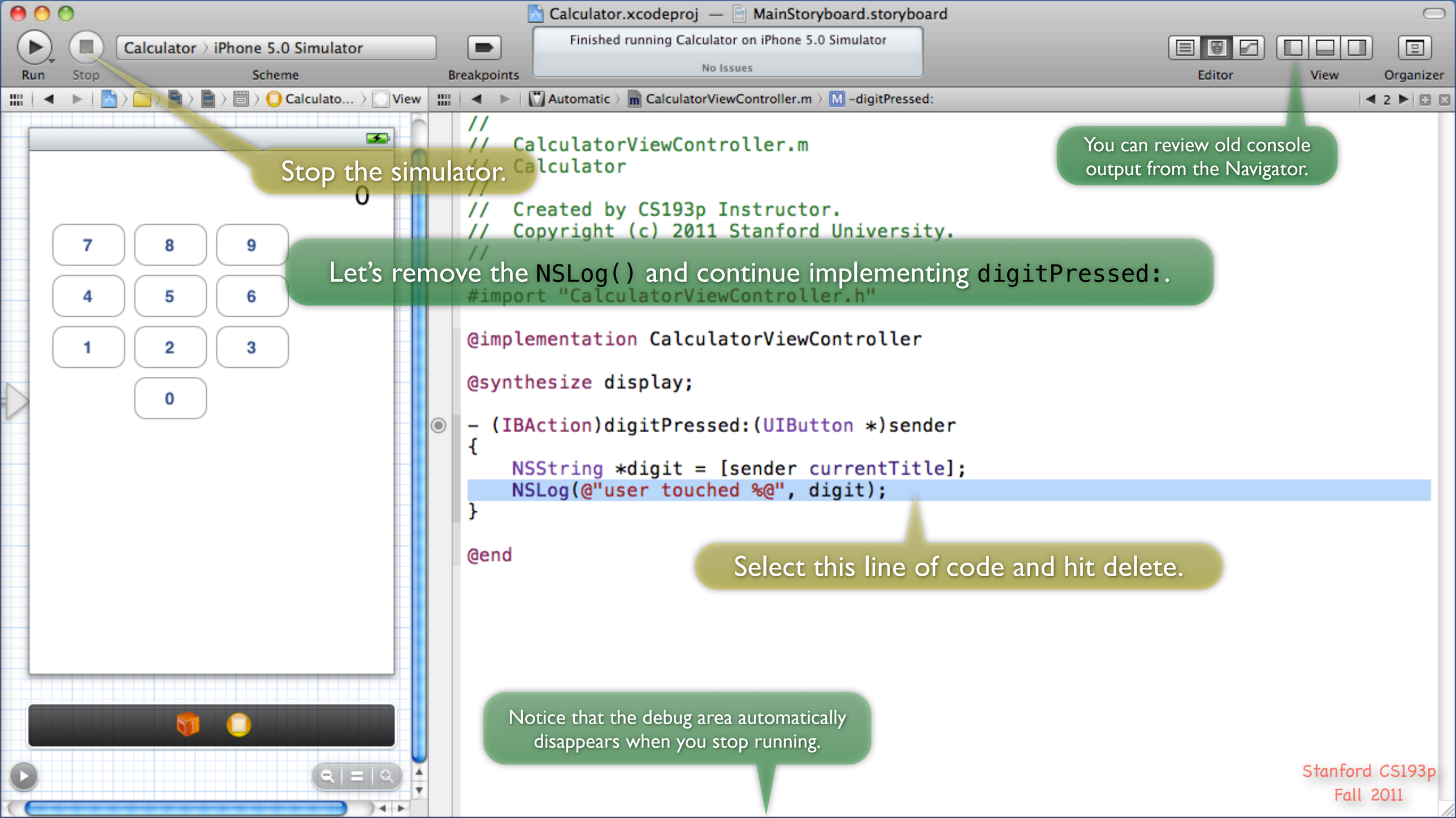
Touch 6
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Stop the simulator.
You can review old console output from the Navigator.
Let's remove the NSLog() and continue implementing digitPressed:.
Select this line of code and hit delete.
Notice that the debug area automatically disappears when you stop running.
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//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    NSLog(@"user touched %@", digit);
}
@end
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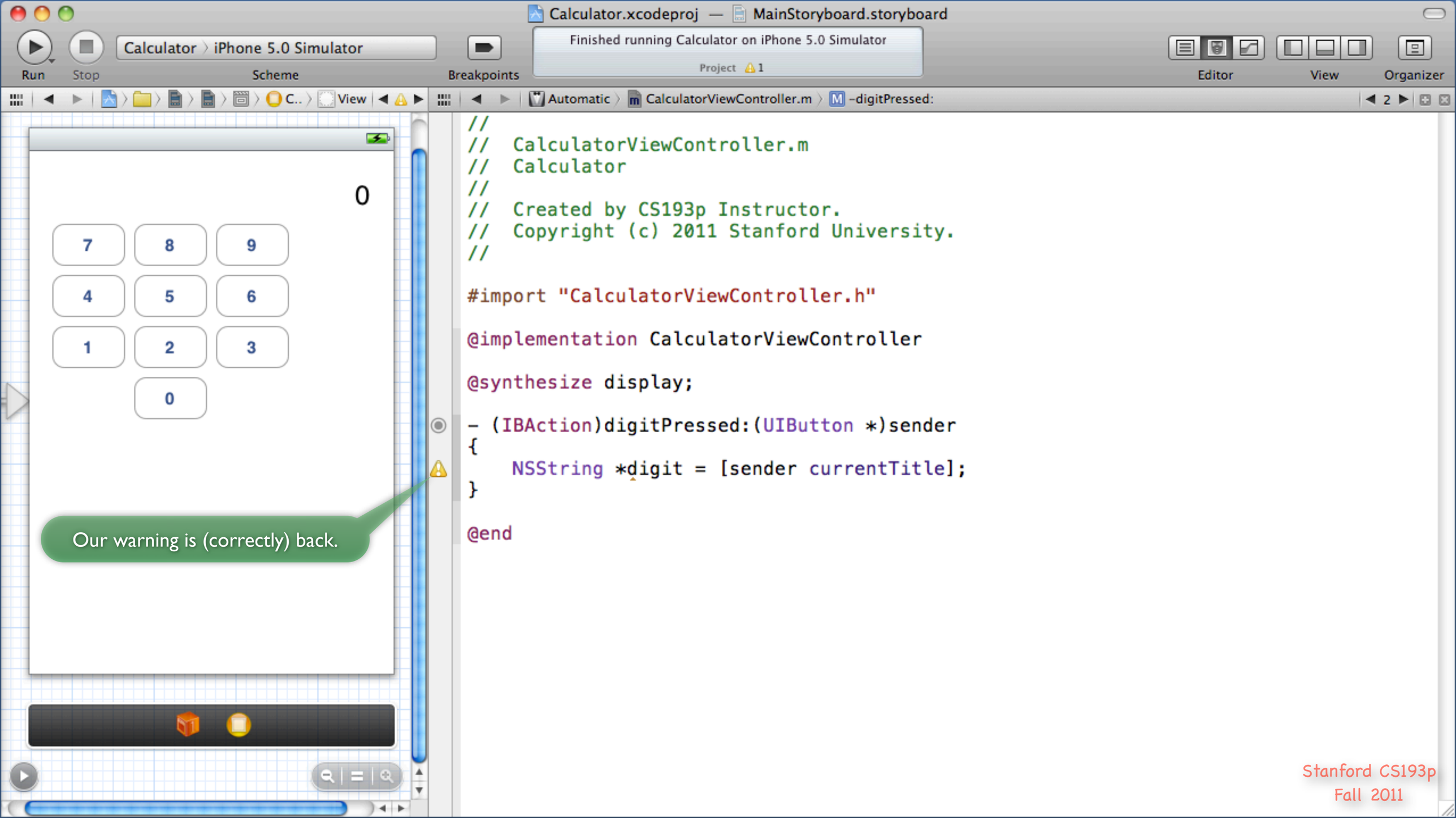
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project ⚠1
Editor
View
Organizer
C.. › View
Automatic › CalculatorViewController.m › -digitPressed:
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Our warning is (correctly) back.
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
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//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
}
@end
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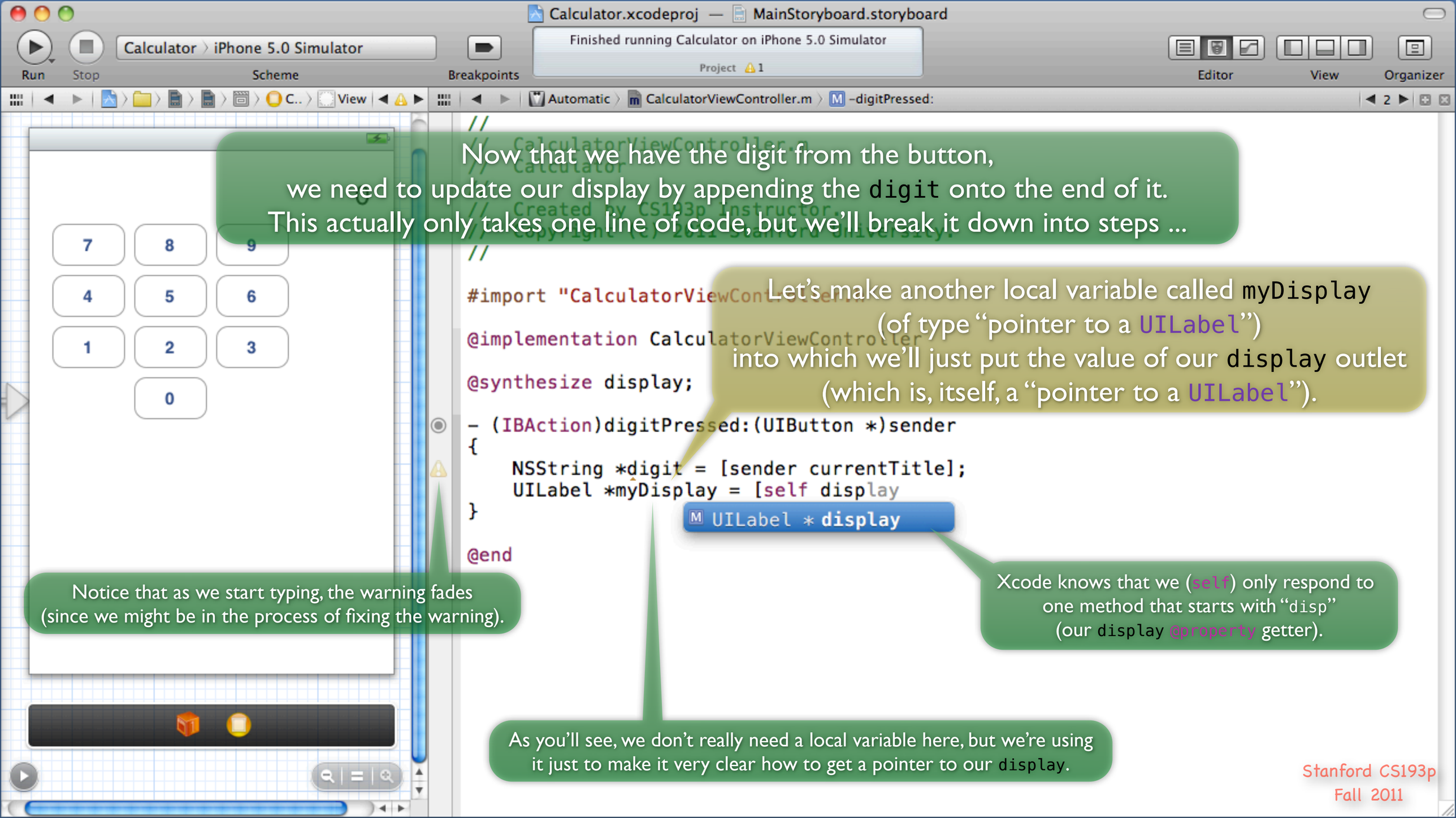
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project ⚠1
Editor
View
Organizer
Automatic › CalculatorViewController.m › -digitPressed:
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//
// CalculatorViewController.m
// Calculator
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
UILabel *myDisplay = [self display
}
@end
UILabel * display
Now that we have the digit from the button,
we need to update our display by appending the digit onto the end of it.
This actually only takes one line of code, but we'll break it down into steps ...
Let's make another local variable called myDisplay
(of type "pointer to a UILabel")
into which we'll just put the value of our display outlet
(which is, itself, a "pointer to a UILabel").
Notice that as we start typing, the warning fades
(since we might be in the process of fixing the warning).
Xcode knows that we (self) only respond to
one method that starts with "disp"
(our display @property getter).
As you'll see, we don't really need a local variable here, but we're using
it just to make it very clear how to get a pointer to our display.
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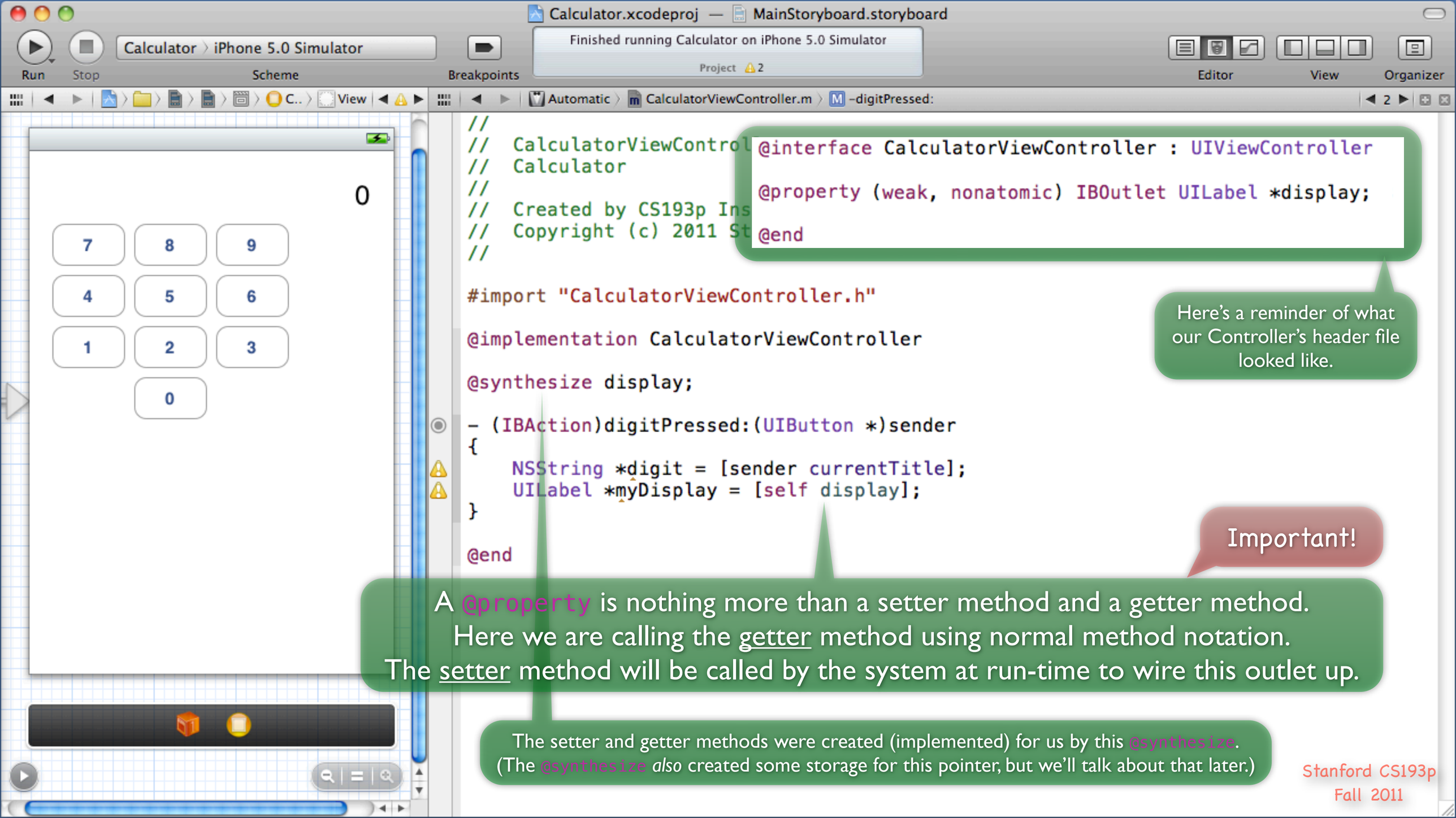
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project ⚠2
Editor
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Organizer
Automatic › CalculatorViewController.m › -digitPressed:
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4 5 6
1 2 3
0
//
// CalculatorViewControl
// Calculator
//
// Created by CS193p Ins
// Copyright (c) 2011 St
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
UILabel *myDisplay = [self display];
}
@end
@interface CalculatorViewController : UIViewController
@property (weak, nonatomic) IBOutlet UILabel *display;
@end
Here's a reminder of what our Controller's header file looked like.
Important!
A @property is nothing more than a setter method and a getter method.
Here we are calling the getter method using normal method notation.
The setter method will be called by the system at run-time to wire this outlet up.
The setter and getter methods were created (implemented) for us by this @synthesize.
(The @synthesize also created some storage for this pointer, but we'll talk about that later.)
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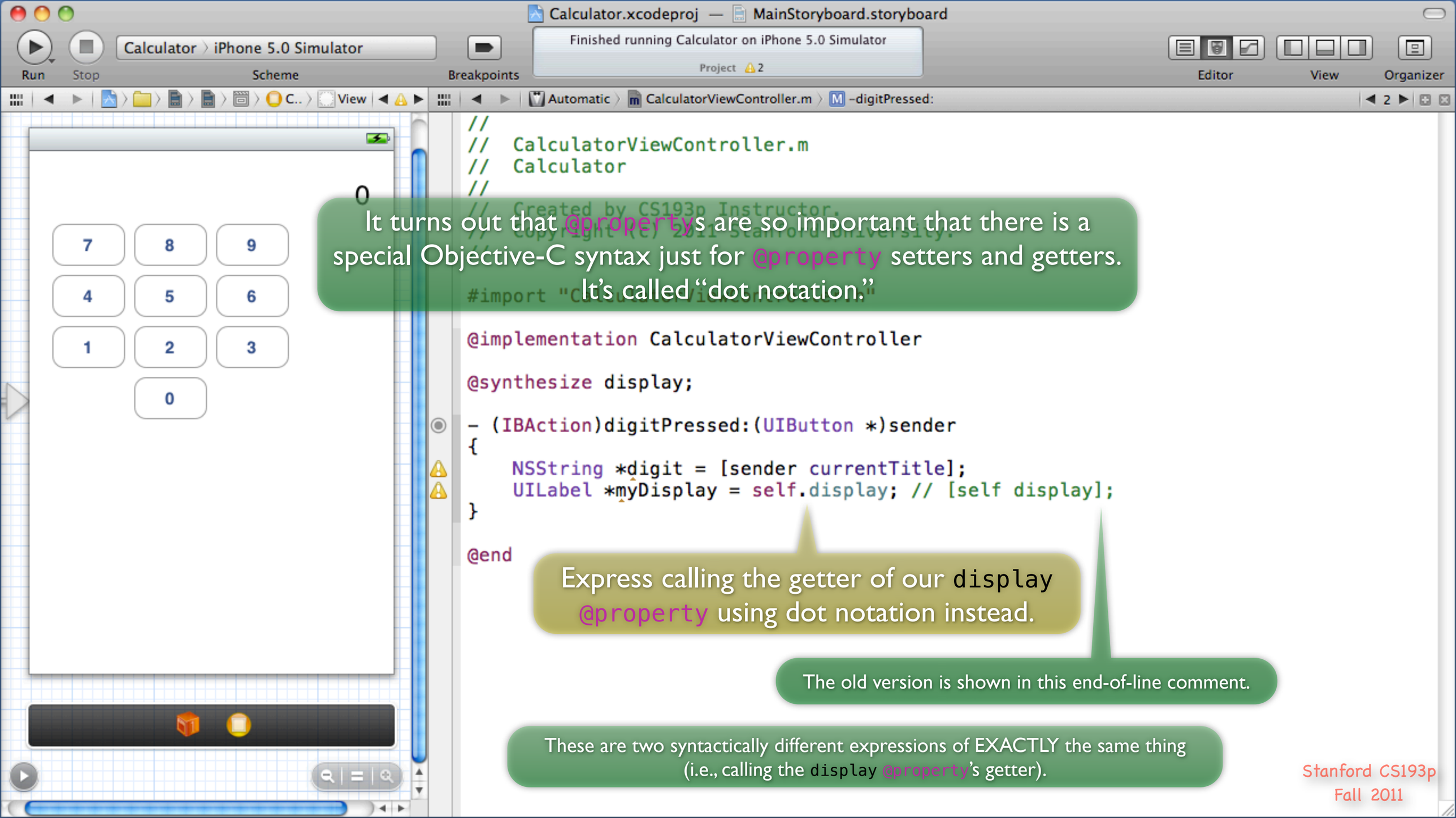
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project ⚠2
Editor
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Organizer
Automatic › CalculatorViewController.m › -digitPressed:
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//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    UILabel *myDisplay = self.display; // [self display];
}
@end
It turns out that @propertys are so important that there is a special Objective-C syntax just for @property setters and getters. It's called "dot notation."
Express calling the getter of our display @property using dot notation instead.
The old version is shown in this end-of-line comment.
These are two syntactically different expressions of EXACTLY the same thing (i.e., calling the display @property's getter).
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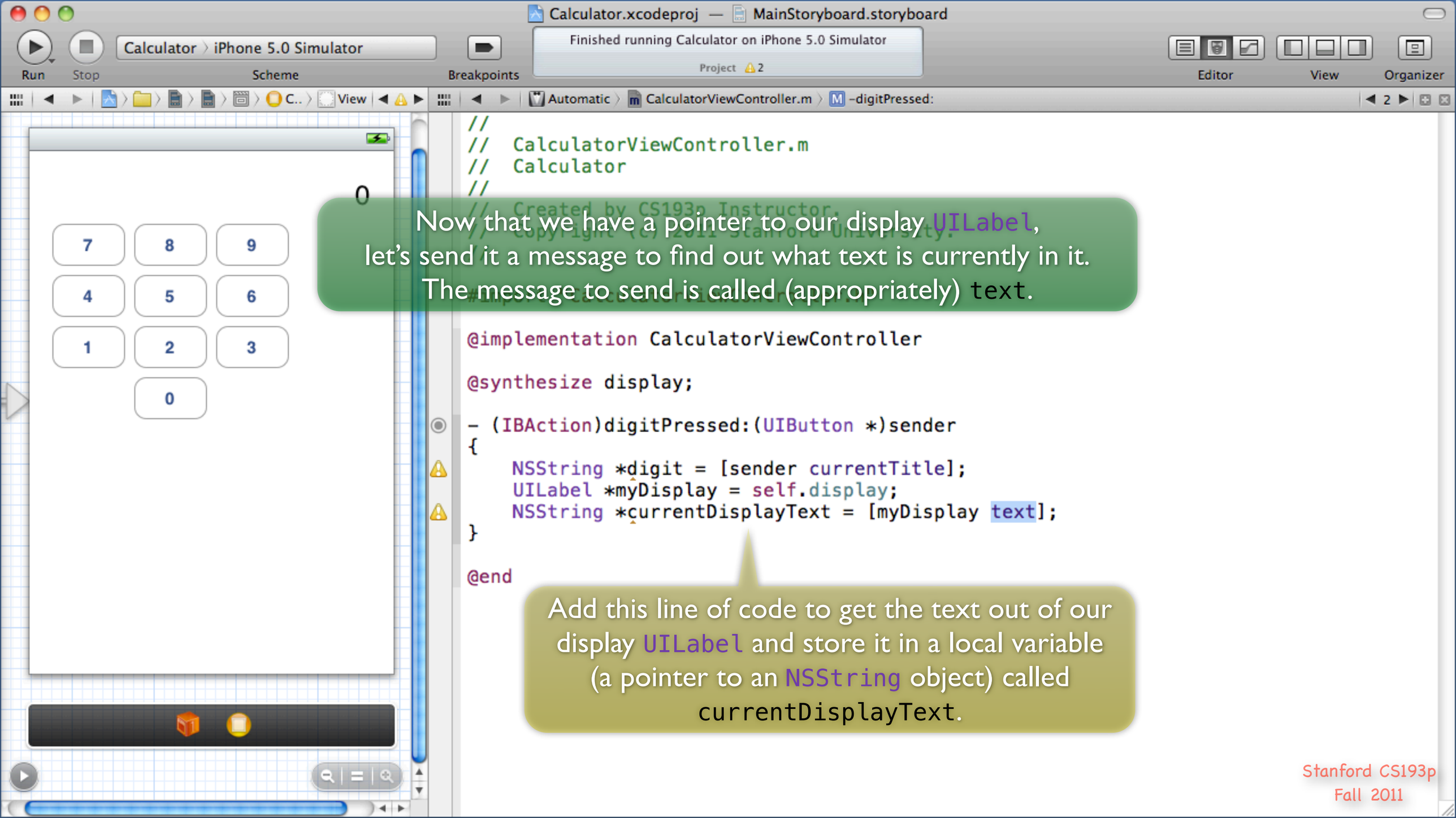
Calculator.xcodeproj — MainStoryboard.storyboard
Run
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Calculator › iPhone 5.0 Simulator
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Finished running Calculator on iPhone 5.0 Simulator
Project ⚠2
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Organizer
Automatic › CalculatorViewController.m › -digitPressed:
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//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    UILabel *myDisplay = self.display;
    NSString *currentDisplayText = [myDisplay text];
}
@end
Now that we have a pointer to our display UILabel, let's send it a message to find out what text is currently in it. The message to send is called (appropriately) text.
Add this line of code to get the text out of our display UILabel and store it in a local variable (a pointer to an NSString object) called currentDisplayText.
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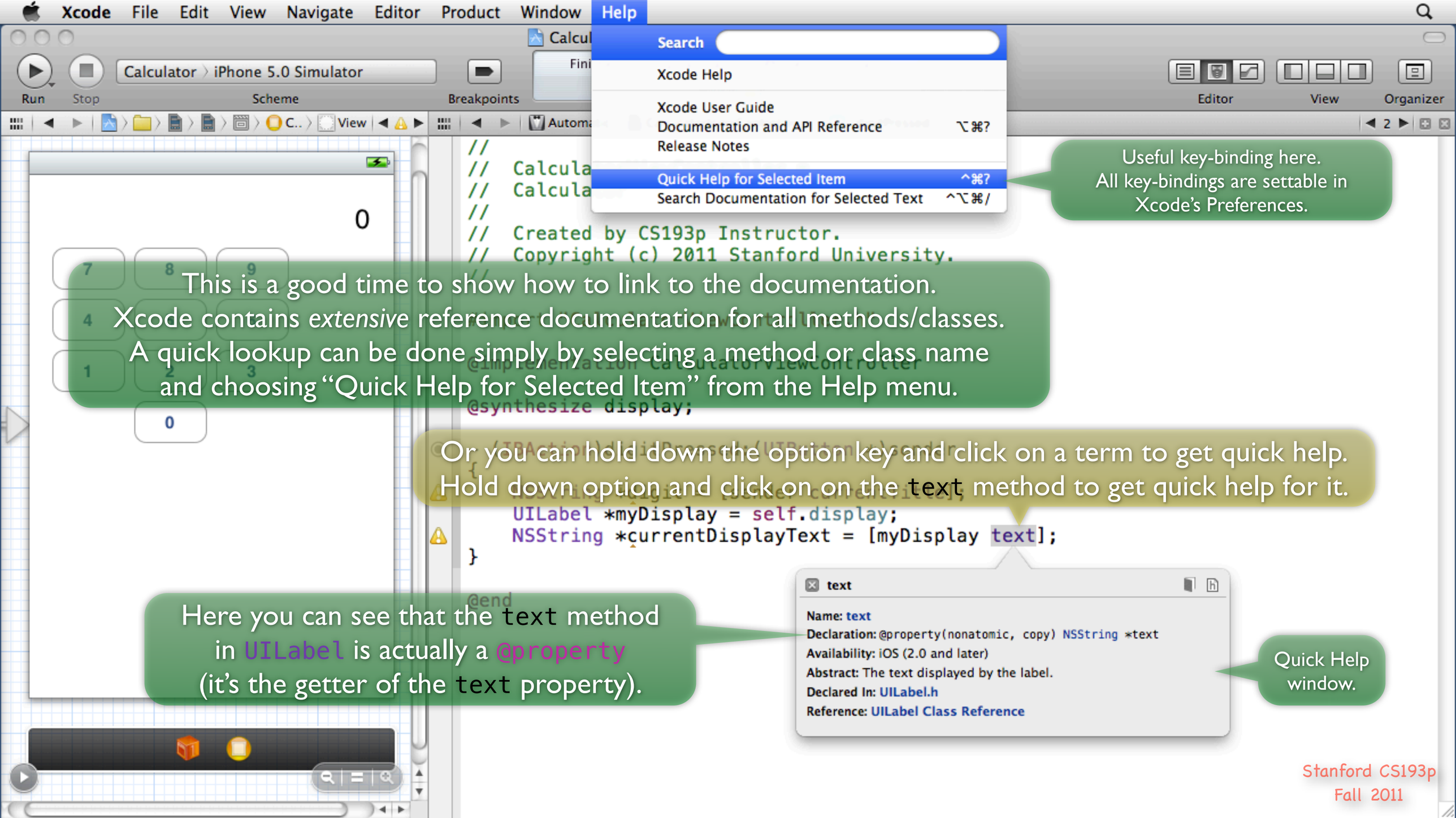
Xcode File Edit View Navigate Editor Product Window Help
Search
Xcode Help
Xcode User Guide
Documentation and API Reference ⌥⌘?
Release Notes
Quick Help for Selected Item ^⌘?
Search Documentation for Selected Text ^⌥⌘/
Useful key-binding here.
All key-bindings are settable in
Xcode's Preferences.
Run
Stop
Calculator 〉iPhone 5.0 Simulator
Scheme
Breakpoints
Editor
View
Organizer
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This is a good time to show how to link to the documentation.
Xcode contains extensive reference documentation for all methods/classes.
A quick lookup can be done simply by selecting a method or class name
and choosing "Quick Help for Selected Item" from the Help menu.
@synthesize display;
Or you can hold down the option key and click on a term to get quick help.
Hold down option and click on on the text method to get quick help for it.
UILabel *myDisplay = self.display;
NSString *currentDisplayText = [myDisplay text];
}
@end
Here you can see that the text method
in UILabel is actually a @property
(it's the getter of the text property).
text
Name: text
Declaration: @property(nonatomic, copy) NSString *text
Availability: iOS (2.0 and later)
Abstract: The text displayed by the label.
Declared In: UILabel.h
Reference: UILabel Class Reference
Quick Help
window.
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Fall 2011

Calculator.xcodeproj — MainStoryboard.storyboard

Run Stop Calculator › iPhone 5.0 Simulator Scheme Breakpoints

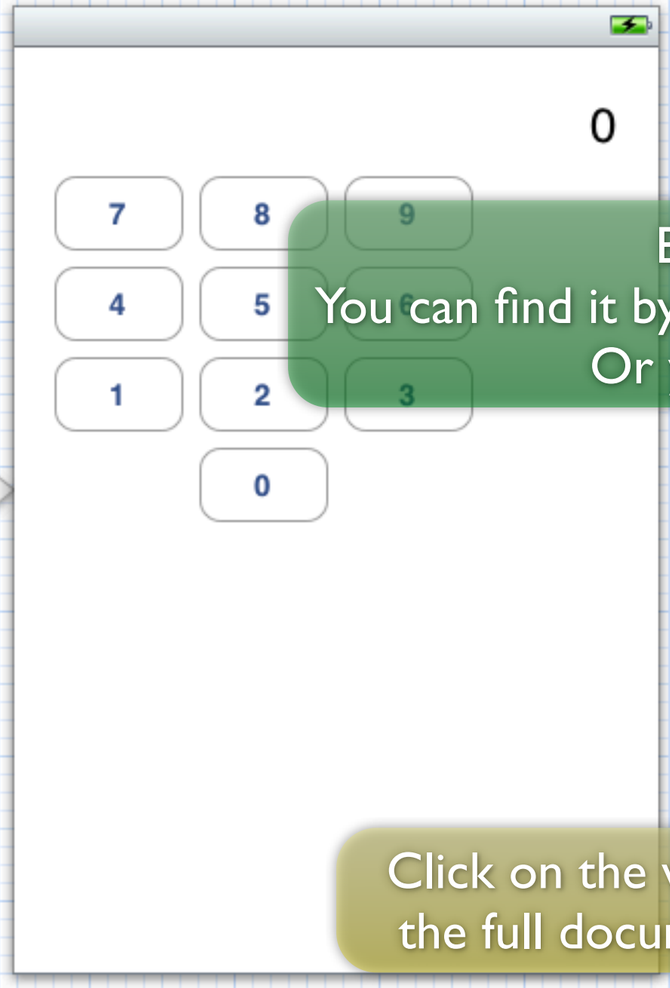
Finished running Calculator on iPhone 5.0 Simulator

Project ⚠2

Editor View Organizer

C.. › View

Automatic › CalculatorViewController.m › -digitPressed:




```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    UILabel *myDisplay = self.display;
    NSString *currentDisplayText = [myDisplay text];
}

@end
```

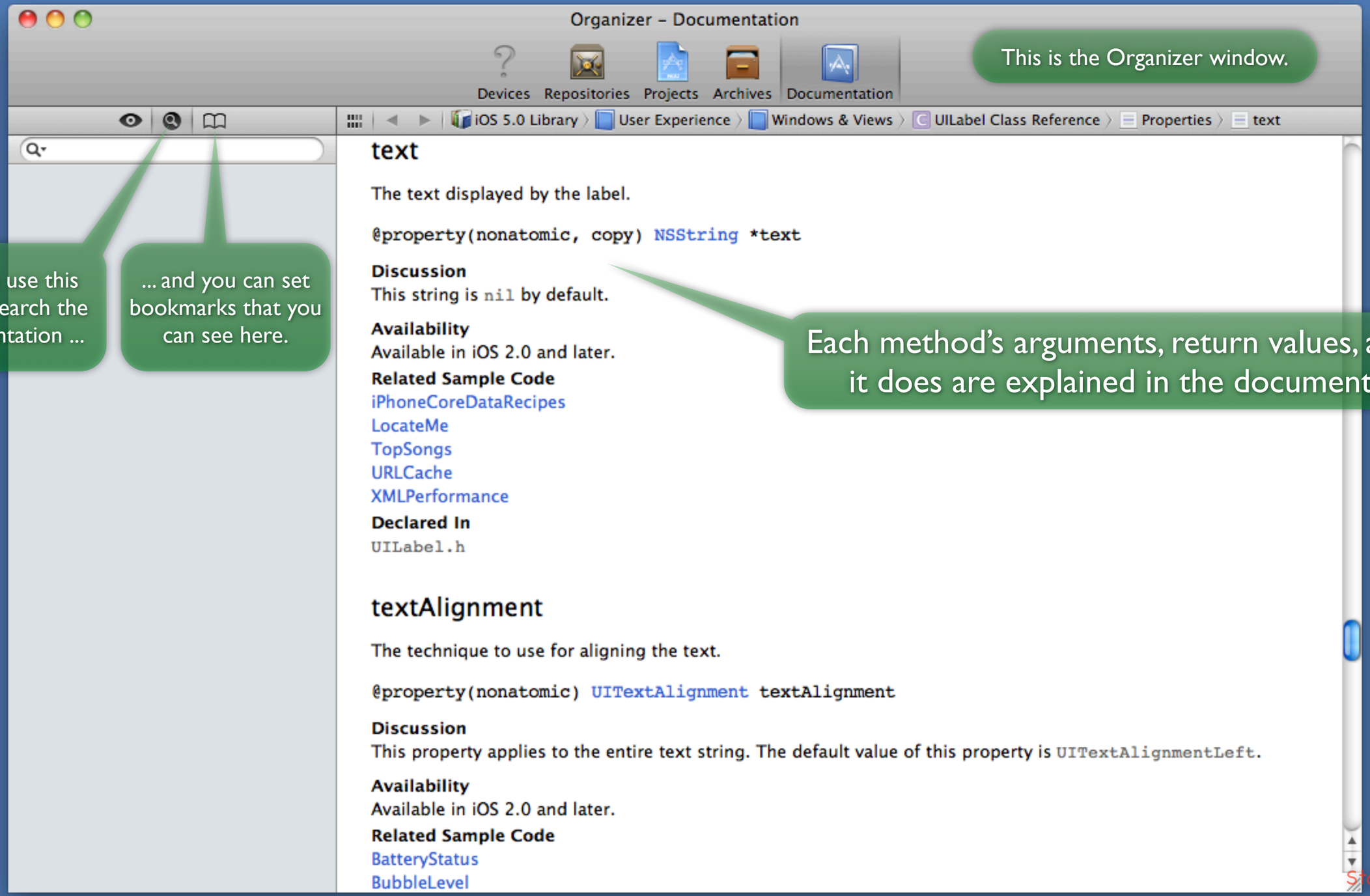
But often you want the full details on a method or class.
You can find it by choosing "Search Documentation for Selected Text" in the Help menu.
Or you can click on links in the Quick Help (as shown below).

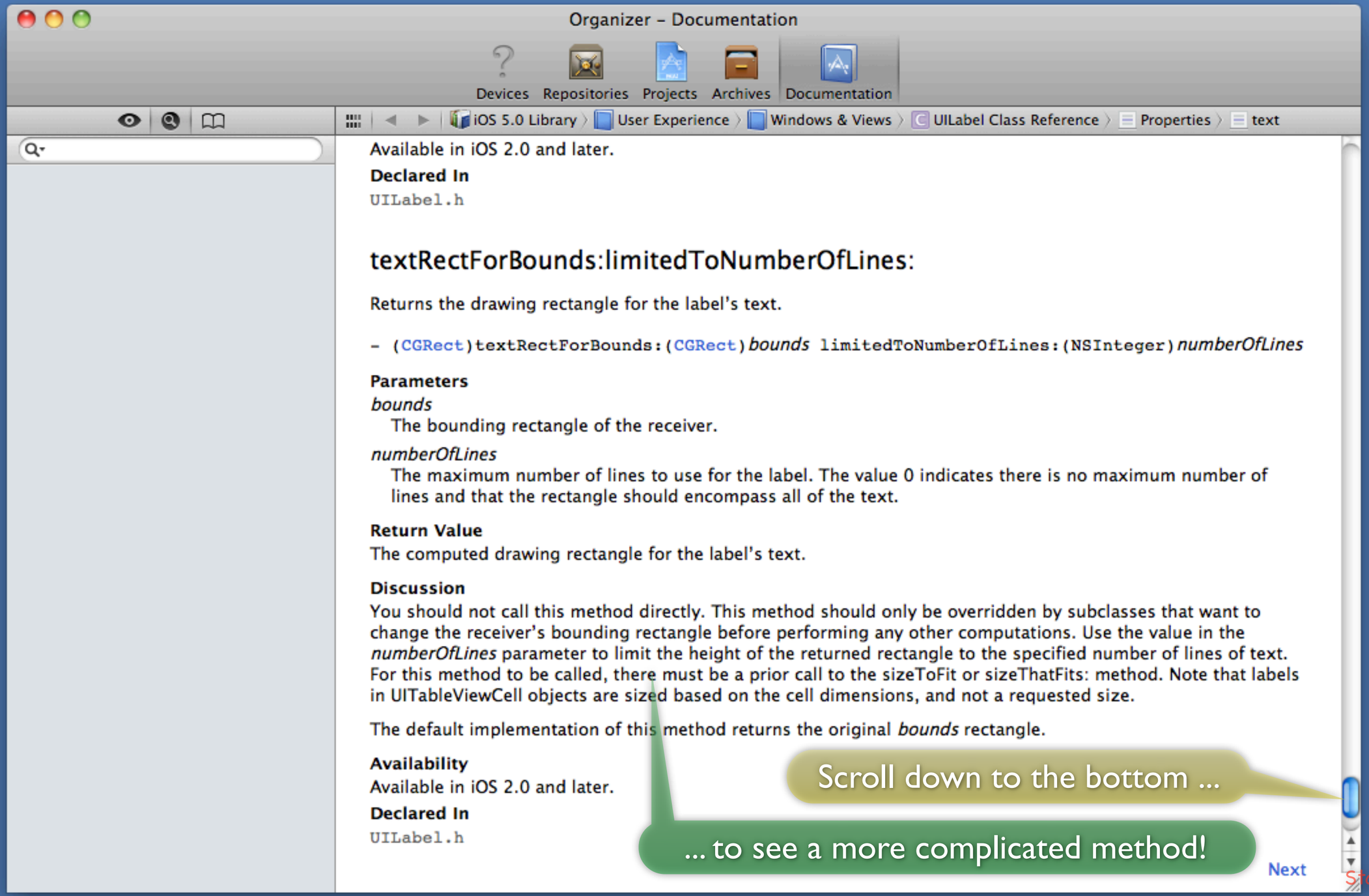
Click on the word text here to open up the full documentation on that method.

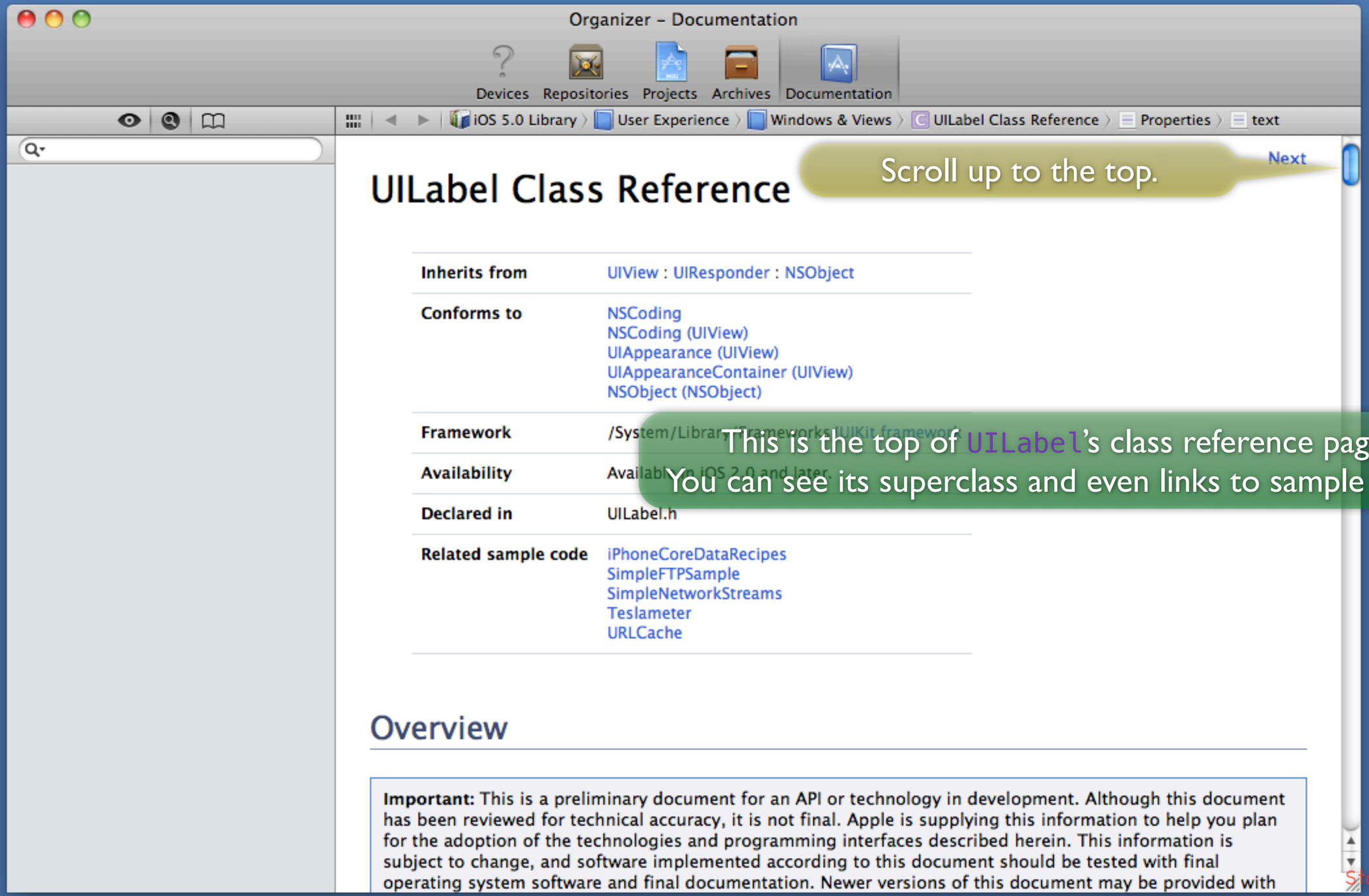
Or you can hold down the option key and double-click on a term go to the documentation.

text

Name: text
Declaration: @property(nonatomic, copy) NSString *text
Availability: iOS (2.0 and later)
Abstract: The text displayed by the label.
Declared In: UILabel.h
Reference: UILabel Class Reference


Organizer – Documentation
Devices
Repositories
Projects
Archives
Documentation
This is the Organizer window.
iOS 5.0 Library
User Experience
Windows & Views
UILabel Class Reference
Properties
text
You can use this field to search the documentation ...
... and you can set bookmarks that you can see here.
Each method's arguments, return values, and what it does are explained in the documentation.
text
The text displayed by the label.
@property(nonatomic, copy) NSString *text
Discussion
This string is nil by default.
Availability
Available in iOS 2.0 and later.
Related Sample Code
iPhoneCoreDataRecipes
LocateMe
TopSongs
URLCache
XMLPerformance
Declared In
UILabel.h
textAlignment
The technique to use for aligning the text.
@property(nonatomic) UITextAlignment textAlignment
Discussion
This property applies to the entire text string. The default value of this property is UITextAlignmentLeft.
Availability
Available in iOS 2.0 and later.
Related Sample Code
BatteryStatus
BubbleLevel


Organizer – Documentation
Devices
Repositories
Projects
Archives
Documentation
iOS 5.0 Library
User Experience
Windows & Views
UILabel Class Reference
Properties
text
Available in iOS 2.0 and later.
Declared In
UILabel.h
textRectForBounds:limitedToNumberOfLines:
Returns the drawing rectangle for the label's text.
- (CGRect)textRectForBounds:(CGRect)bounds limitedToNumberOfLines:(NSInteger)numberOfLines
Parameters
bounds
The bounding rectangle of the receiver.
numberOfLines
The maximum number of lines to use for the label. The value 0 indicates there is no maximum number of lines and that the rectangle should encompass all of the text.
Return Value
The computed drawing rectangle for the label's text.
Discussion
You should not call this method directly. This method should only be overridden by subclasses that want to change the receiver's bounding rectangle before performing any other computations. Use the value in the numberOfLines parameter to limit the height of the returned rectangle to the specified number of lines of text. For this method to be called, there must be a prior call to the sizeToFit or sizeThatFits: method. Note that labels in UITableViewCell objects are sized based on the cell dimensions, and not a requested size.
The default implementation of this method returns the original bounds rectangle.
Availability
Available in iOS 2.0 and later.
Declared In
UILabel.h
Scroll down to the bottom ...
... to see a more complicated method!
Next


Organizer – Documentation
Devices
Repositories
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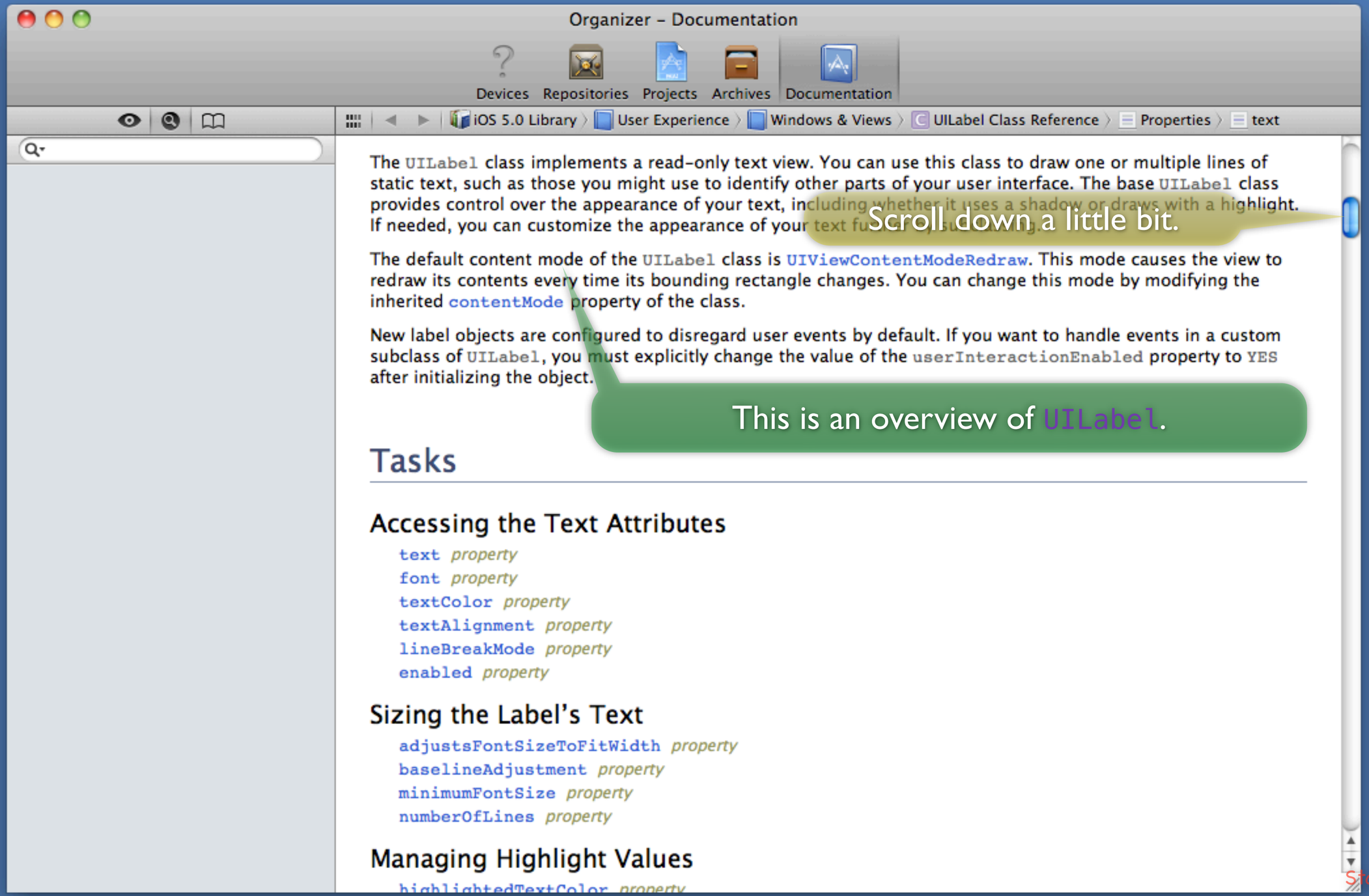
Archives
Documentation
iOS 5.0 Library
User Experience
Windows & Views
UILabel Class Reference
Properties
text
Next
Scroll up to the top.
UILabel Class Reference
Inherits from
UIView : UIResponder : NSObject
Conforms to
NSCoding
NSCoding (UIView)
UIAppearance (UIView)
UIAppearanceContainer (UIView)
NSObject (NSObject)
Framework
/System/Library/Frameworks/UIKit.framework
Availability
Available in iOS 2.0 and later.
Declared in
UILabel.h
Related sample code
iPhoneCoreDataRecipes
SimpleFTPSample
SimpleNetworkStreams
Teslameter
URLCache
This is the top of UILabel's class reference page.
You can see its superclass and even links to sample code.
Overview
Important: This is a preliminary document for an API or technology in development. Although this document has been reviewed for technical accuracy, it is not final. Apple is supplying this information to help you plan for the adoption of the technologies and programming interfaces described herein. This information is subject to change, and software implemented according to this document should be tested with final operating system software and final documentation. Newer versions of this document may be provided with


Organizer – Documentation
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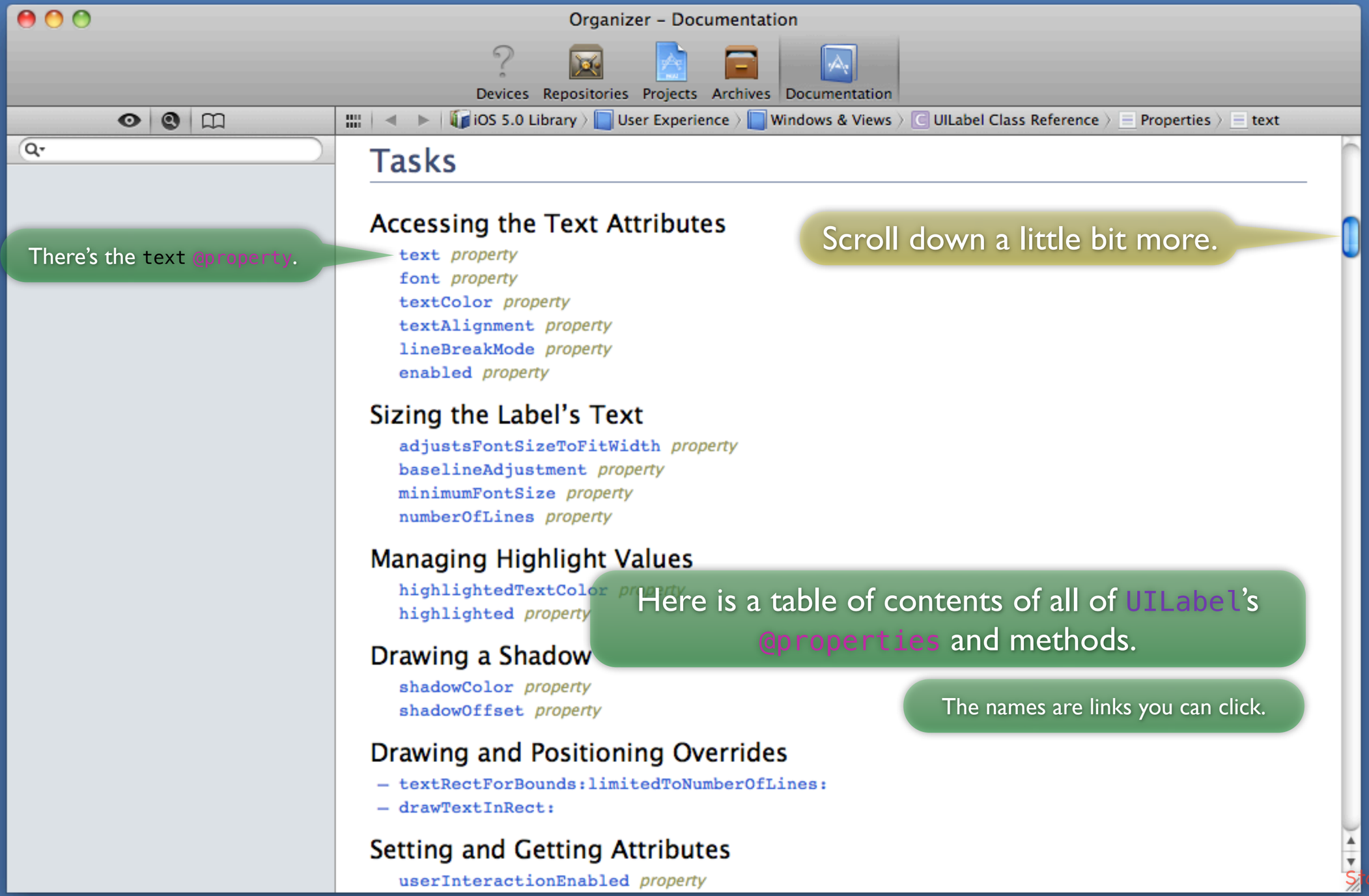
UILabel Class Reference
Properties
text
The UILabel class implements a read-only text view. You can use this class to draw one or multiple lines of static text, such as those you might use to identify other parts of your user interface. The base UILabel class provides control over the appearance of your text, including whether it uses a shadow or draws with a highlight. If needed, you can customize the appearance of your text fu
The default content mode of the UILabel class is UIViewContentModeRedraw. This mode causes the view to redraw its contents every time its bounding rectangle changes. You can change this mode by modifying the inherited contentMode property of the class.
New label objects are configured to disregard user events by default. If you want to handle events in a custom subclass of UILabel, you must explicitly change the value of the userInteractionEnabled property to YES after initializing the object.
Scroll down a little bit.
This is an overview of UILabel.
Tasks
Accessing the Text Attributes
text property
font property
textColor property
textAlignment property
lineBreakMode property
enabled property
Sizing the Label's Text
adjustsFontSizeToFitWidth property
baselineAdjustment property
minimumFontSize property
numberOfLines property
Managing Highlight Values
highlightedTextColor property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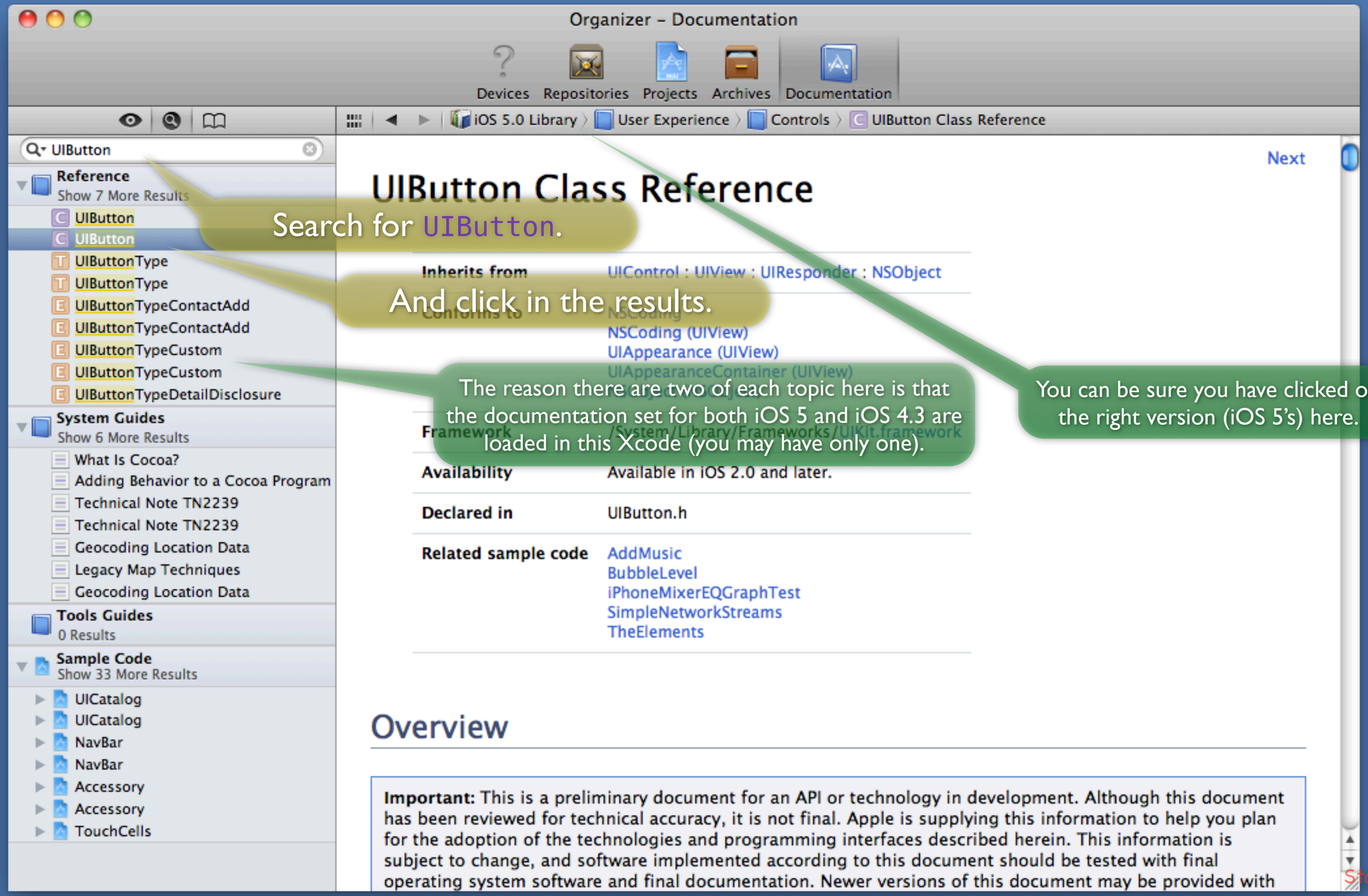
Drawing a Shadow
shadowColor property
shadowOffset property
Drawing and Positioning Overrides
– textRectForBounds:limitedToNumberOfLines:
– drawTextInRect:
Setting and Getting Attributes
userInteractionEnabled property
There's the text @property.
Scroll down a little bit more.
Here is a table of contents of all of UILabel's @properties and methods.
The names are links you can click.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Technical Note TN2239
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Legacy Map Techniques
Geocoding Location Data
Tools Guides
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Sample Code
Show 33 More Results
UICatalog
UICatalog
NavBar
NavBar
Accessory
Accessory
TouchCells
Search for UIButton.
And click in the results.
The reason there are two of each topic here is that the documentation set for both iOS 5 and iOS 4.3 are loaded in this Xcode (you may have only one).
You can be sure you have clicked on the right version (iOS 5's) here.
Next
UIButton Class Reference
Inherits from
UIControl : UIView : UIResponder : NSObject
NSCoding (UIView)
UIAppearance (UIView)
UIAppearanceContainer (UIView)
Framework
/System/Library/Frameworks/UIKit.framework
Availability
Available in iOS 2.0 and later.
Declared in
UIButton.h
Related sample code
AddMusic
BubbleLevel
iPhoneMixerEQGraphTest
SimpleNetworkStreams
TheElements
Overview
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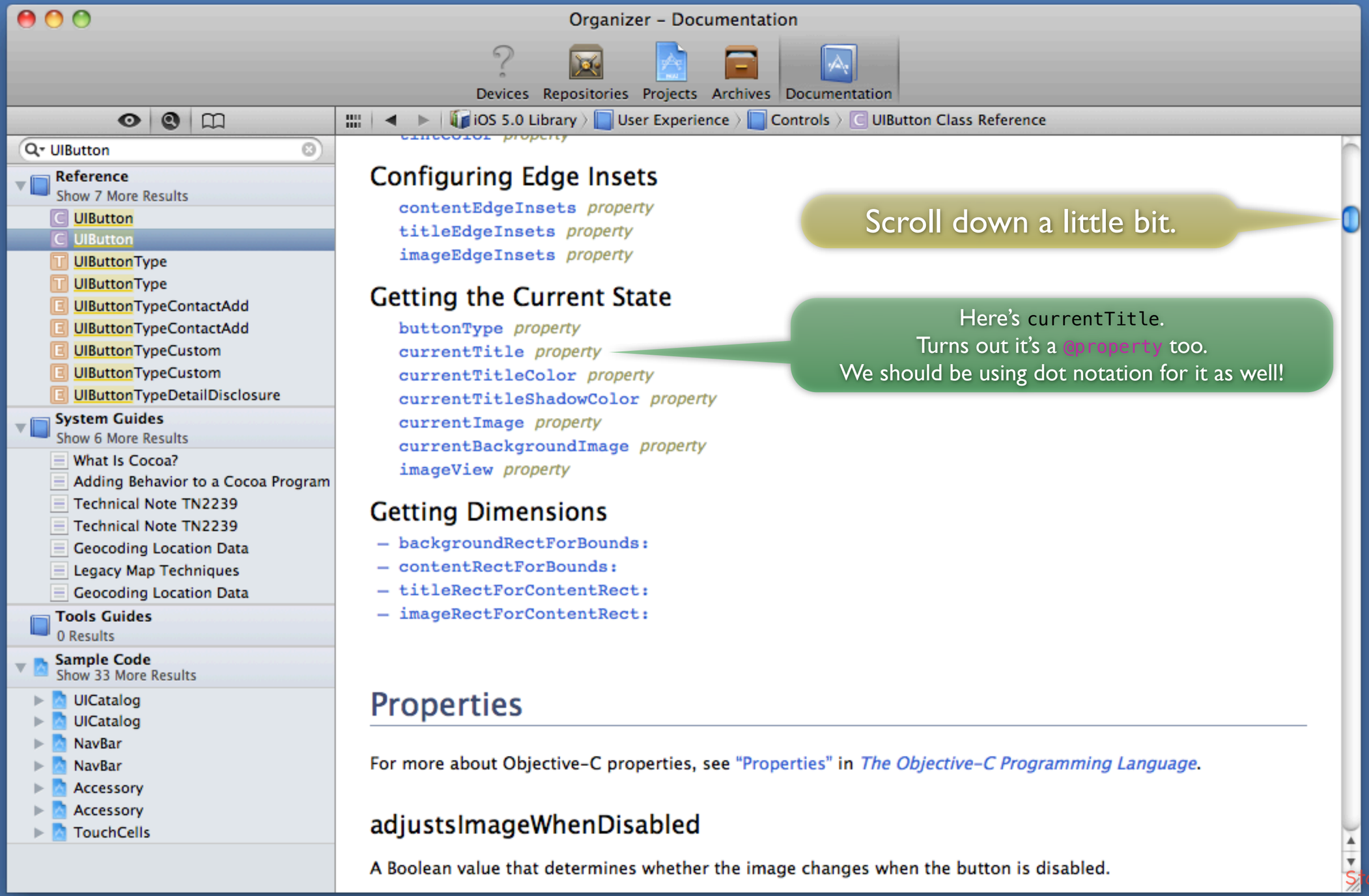
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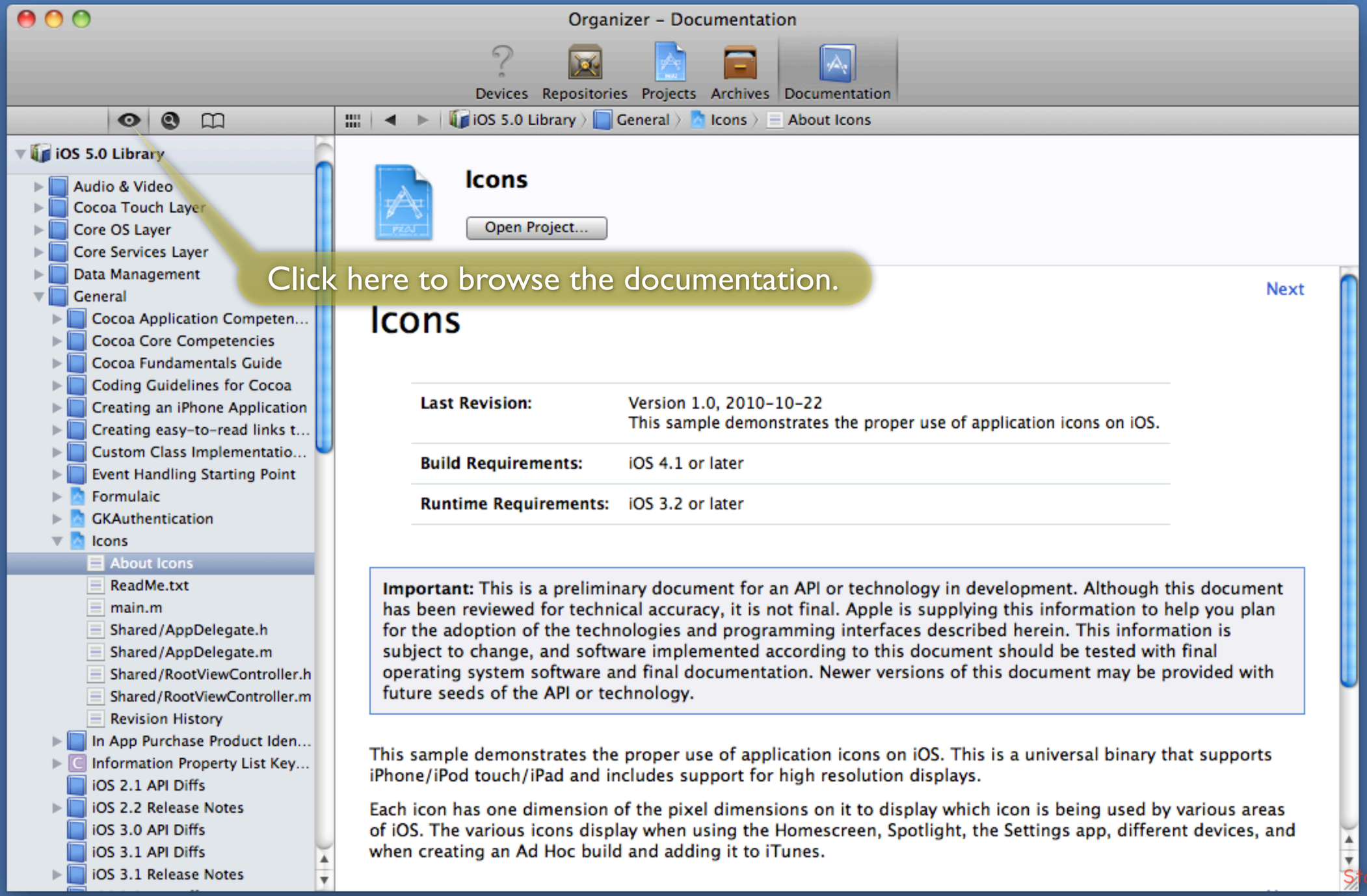
currentTitleColor property
currentTitleShadowColor property
currentImage property
currentBackgroundImage property
imageView property
Getting Dimensions
– backgroundRectForBounds:
– contentRectForBounds:
– titleRectForContentRect:
– imageRectForContentRect:
Scroll down a little bit.
Here's currentTitle.
Turns out it's a @property too.
We should be using dot notation for it as well!
Properties
For more about Objective-C properties, see "Properties" in The Objective-C Programming Language.
adjustsImageWhenDisabled
A Boolean value that determines whether the image changes when the button is disabled.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iOS 2.2 Release Notes
iOS 3.0 API Diffs
iOS 3.1 API Diffs
iOS 3.1 Release Notes
Click here to browse the documentation.
Icons
Open Project...
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Icons
Last Revision:
Version 1.0, 2010-10-22
This sample demonstrates the proper use of application icons on iOS.
Build Requirements:
iOS 4.1 or later
Runtime Requirements:
iOS 3.2 or later
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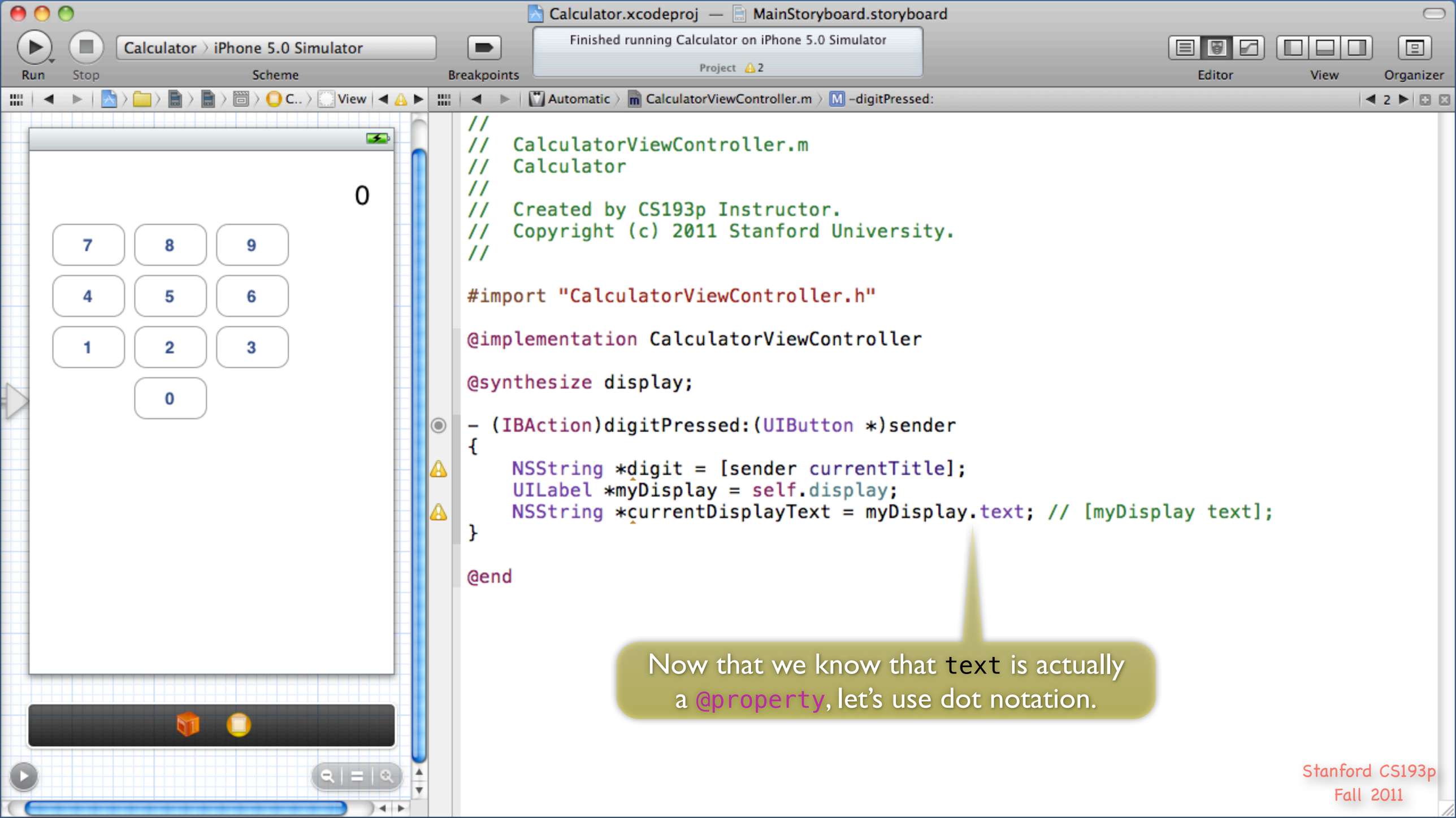
This sample demonstrates the proper use of application icons on iOS. This is a universal binary that supports iPhone/iPod touch/iPad and includes support for high resolution displays.
Each icon has one dimension of the pixel dimensions on it to display which icon is being used by various areas of iOS. The various icons display when using the Homescreen, Spotlight, the Settings app, different devices, and when creating an Ad Hoc build and adding it to iTunes.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//
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// Calculator
//
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//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    UILabel *myDisplay = self.display;
    NSString *currentDisplayText = myDisplay.text; // [myDisplay text];
}
@end
Now that we know that text is actually a @property, let's use dot notation.
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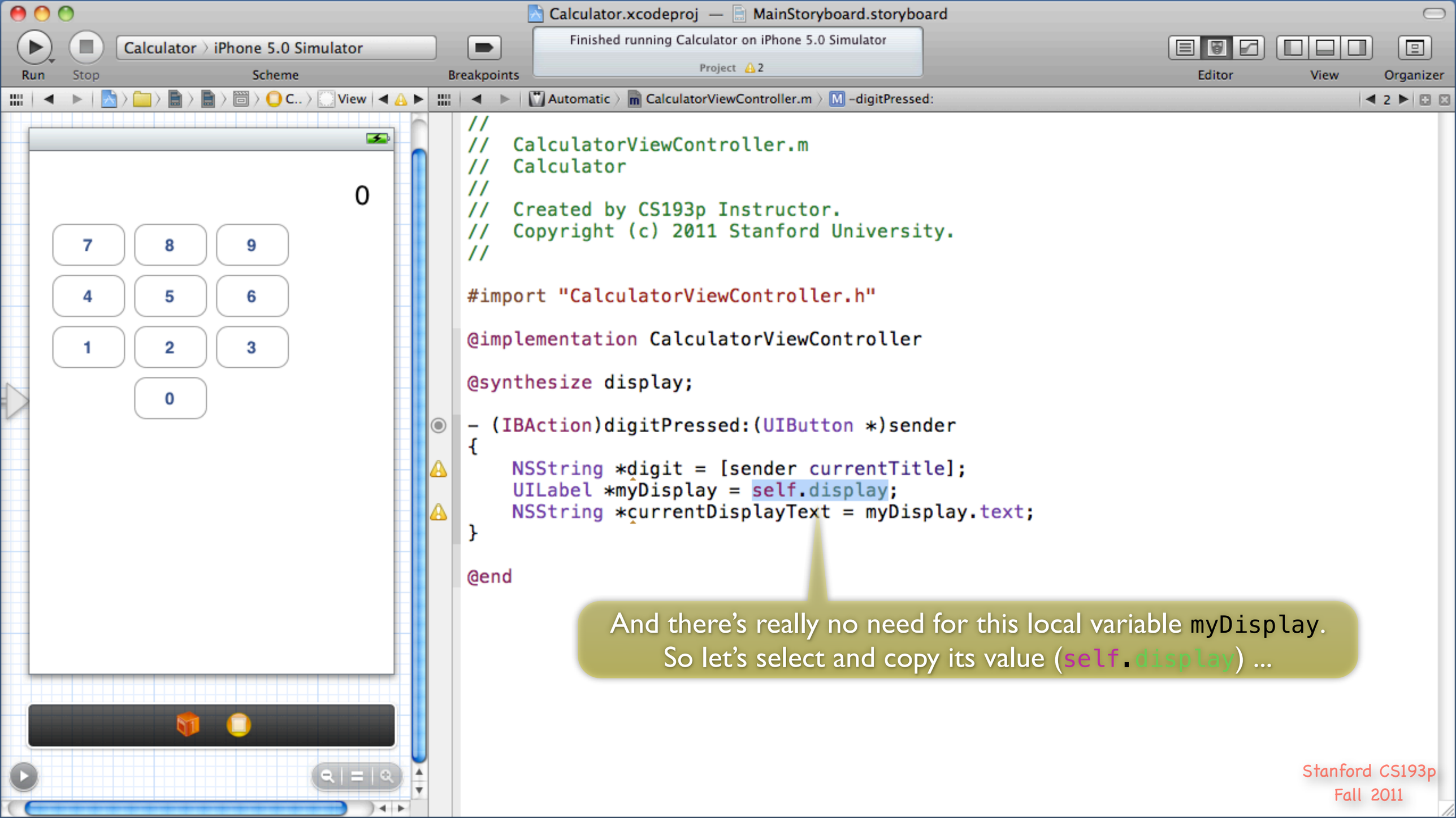
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{
    NSString *digit = [sender currentTitle];
    UILabel *myDisplay = self.display;
    NSString *currentDisplayText = myDisplay.text;
}
@end
And there's really no need for this local variable myDisplay.
So let's select and copy its value (self.display) ...
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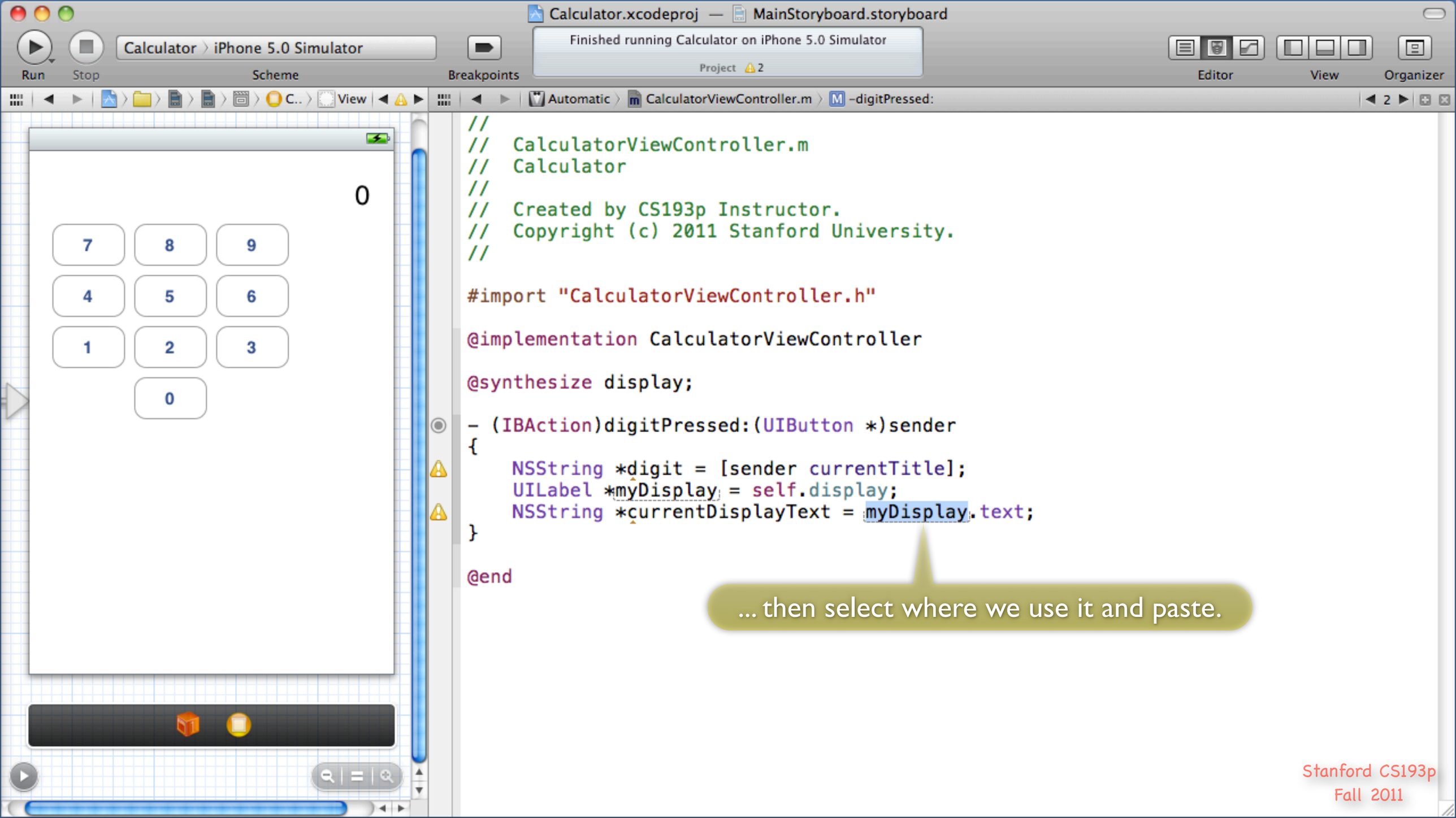
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#import "CalculatorViewController.h"

@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    UILabel *myDisplay = self.display;
    NSString *currentDisplayText = myDisplay.text;
}

@end
... then select where we use it and paste.
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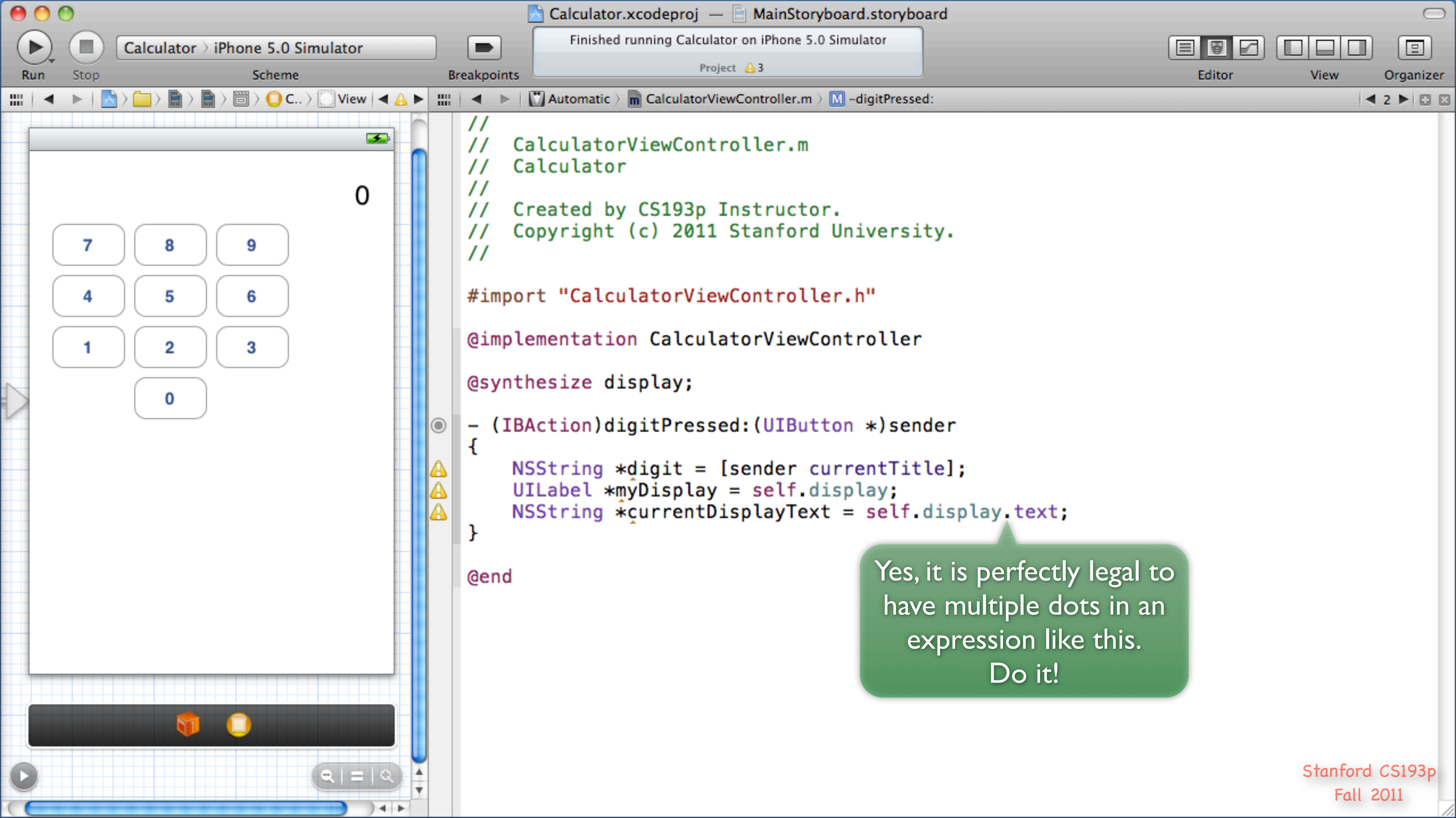
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#import "CalculatorViewController.h"

@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    UILabel *myDisplay = self.display;
    NSString *currentDisplayText = self.display.text;
}

@end
Yes, it is perfectly legal to have multiple dots in an expression like this. Do it!
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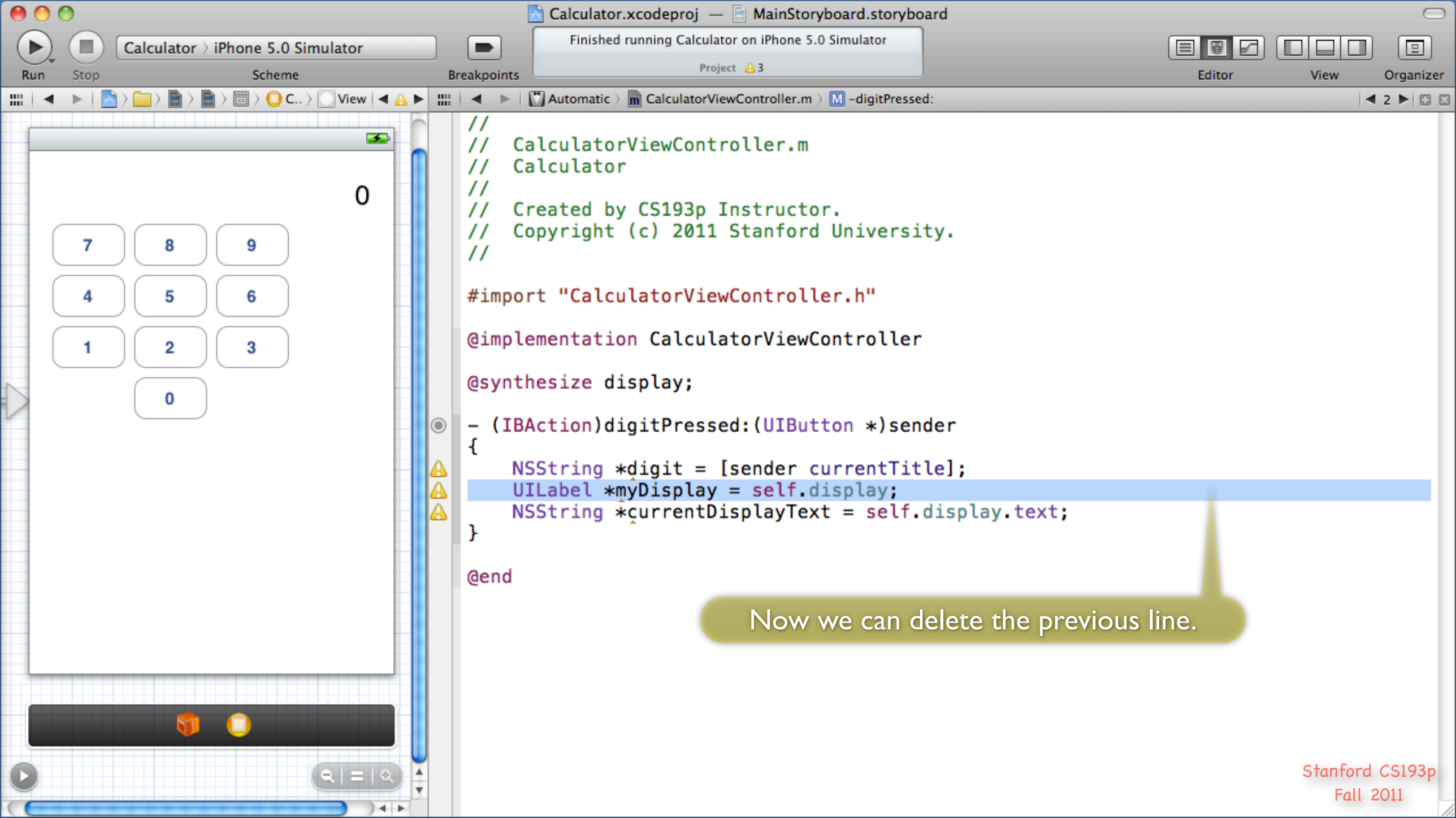
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#import "CalculatorViewController.h"

@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    UILabel *myDisplay = self.display;
    NSString *currentDisplayText = self.display.text;
}

@end
Now we can delete the previous line.
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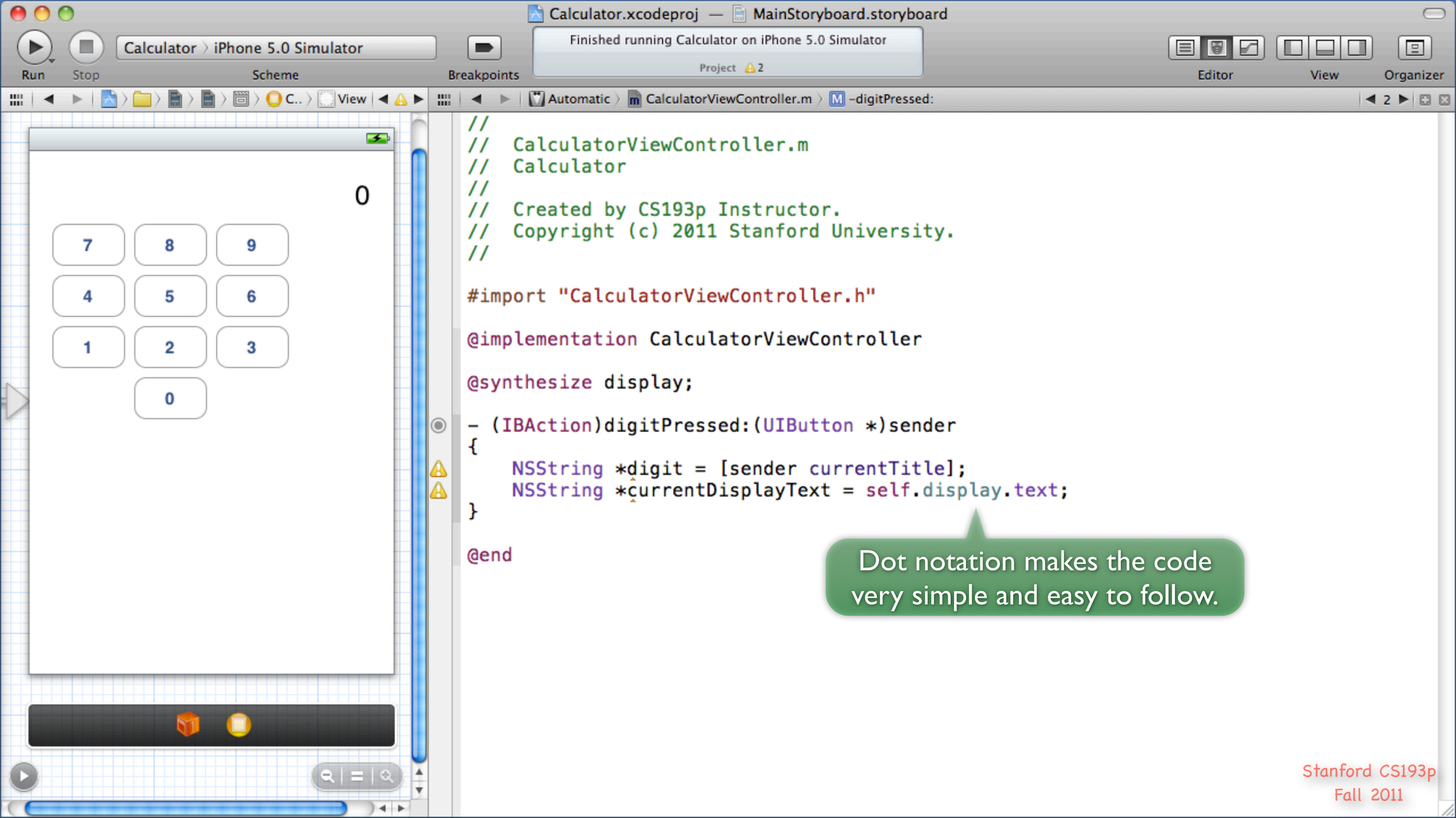
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@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    NSString *currentDisplayText = self.display.text;
}
@end
Dot notation makes the code very simple and easy to follow.
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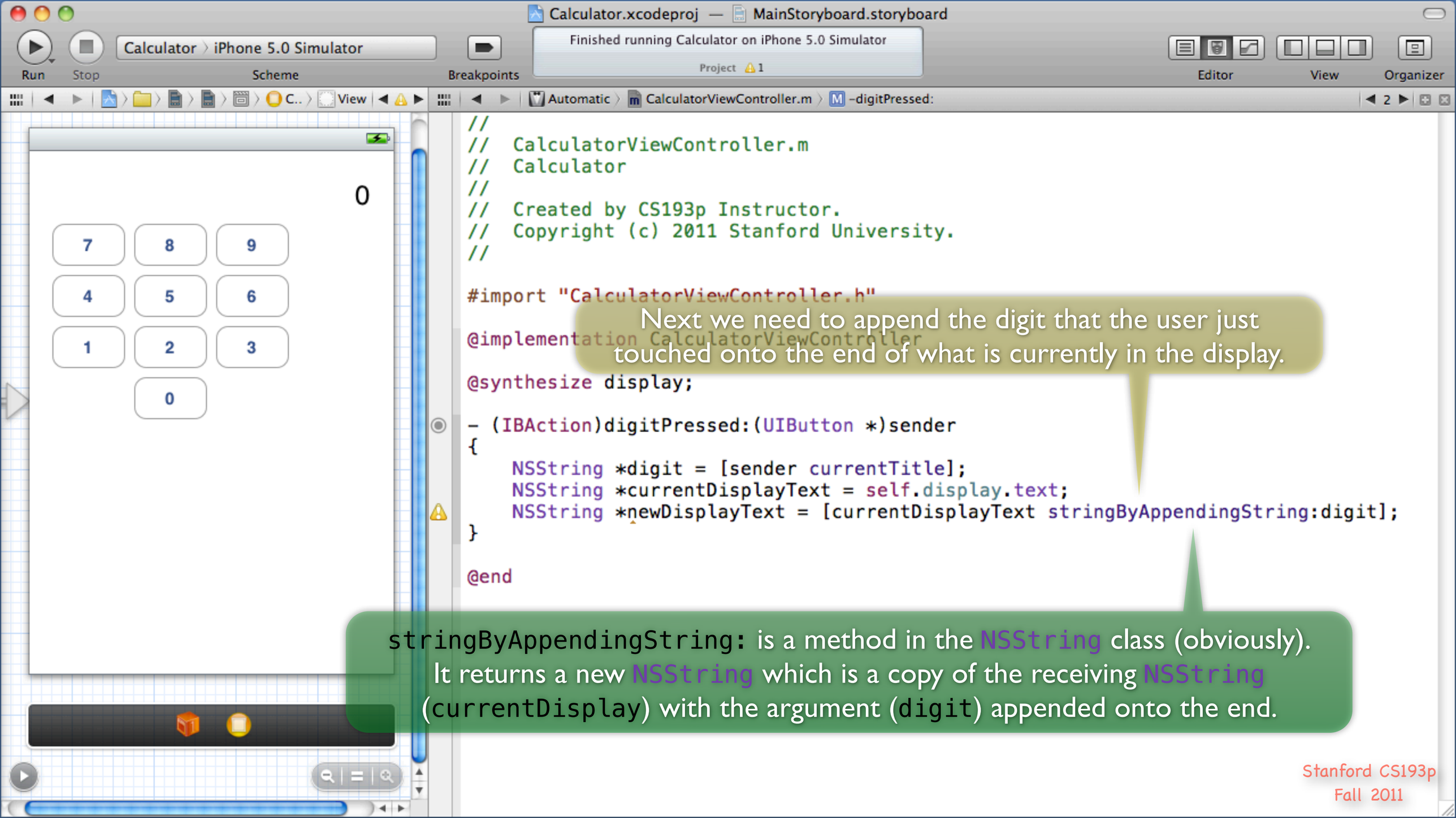
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@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
NSString *currentDisplayText = self.display.text;
NSString *newDisplayText = [currentDisplayText stringByAppendingString:digit];
}
@end
Next we need to append the digit that the user just touched onto the end of what is currently in the display.
stringByAppendingString: is a method in the NSString class (obviously). It returns a new NSString which is a copy of the receiving NSString (currentDisplay) with the argument (digit) appended onto the end.
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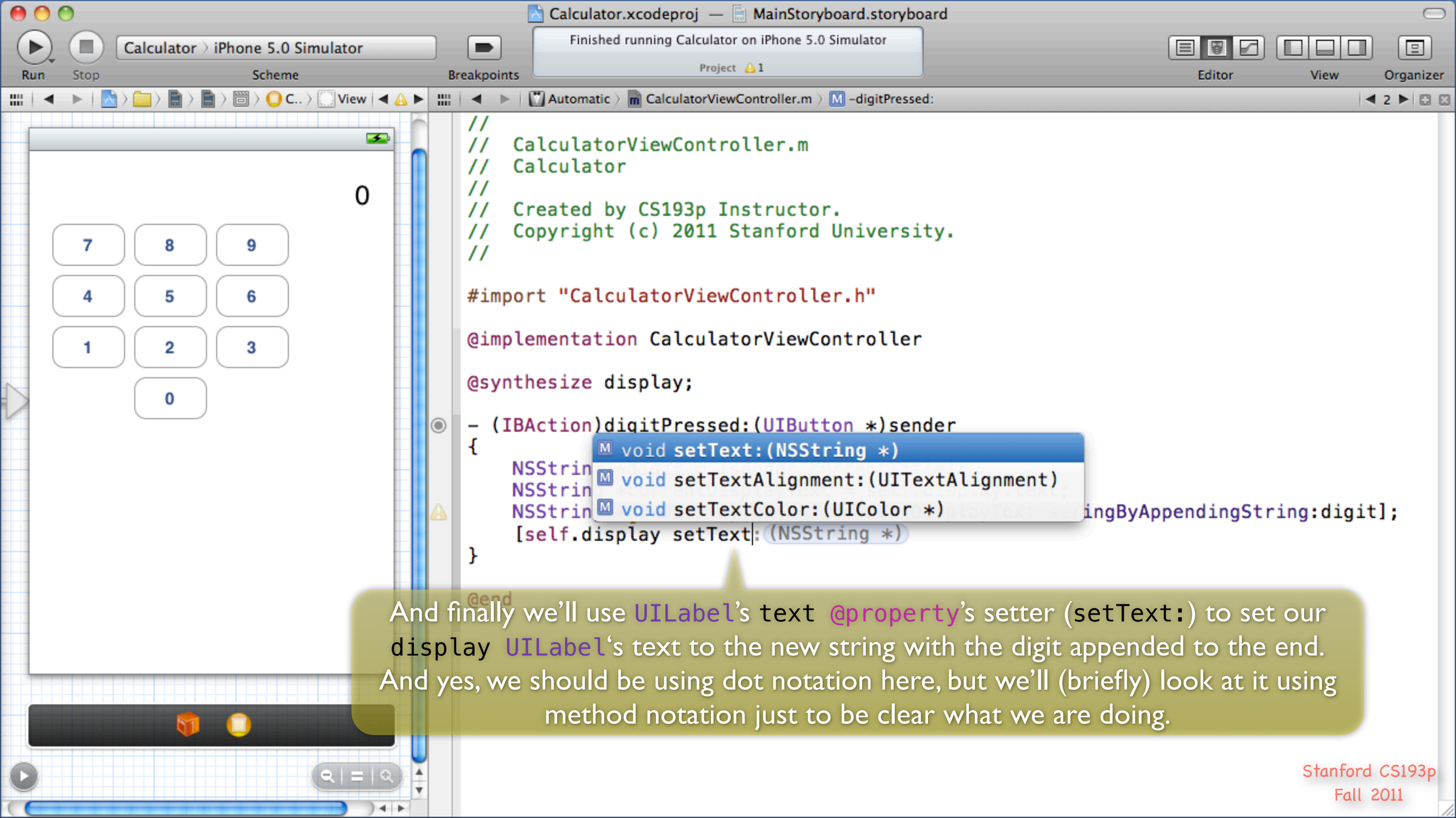
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#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSStrin
    NSStrin
    NSStrin
    [self.display setText:(NSString *)
}
@end
void setText:(NSString *)
void setTextAlignment:(UITextAlignment)
void setTextColor:(UIColor *)
ingByAppendingString:digit];
And finally we'll use UILabel's text @property's setter (setText:) to set our display UILabel's text to the new string with the digit appended to the end. And yes, we should be using dot notation here, but we'll (briefly) look at it using method notation just to be clear what we are doing.
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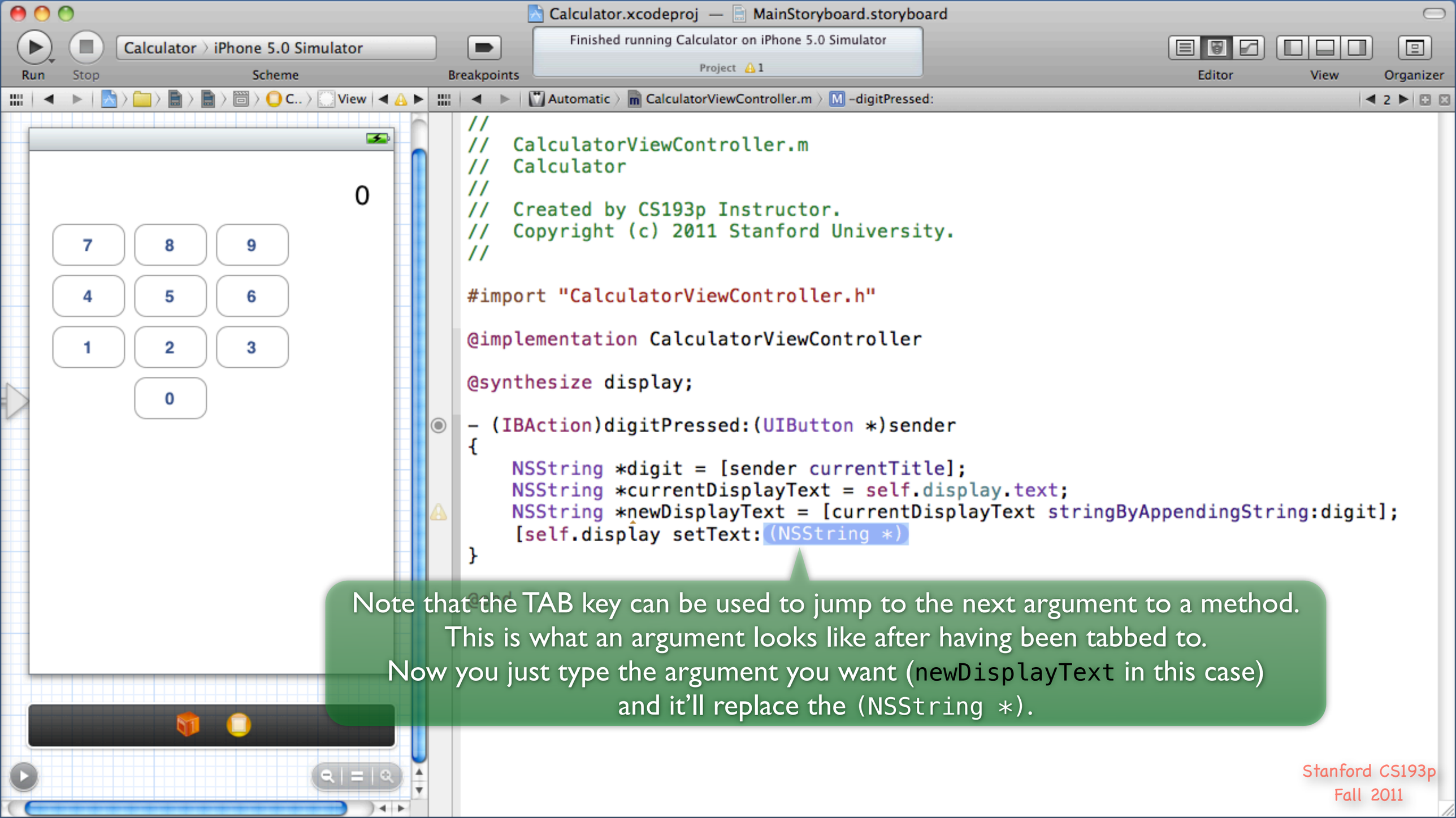
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- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
NSString *currentDisplayText = self.display.text;
NSString *newDisplayText = [currentDisplayText stringByAppendingString:digit];
[self.display setText:(NSString *)
}
@end
Note that the TAB key can be used to jump to the next argument to a method.
This is what an argument looks like after having been tabbed to.
Now you just type the argument you want (newDisplayText in this case)
and it'll replace the (NSString *).
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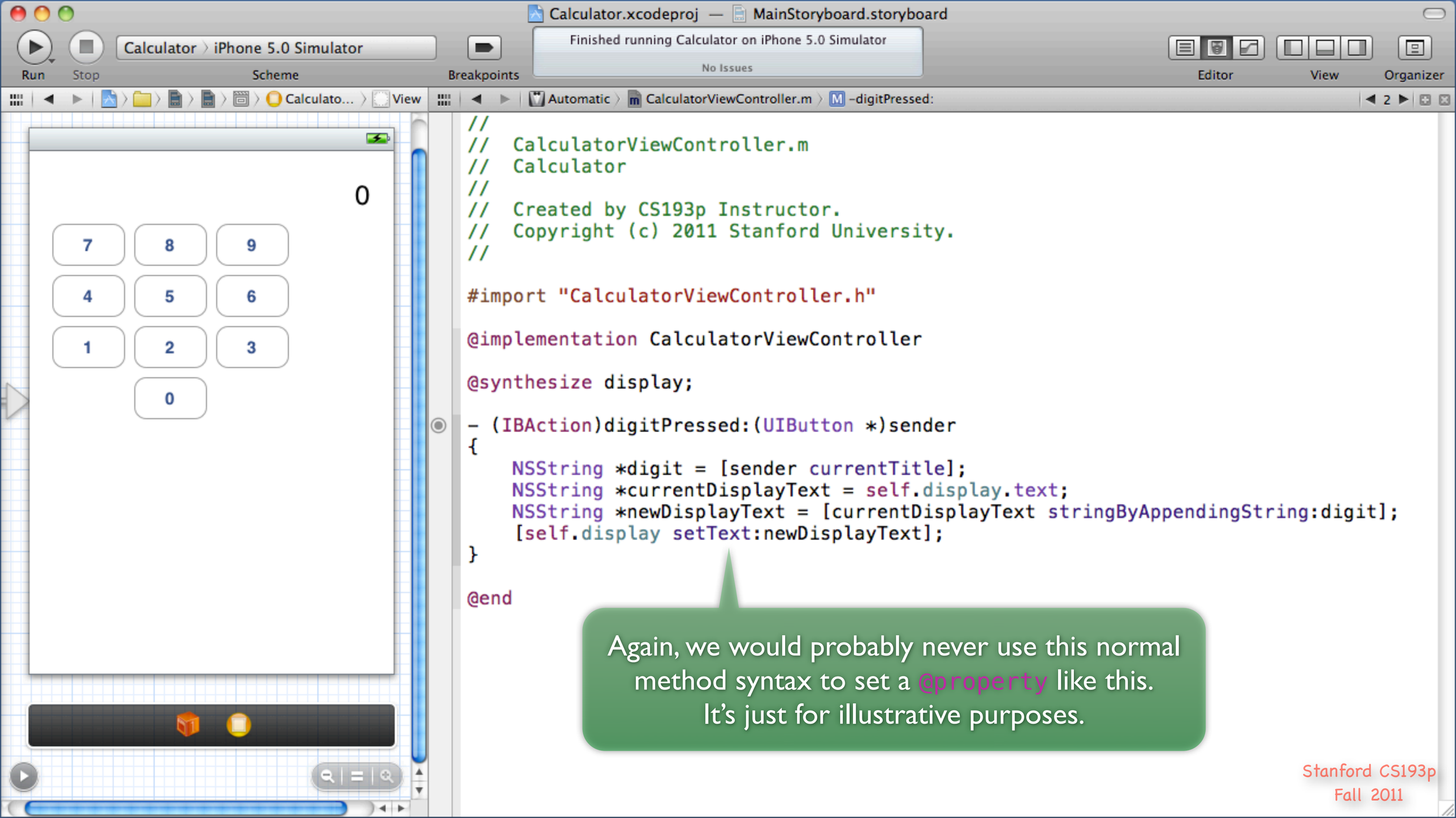
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    NSString *digit = [sender currentTitle];
    NSString *currentDisplayText = self.display.text;
    NSString *newDisplayText = [currentDisplayText stringByAppendingString:digit];
    [self.display setText:newDisplayText];
}
@end
Again, we would probably never use this normal method syntax to set a @property like this. It's just for illustrative purposes.
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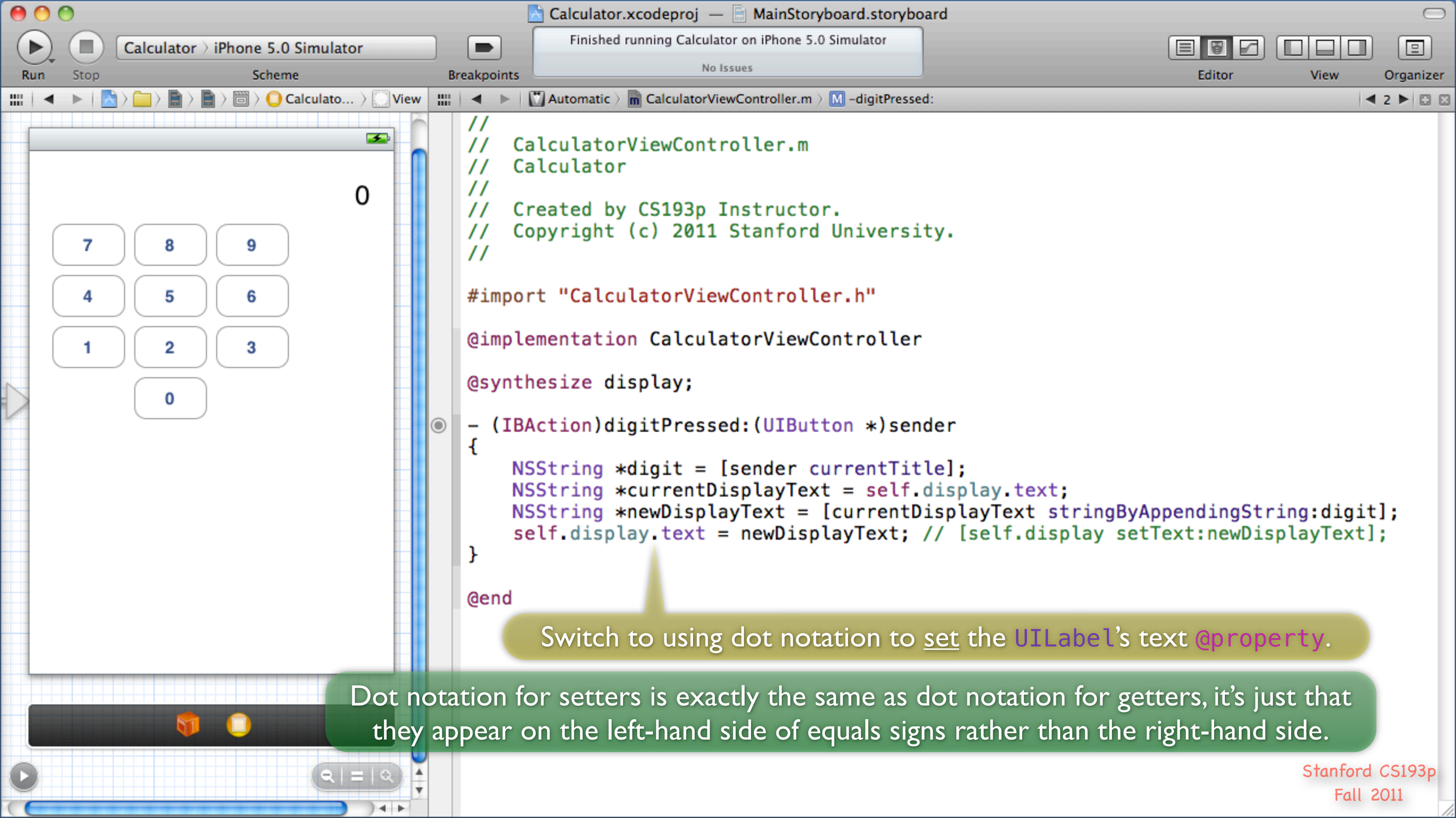
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{
NSString *digit = [sender currentTitle];
NSString *currentDisplayText = self.display.text;
NSString *newDisplayText = [currentDisplayText stringByAppendingString:digit];
self.display.text = newDisplayText; // [self.display setText:newDisplayText];
}
@end
Switch to using dot notation to set the UILabel's text @property.
Dot notation for setters is exactly the same as dot notation for getters, it's just that they appear on the left-hand side of equals signs rather than the right-hand side.
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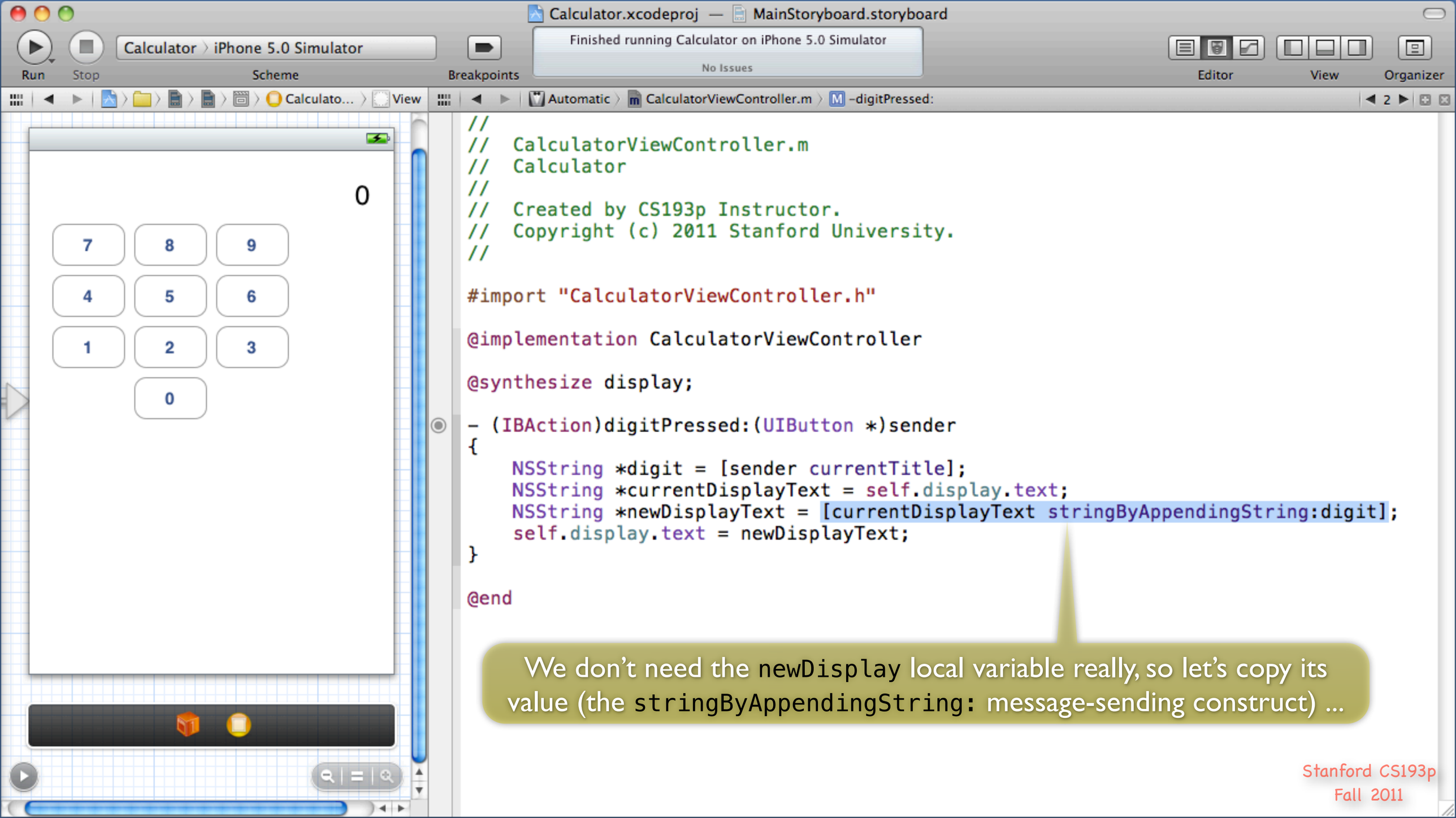
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NSString *digit = [sender currentTitle];
NSString *currentDisplayText = self.display.text;
NSString *newDisplayText = [currentDisplayText stringByAppendingString:digit];
self.display.text = newDisplayText;
}
@end
We don't need the newDisplay local variable really, so let's copy its value (the stringByAppendingString: message-sending construct) ...
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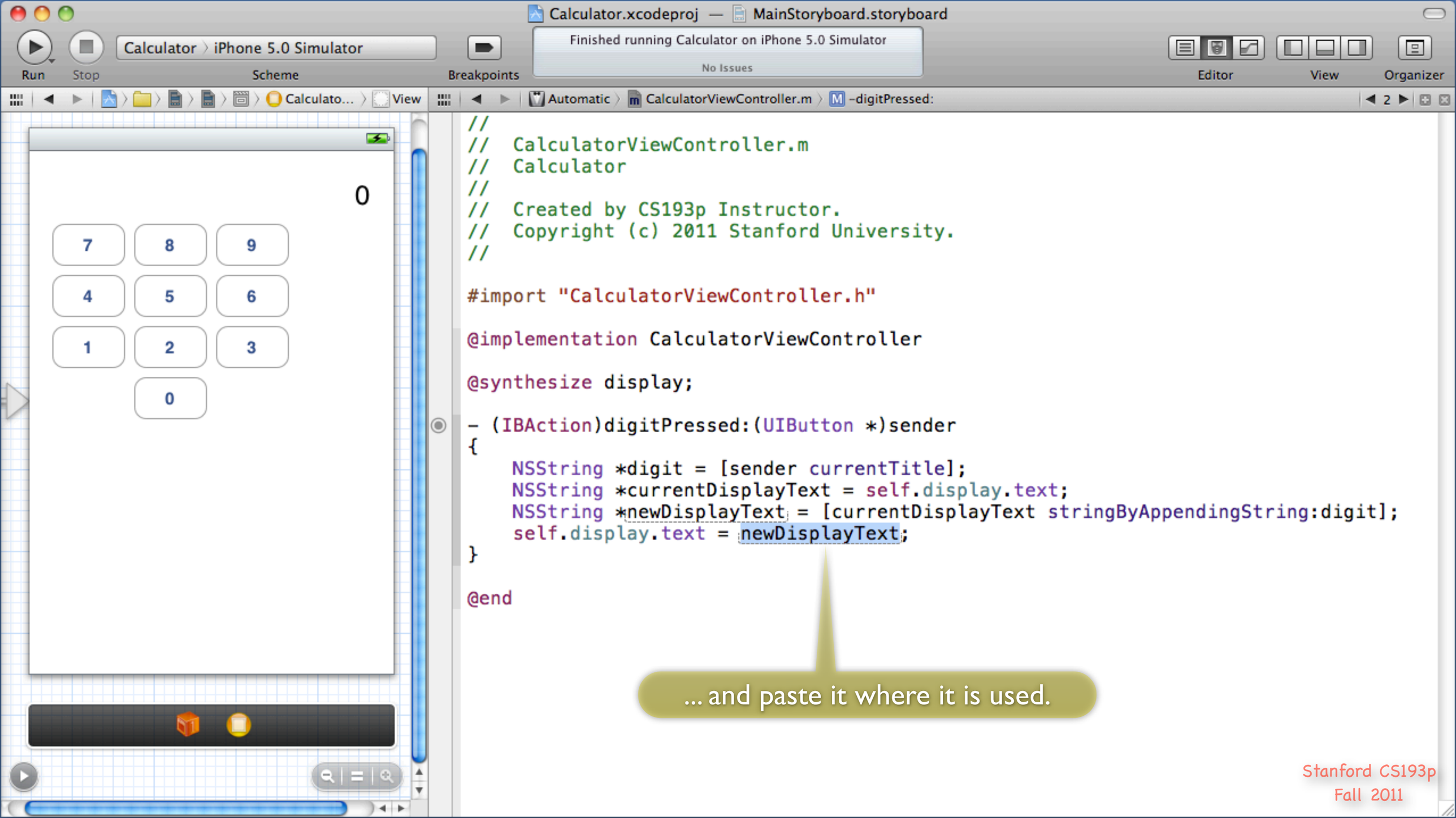
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
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Automatic
CalculatorViewController.m
-digitPressed:
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//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
NSString *currentDisplayText = self.display.text;
NSString *newDisplayText = [currentDisplayText stringByAppendingString:digit];
self.display.text = newDisplayText;
}
@end
... and paste it where it is used.
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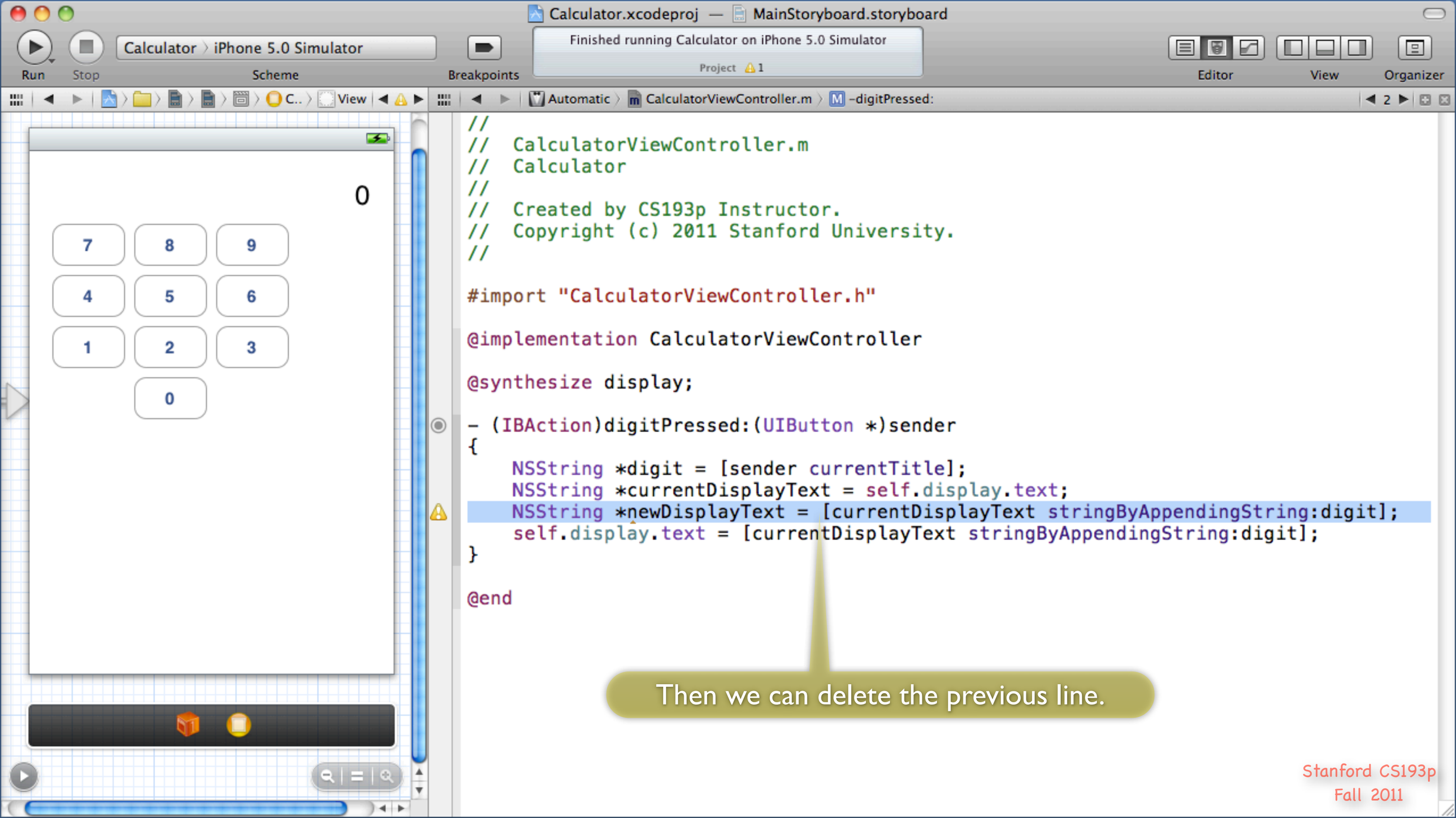
Calculator.xcodeproj — MainStoryboard.storyboard
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Calculator › iPhone 5.0 Simulator
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Finished running Calculator on iPhone 5.0 Simulator
Project ⚠1
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Automatic › CalculatorViewController.m › -digitPressed:
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//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
NSString *currentDisplayText = self.display.text;
NSString *newDisplayText = [currentDisplayText stringByAppendingString:digit];
self.display.text = [currentDisplayText stringByAppendingString:digit];
}
@end
Then we can delete the previous line.
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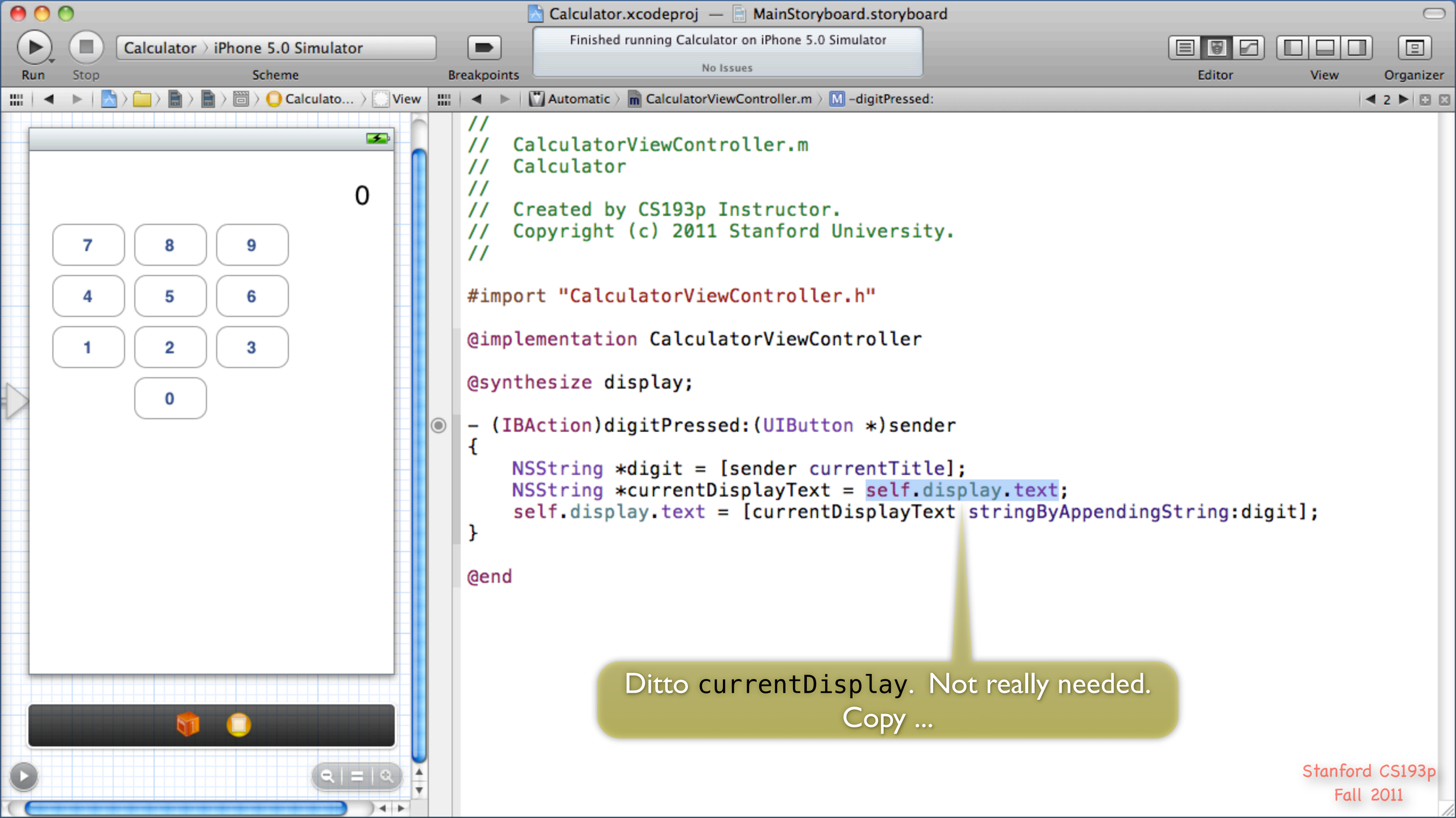
Calculator.xcodeproj — MainStoryboard.storyboard
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Calculator 〉 iPhone 5.0 Simulator
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Finished running Calculator on iPhone 5.0 Simulator
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@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    NSString *currentDisplayText = self.display.text;
    self.display.text = [currentDisplayText stringByAppendingString:digit];
}
@end
Ditto currentDisplay. Not really needed.
Copy ...
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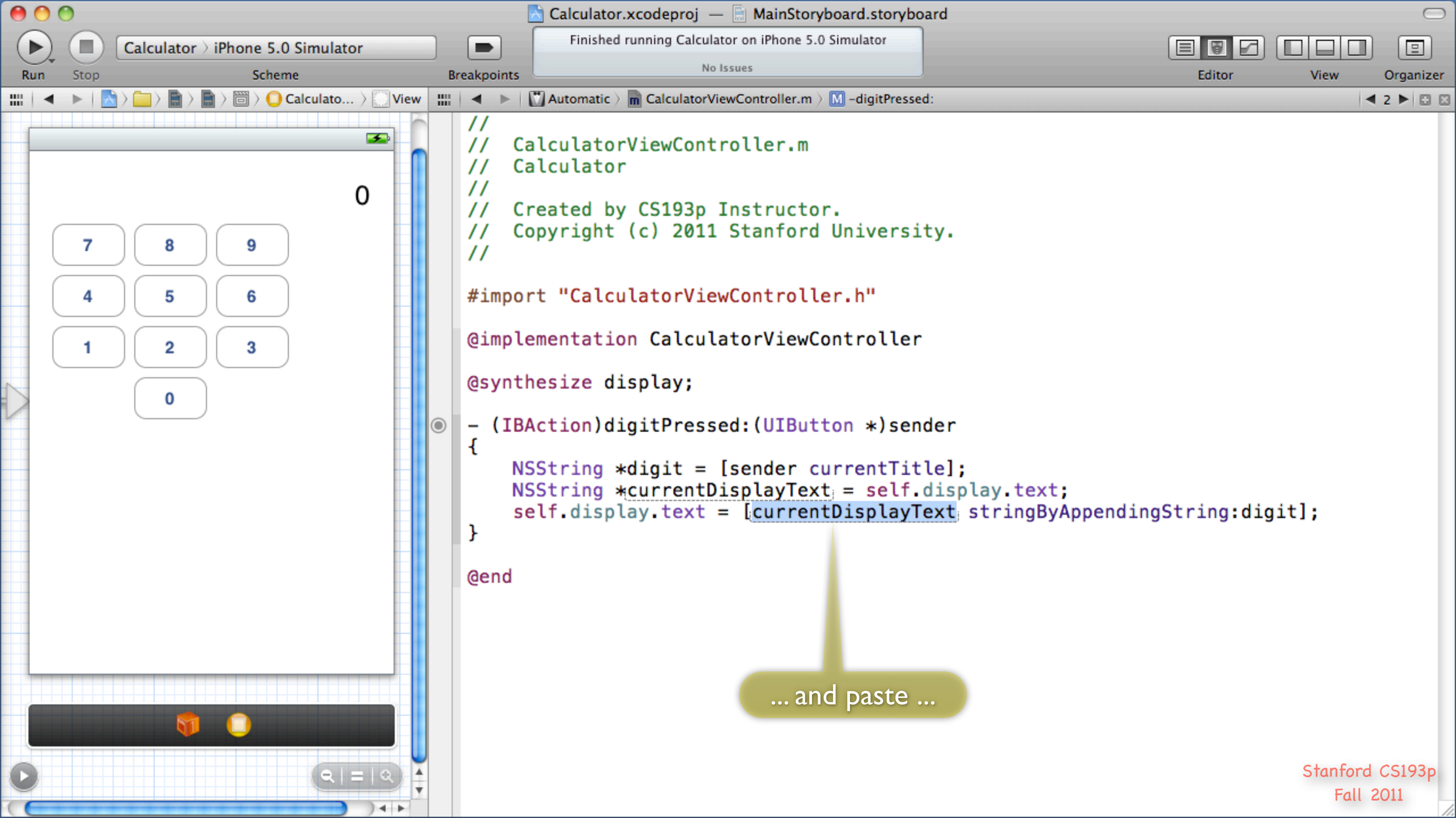
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@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    NSString *currentDisplayText = self.display.text;
    self.display.text = [currentDisplayText stringByAppendingString:digit];
}
@end
... and paste ...
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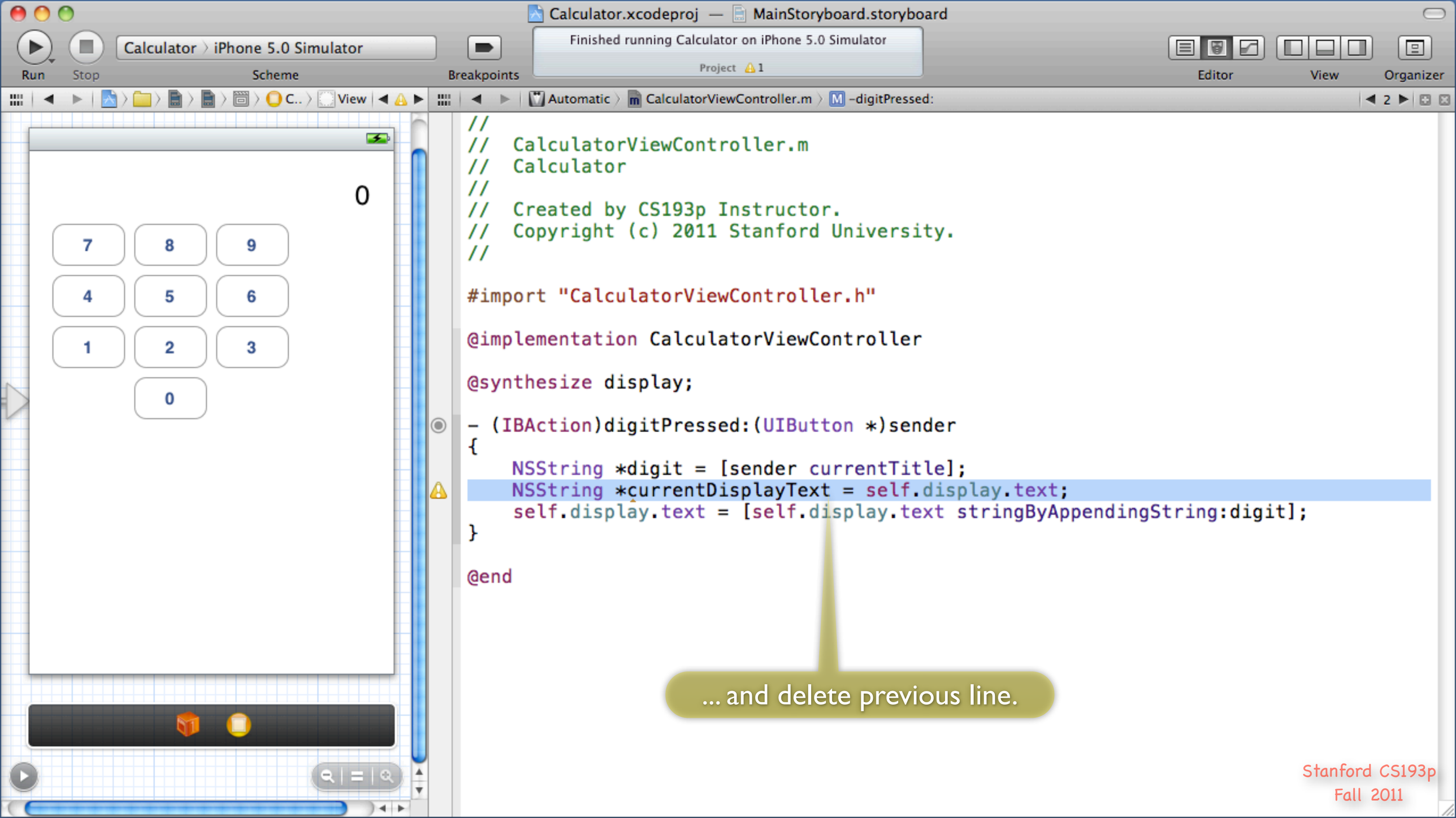
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Project ⚠1
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#import "CalculatorViewController.h"

@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    NSString *currentDisplayText = self.display.text;
    self.display.text = [self.display.text stringByAppendingString:digit];
}

@end
... and delete previous line.
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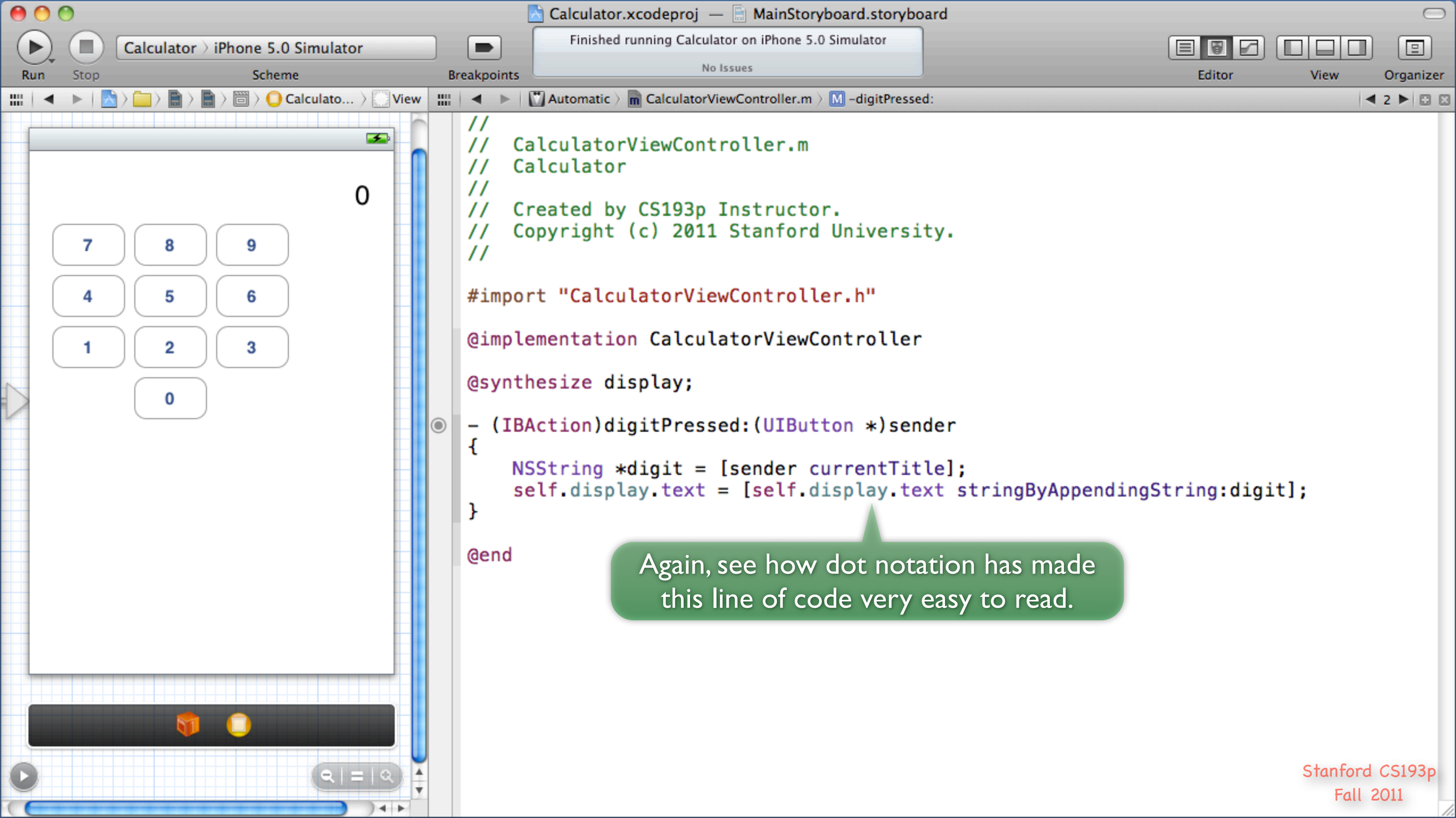
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// Calculator
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//
#import "CalculatorViewController.h"
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
self.display.text = [self.display.text stringByAppendingString:digit];
}
@end
Again, see how dot notation has made this line of code very easy to read.
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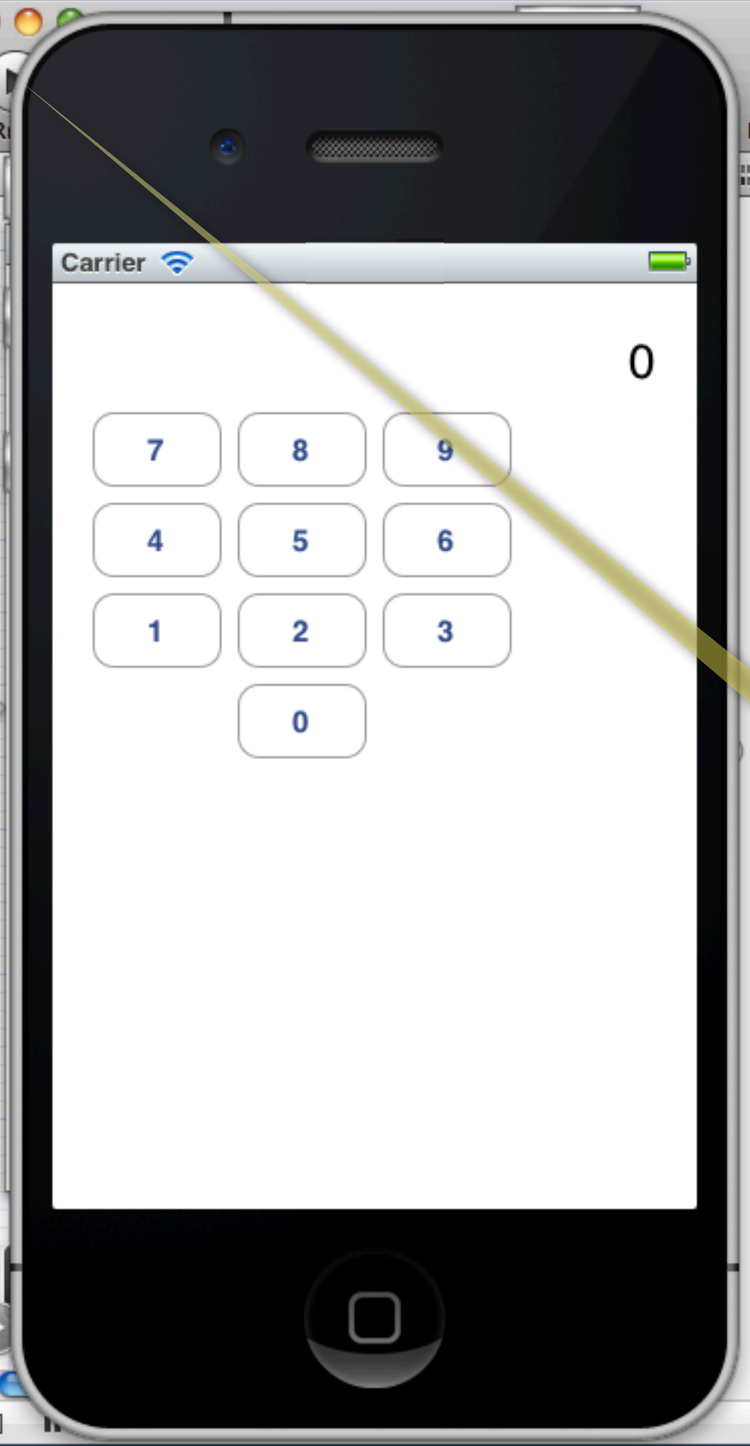

Calculator.xcodeproj — MainStoryboard.storyboard

Running Calculator on iPhone 5.0 Simulator

No Issues

Breakpoints

Editor View Organizer

Automatic › CalculatorViewController.m › -digitPressed:

```
//
//  CalculatorViewController.m
//  Calculator
//
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//

#import "CalculatorViewController.h"

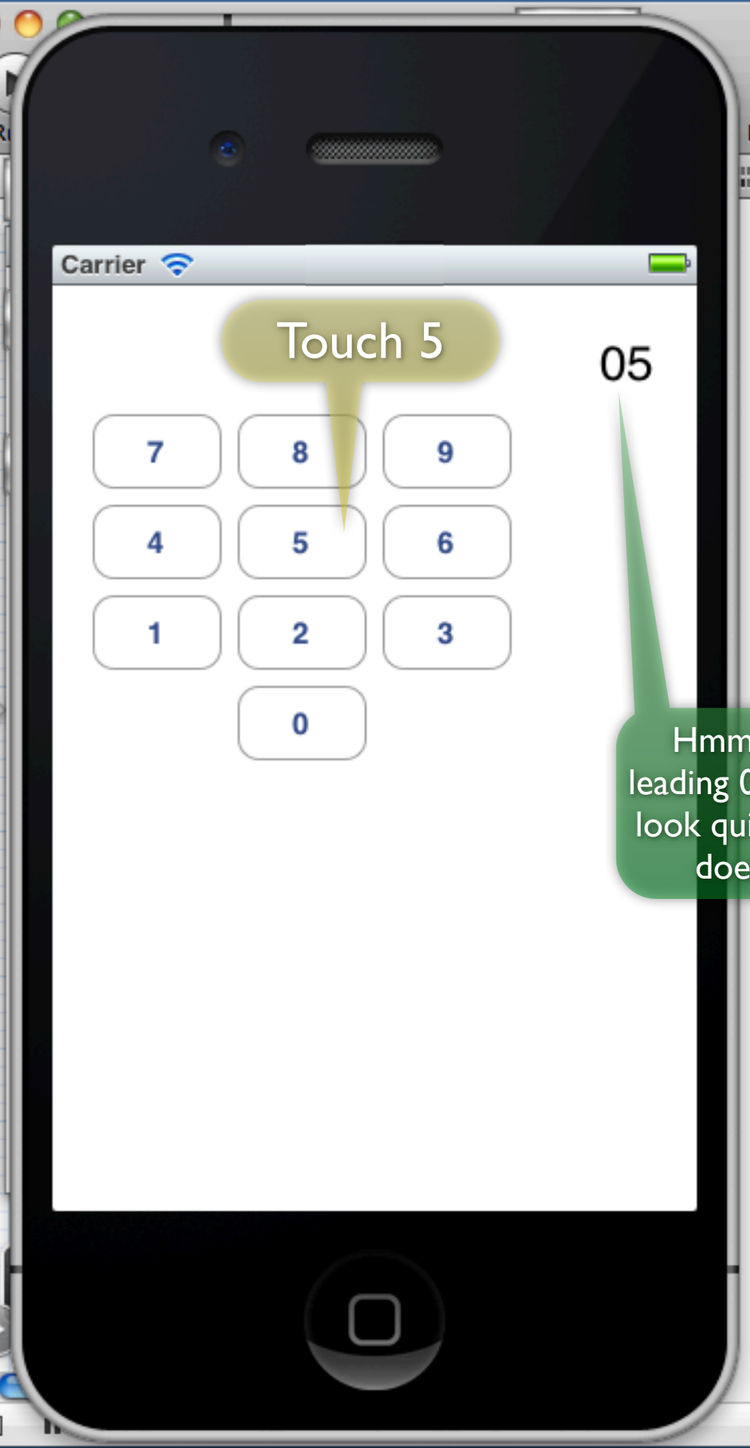
@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    self.display.text = [self.display.text stringByAppendingString:digit];
}

@end
```

Okay, let's Run and see if this works!



Calculator.xcodeproj — MainStoryboard.storyboard

Running Calculator on iPhone 5.0 Simulator

No Issues

Breakpoints | Editor | View | Organizer

Automatic › CalculatorViewController.m › -digitPressed:

```
//
//  CalculatorViewController.m
//  Calculator
//
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//

#import "CalculatorViewController.h"

@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    self.display.text = [self.display.text stringByAppendingString:digit];
}

@end
```

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Calculator.xcodeproj — MainStoryboard.storyboard

Running Calculator on iPhone 5.0 Simulator

No Issues

Breakpoints

Editor View Organizer

Automatic › CalculatorViewController.m › -digitPressed:

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"

@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    self.display.text = [self.display.text stringByAppendingString:digit];
}

@end
```

Calculator.xcodeproj — MainStoryboard.storyboard

Running Calculator on iPhone 5.0 Simulator

No Issues

Breakpoints

Editor View Organizer

Automatic › CalculatorViewController.m › -digitPressed:

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"

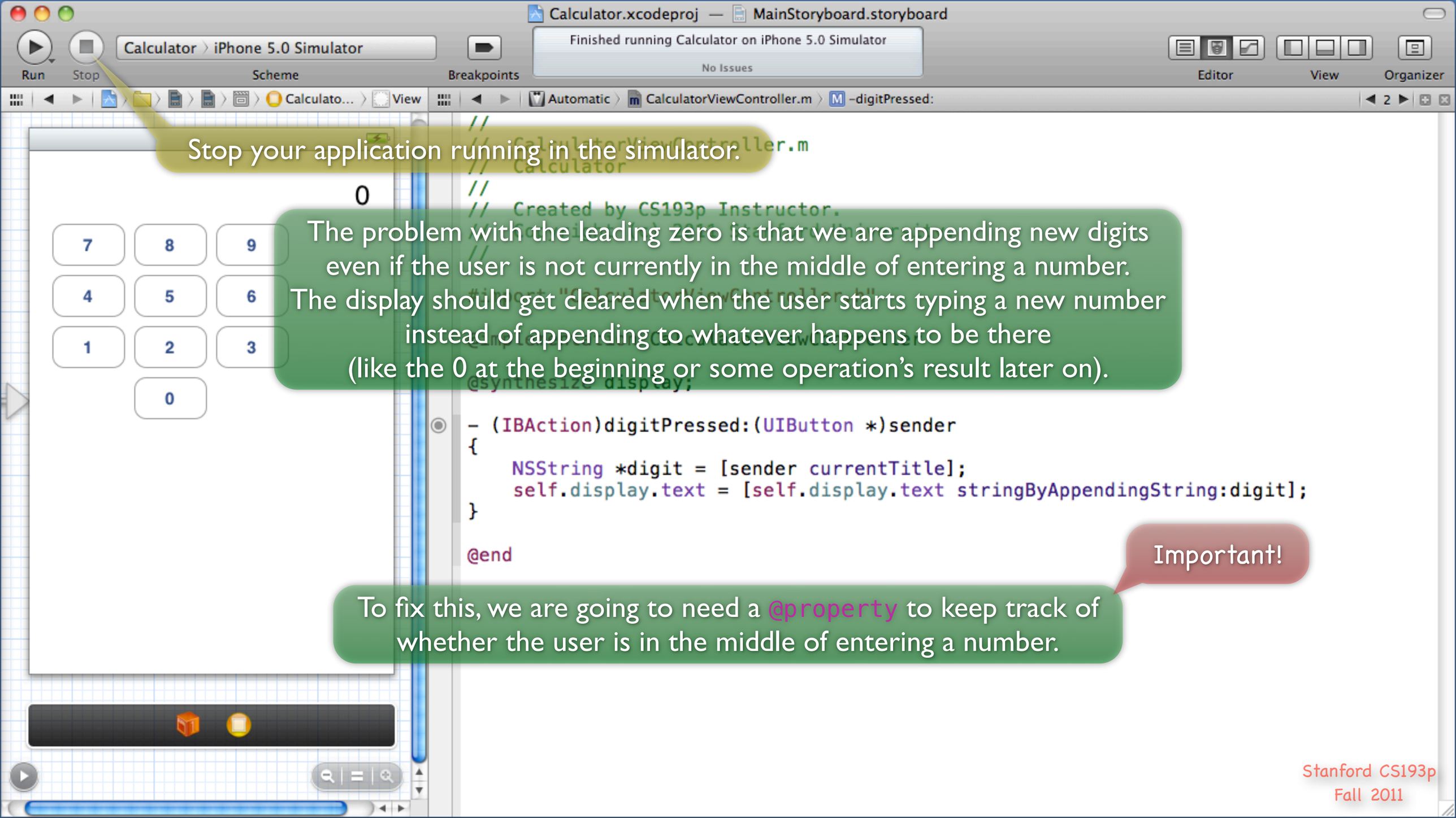
@implementation CalculatorViewController

@synthesize display;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    self.display.text = [self.display.text stringByAppendingString:digit];
}

@end
```

Let's fix this problem of the leading zero.


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Stop your application running in the simulator.
0
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0
The problem with the leading zero is that we are appending new digits even if the user is not currently in the middle of entering a number. The display should get cleared when the user starts typing a new number instead of appending to whatever happens to be there (like the 0 at the beginning or some operation's result later on).
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
self.display.text = [self.display.text stringByAppendingString:digit];
}
@end
Important!
To fix this, we are going to need a @property to keep track of whether the user is in the middle of entering a number.
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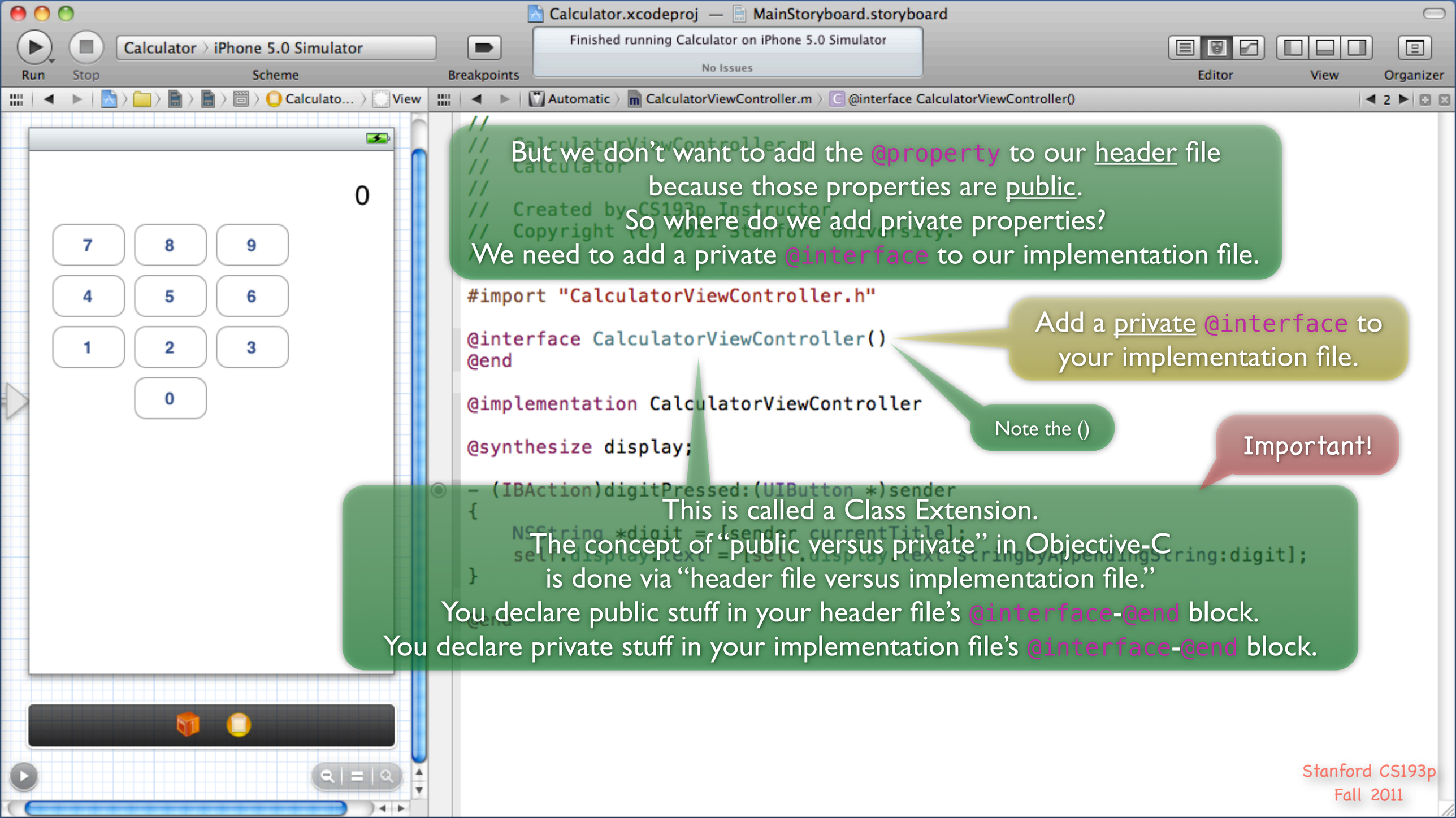
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
@interface CalculatorViewController()
0
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3
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@end
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    self.display.text = [self.display.text stringByAppendingString:digit];
}
@end
But we don't want to add the @property to our header file
because those properties are public.
So where do we add private properties?
We need to add a private @interface to our implementation file.
Add a private @interface to
your implementation file.
Note the ()
Important!
This is called a Class Extension.
The concept of "public versus private" in Objective-C
is done via "header file versus implementation file."
You declare public stuff in your header file's @interface-@end block.
You declare private stuff in your implementation file's @interface-@end block.
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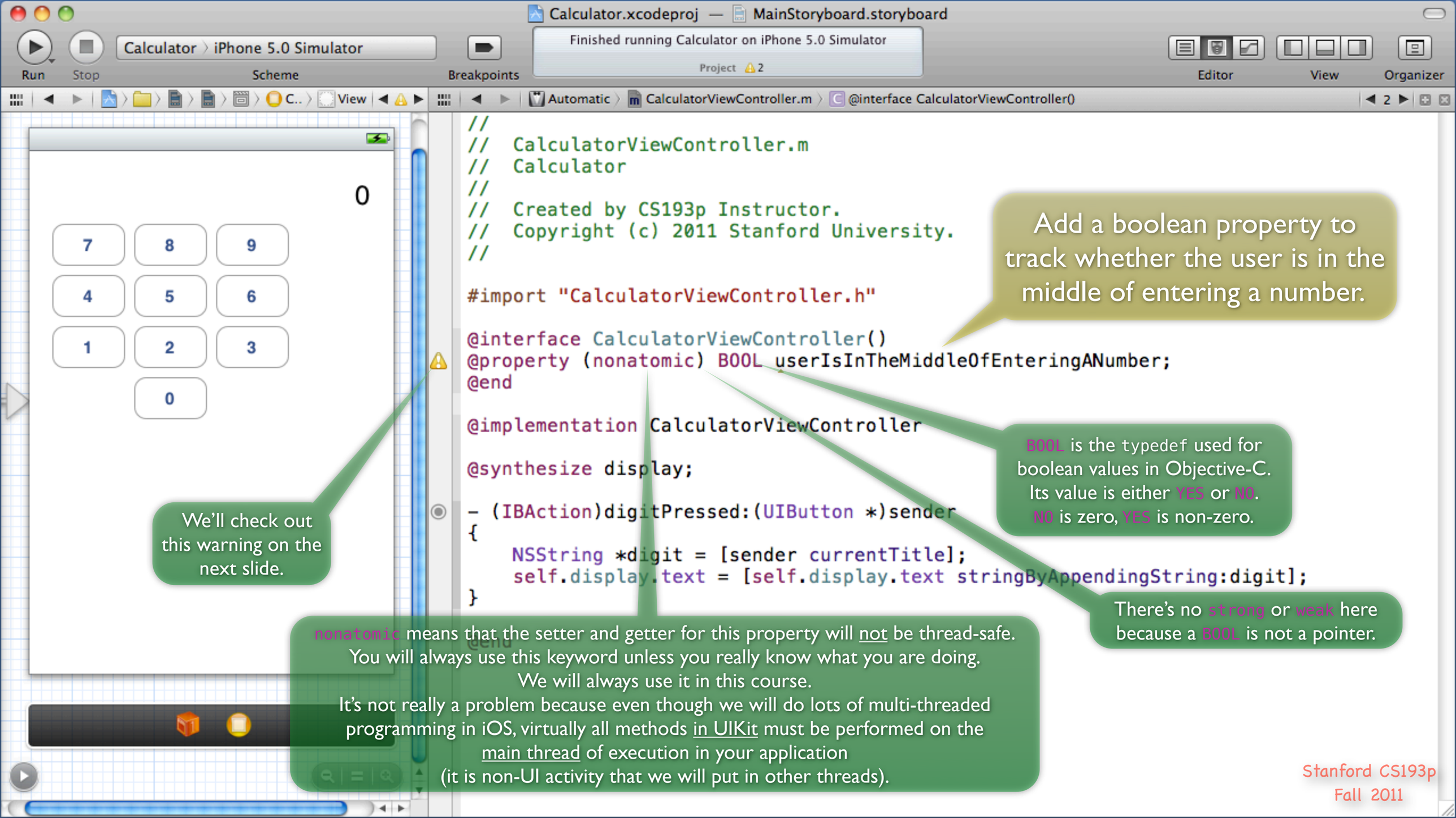
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project ⚠2
Editor
View
Organizer
Automatic › CalculatorViewController.m › @interface CalculatorViewController()
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7 8 9
4 5 6
1 2 3
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
self.display.text = [self.display.text stringByAppendingString:digit];
}
Add a boolean property to track whether the user is in the middle of entering a number.
BOOL is the typedef used for boolean values in Objective-C. Its value is either YES or NO. NO is zero, YES is non-zero.
There's no strong or weak here because a BOOL is not a pointer.
We'll check out this warning on the next slide.
nonatomic means that the setter and getter for this property will not be thread-safe.
You will always use this keyword unless you really know what you are doing.
We will always use it in this course.
It's not really a problem because even though we will do lots of multi-threaded programming in iOS, virtually all methods in UIKit must be performed on the main thread of execution in your application
(it is non-UI activity that we will put in other threads).
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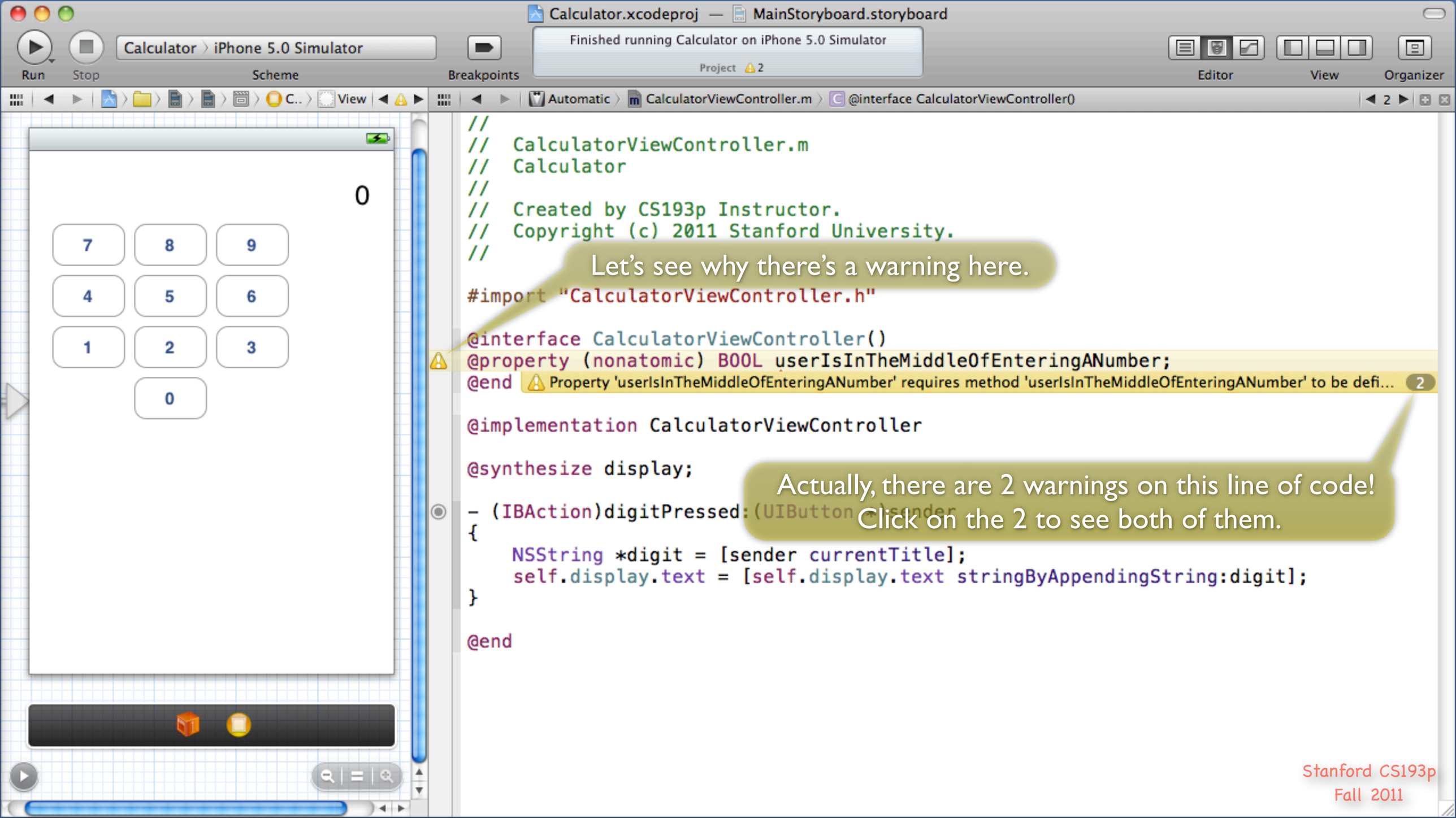
Calculator.xcodeproj — MainStoryboard.storyboard
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Project ⚠2
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View
Organizer
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Automatic › CalculatorViewController.m › @interface CalculatorViewController()
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
Let's see why there's a warning here.
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
Property 'userIsInTheMiddleOfEnteringANumber' requires method 'userIsInTheMiddleOfEnteringANumber' to be defi... 2
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    self.display.text = [self.display.text stringByAppendingString:digit];
}
@end
Actually, there are 2 warnings on this line of code!
Click on the 2 to see both of them.
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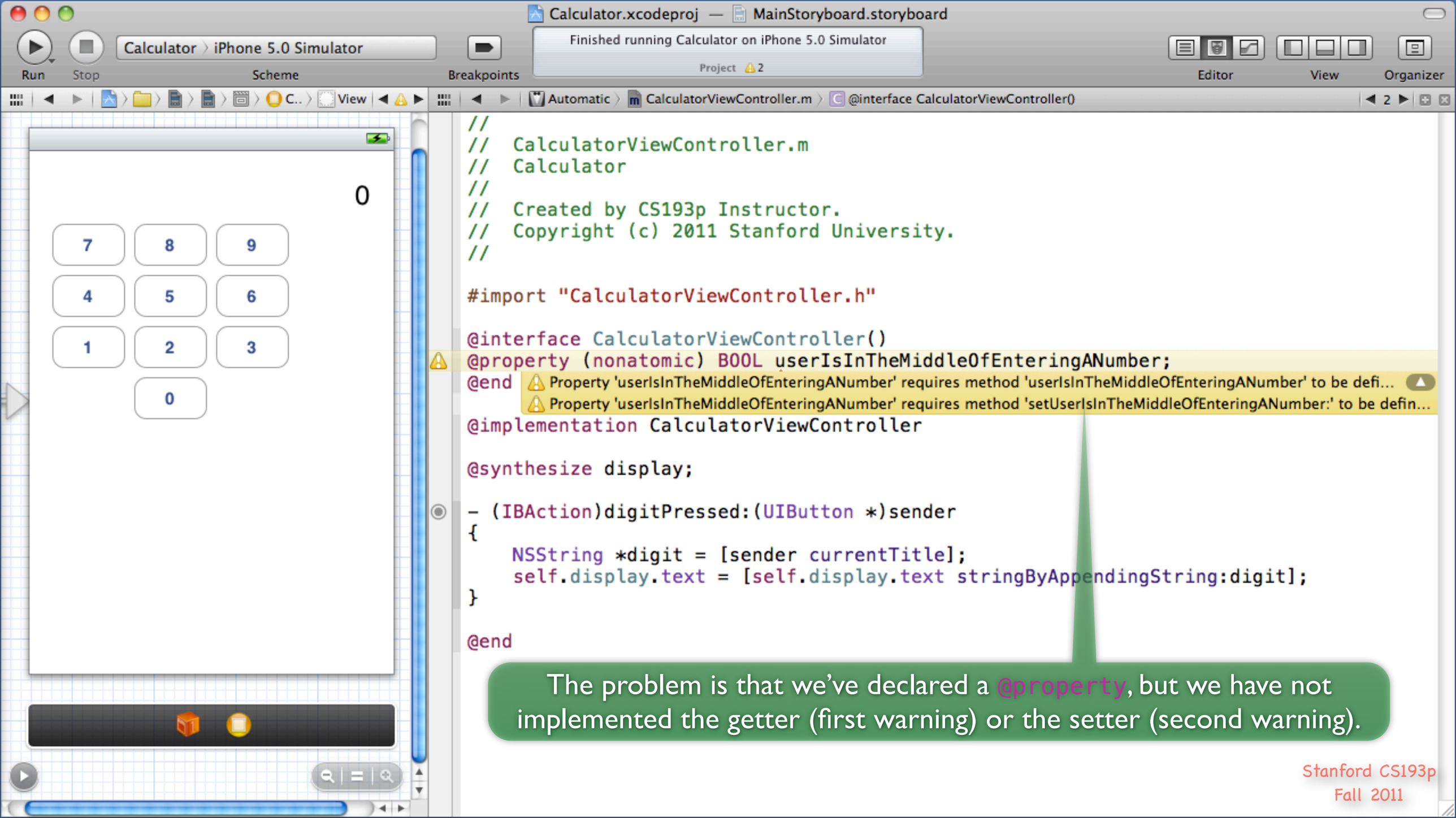
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Project ⚠2
Editor
View
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Automatic › CalculatorViewController.m › @interface CalculatorViewController()
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//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
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//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
Property 'userIsInTheMiddleOfEnteringANumber' requires method 'userIsInTheMiddleOfEnteringANumber' to be defi...
Property 'userIsInTheMiddleOfEnteringANumber' requires method 'setUserIsInTheMiddleOfEnteringANumber:' to be defin...
@implementation CalculatorViewController
@synthesize display;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    self.display.text = [self.display.text stringByAppendingString:digit];
}
@end
The problem is that we've declared a @property, but we have not implemented the getter (first warning) or the setter (second warning).
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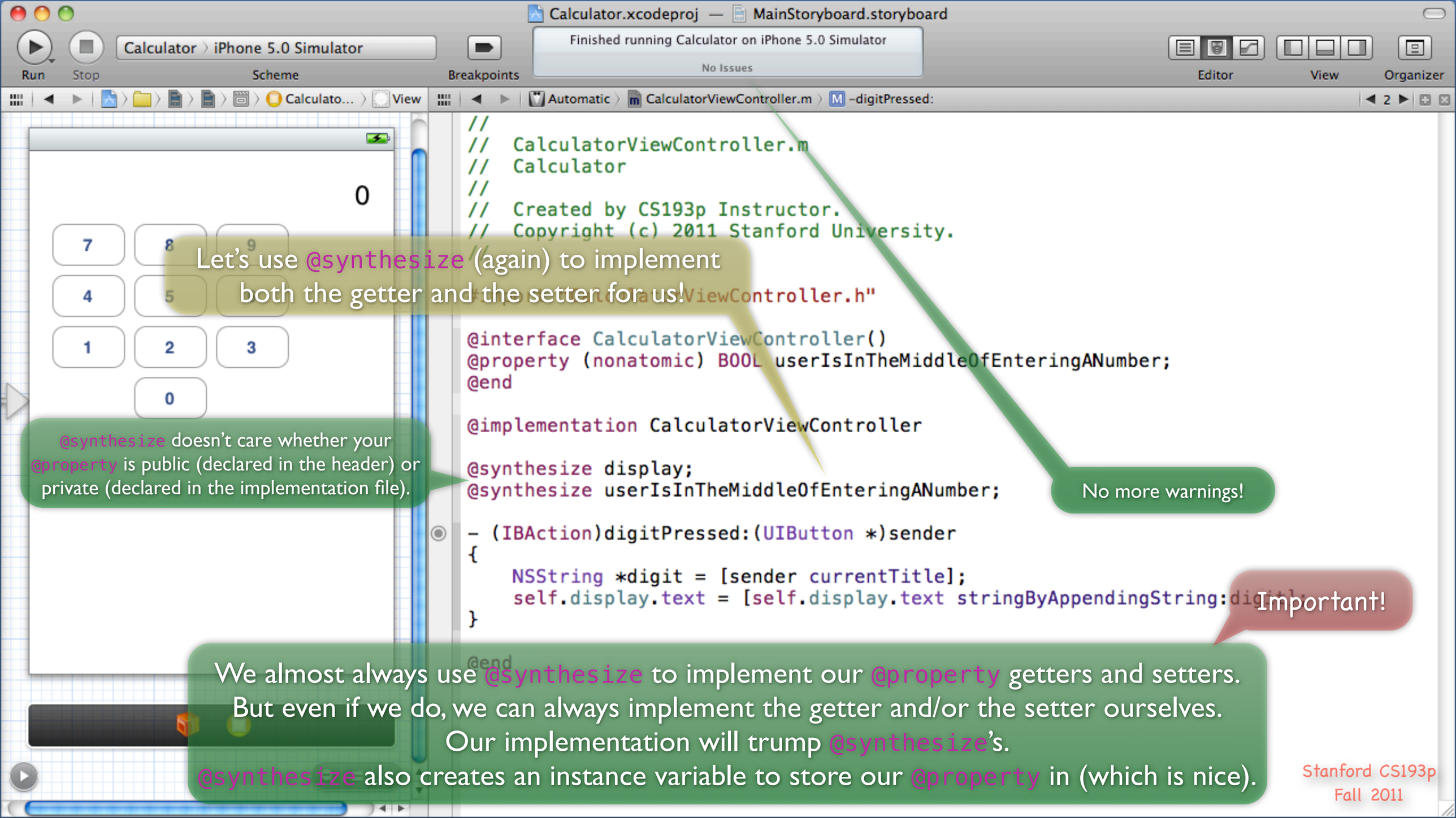
Calculator.xcodeproj — MainStoryboard.storyboard
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No Issues
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Calculato... 〉 View
Automatic 〉 CalculatorViewController.m 〉 -digitPressed:
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#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
self.display.text = [self.display.text stringByAppendingString:digit];
}
@end
Let's use @synthesize (again) to implement both the getter and the setter for us!
@synthesize doesn't care whether your @property is public (declared in the header) or private (declared in the implementation file).
No more warnings!
Important!
We almost always use @synthesize to implement our @property getters and setters.
But even if we do, we can always implement the getter and/or the setter ourselves.
Our implementation will trump @synthesize's.
@synthesize also creates an instance variable to store our @property in (which is nice).
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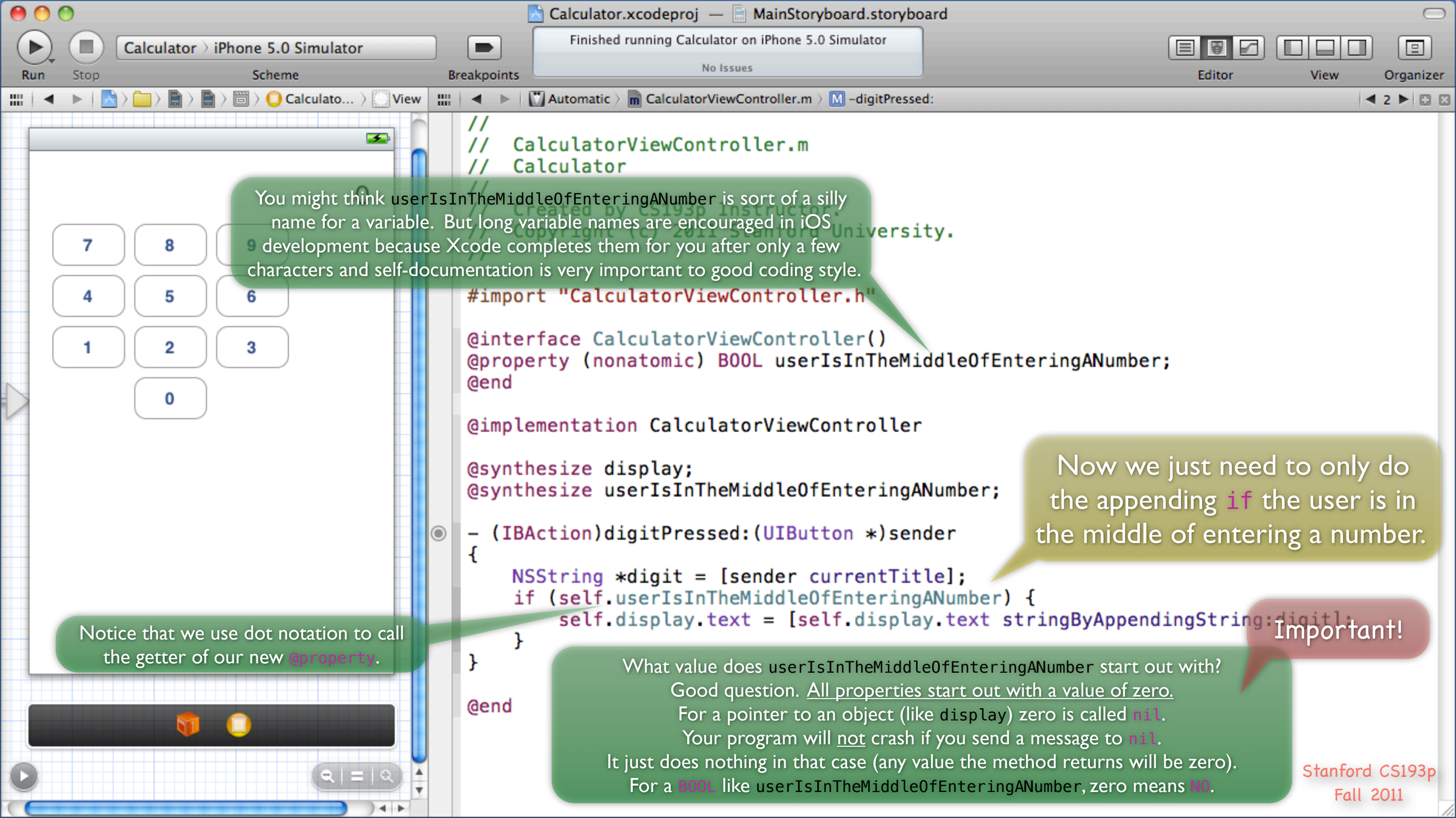
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//
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// Calculator
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// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text stringByAppendingString:digit];
}
}
@end
You might think userIsInTheMiddleOfEnteringANumber is sort of a silly name for a variable. But long variable names are encouraged in iOS development because Xcode completes them for you after only a few characters and self-documentation is very important to good coding style.
Now we just need to only do the appending if the user is in the middle of entering a number.
Notice that we use dot notation to call the getter of our new @property.
Important!
What value does userIsInTheMiddleOfEnteringANumber start out with?
Good question. All properties start out with a value of zero.
For a pointer to an object (like display) zero is called nil.
Your program will not crash if you send a message to nil.
It just does nothing in that case (any value the method returns will be zero).
For a BOOL like userIsInTheMiddleOfEnteringANumber, zero means NO.
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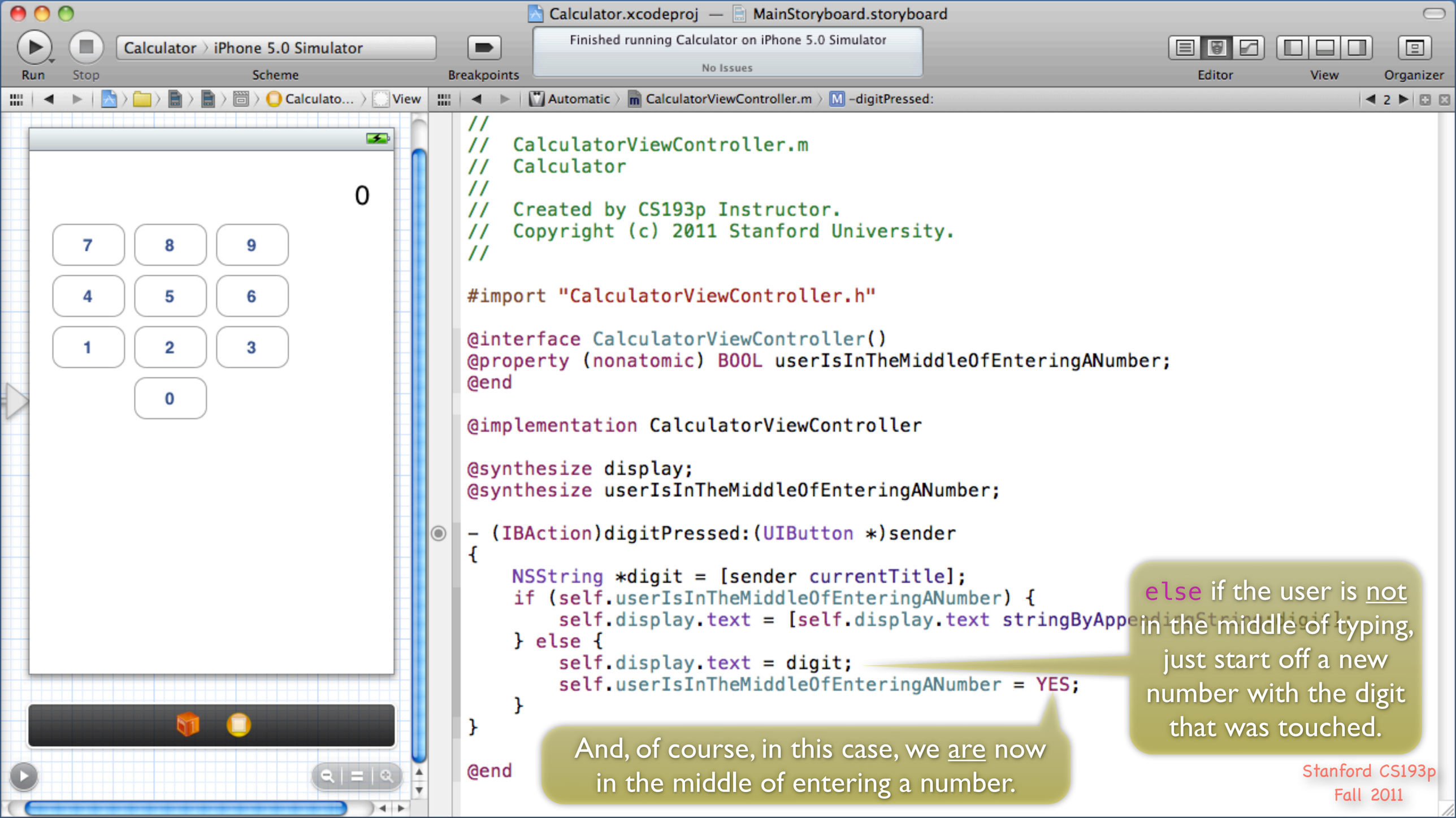
Calculator.xcodeproj — MainStoryboard.storyboard
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Breakpoints
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No Issues
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Organizer
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Automatic
CalculatorViewController.m
-digitPressed:
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9
4
5
6
1
2
3
0
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text stringByAppe
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
@end
else if the user is not in the middle of typing, just start off a new number with the digit that was touched.
And, of course, in this case, we are now in the middle of entering a number.
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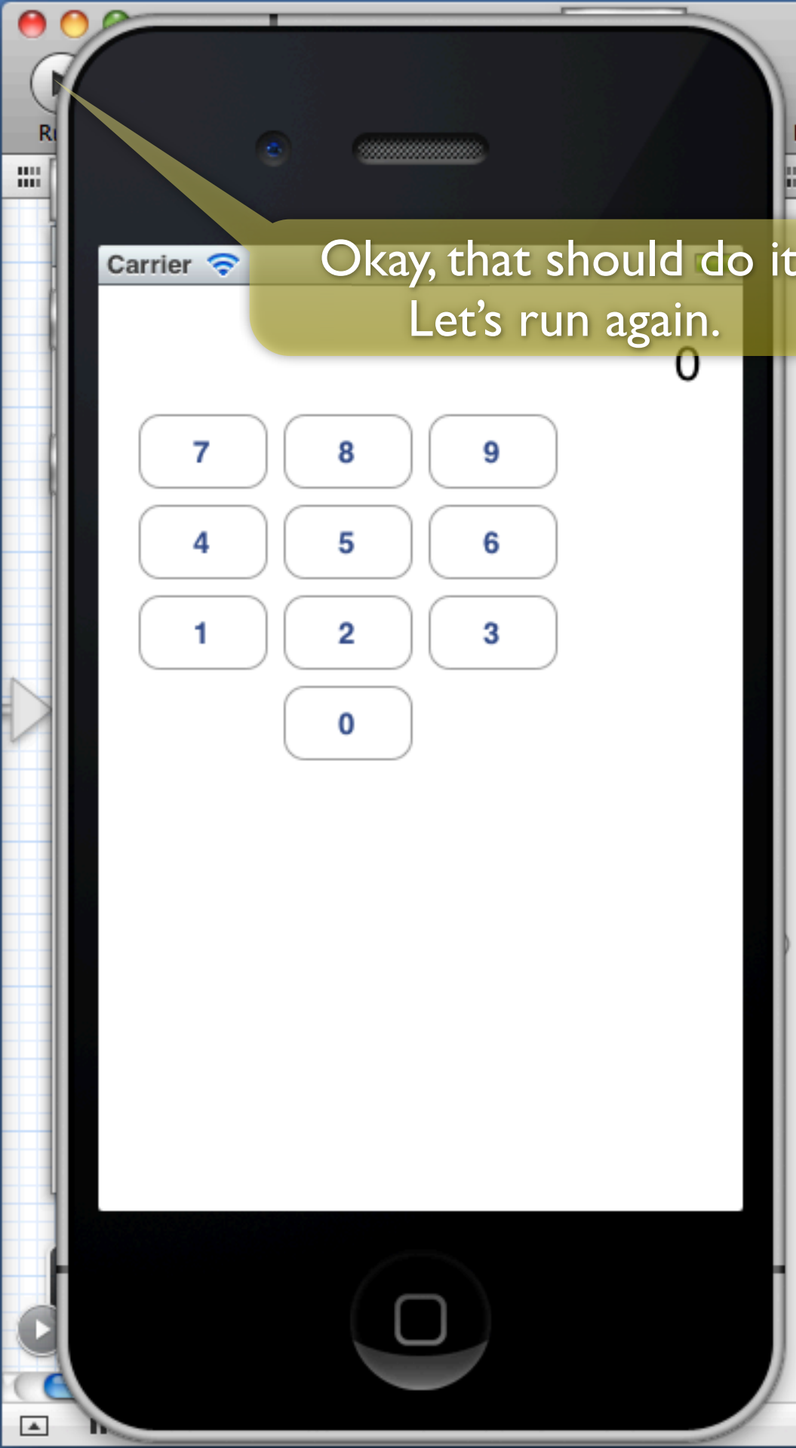
Fall 2011



Okay, that should do it.
Let's run again.

Calculator.xcodeproj — MainStoryboard.storyboard

Running Calculator on iPhone 5.0 Simulator

No Issues

Breakpoints

Editor View Organizer

Automatic › CalculatorViewController.m › -digitPressed:

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"

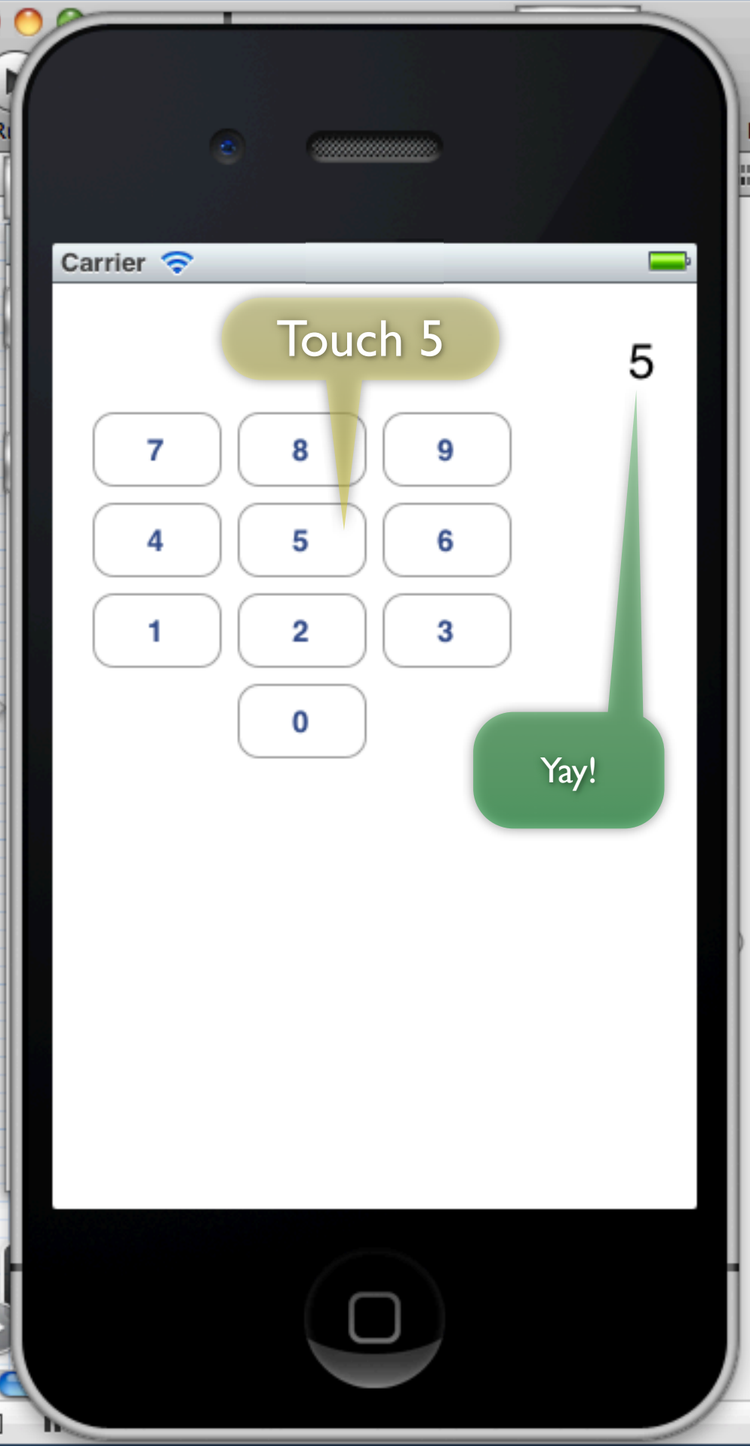
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end

@implementation CalculatorViewController

@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

@end
```



Calculator.xcodeproj — MainStoryboard.storyboard

Running Calculator on iPhone 5.0 Simulator

No Issues

Breakpoints

Editor View Organizer

Automatic › CalculatorViewController.m › -digitPressed:

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"

@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end

@implementation CalculatorViewController

@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

@end
```

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Fall 2011

Calculator.xcodeproj — MainStoryboard.storyboard

Running Calculator on iPhone 5.0 Simulator

No Issues

Breakpoints

Editor View Organizer

Automatic › CalculatorViewController.m › -digitPressed:

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"

@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end

@implementation CalculatorViewController

@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

@end
```

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Fall 2011

Calculator.xcodeproj — MainStoryboard.storyboard

Running Calculator on iPhone 5.0 Simulator

No Issues

Breakpoints

Editor View Organizer

Automatic › CalculatorViewController.m › -digitPressed:

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructo
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"

@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end

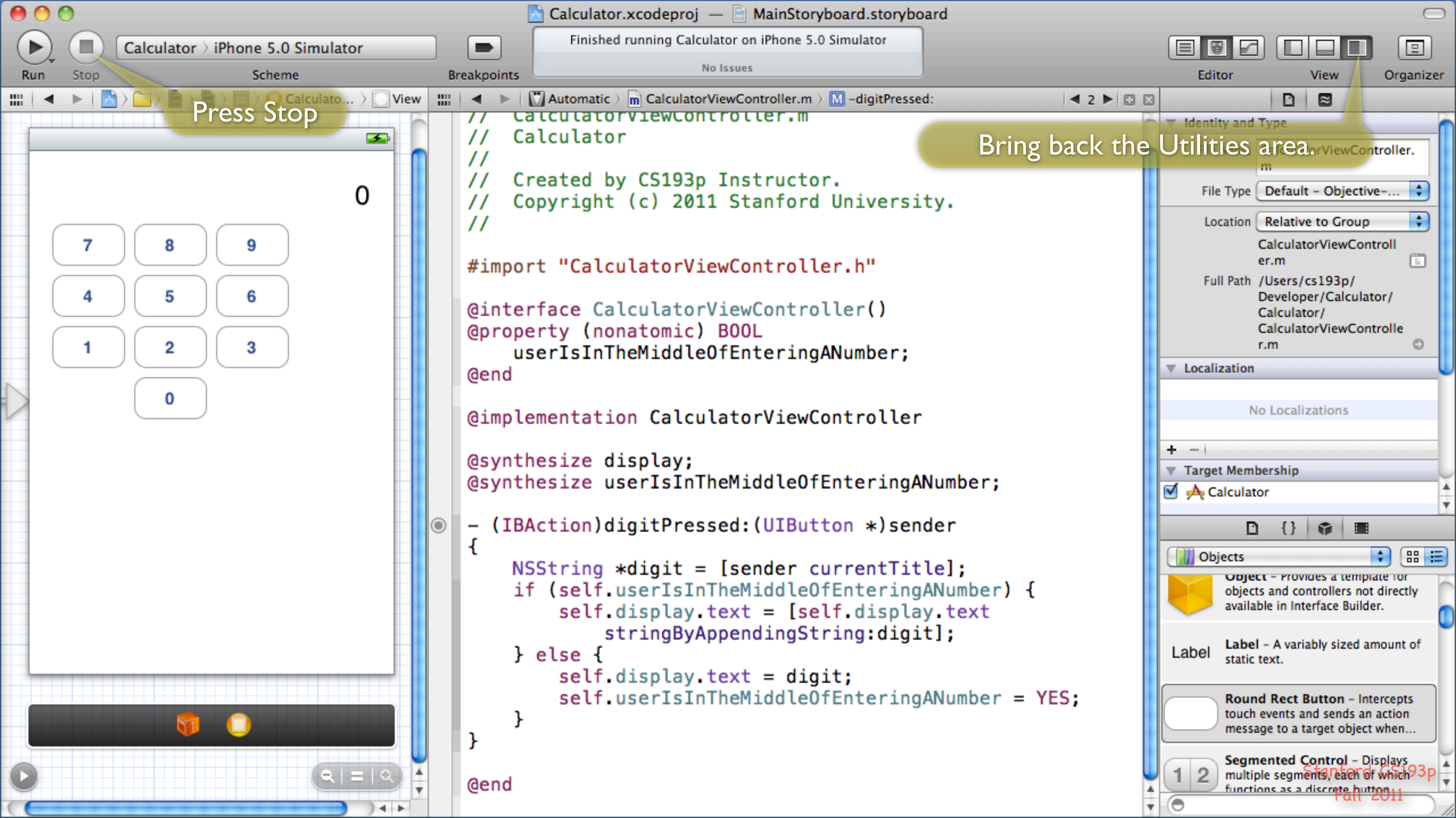
@implementation CalculatorViewController

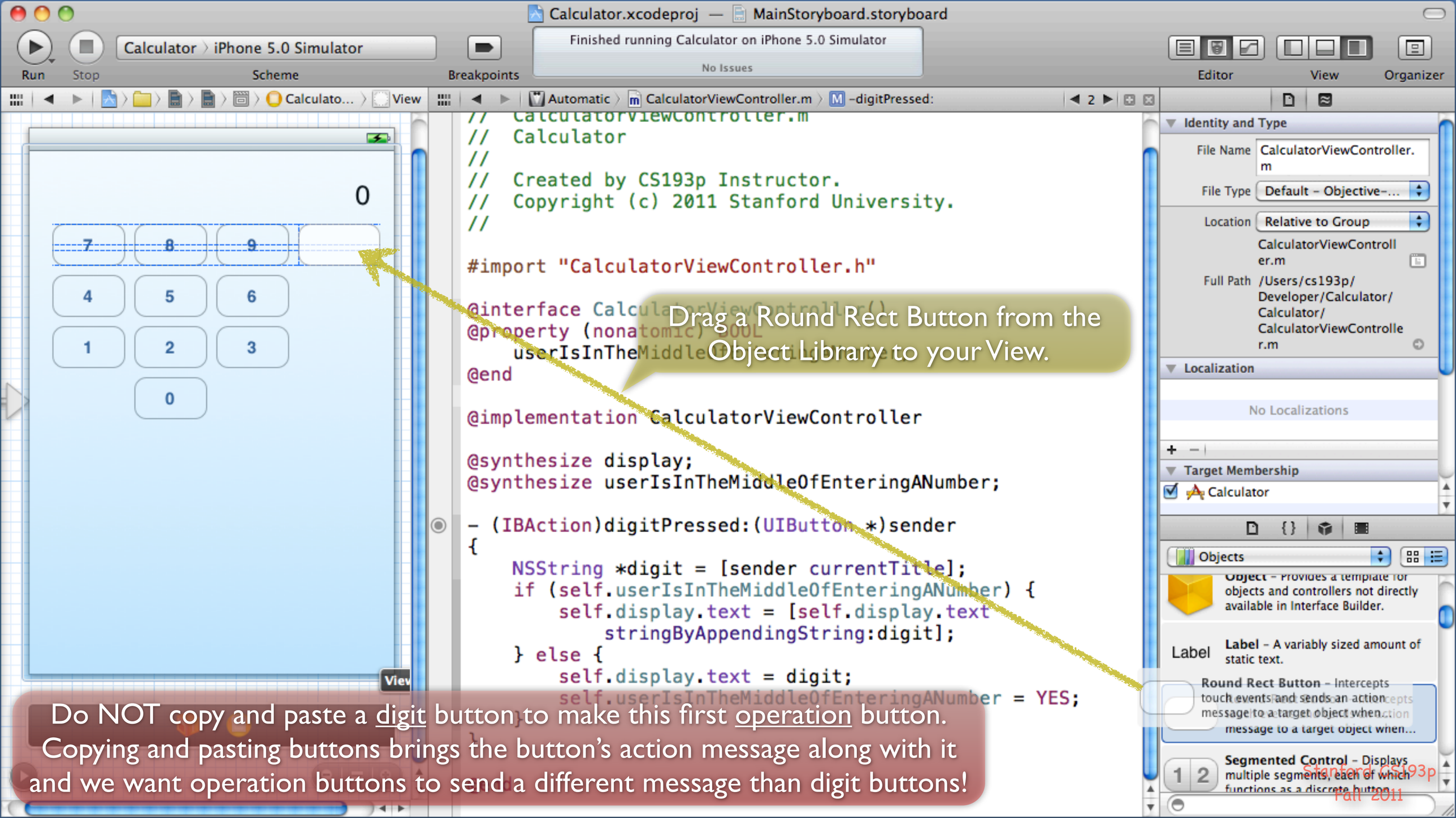
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

@end
```

Okay, all working now!
Next we need to add some more buttons (for operations and Enter).


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Press Stop
Bring back the Utilities area.
Automatic 〉 CalculatorViewController.m 〉 -digitPressed:
0
7 8 9
4 5 6
1 2 3
0
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
@end
Identity and Type
File Type
Default – Objective-...
Location
Relative to Group
CalculatorViewControll
er.m
Full Path
/Users/cs193p/
Developer/Calculator/
Calculator/
CalculatorViewControlle
r.m
Localization
No Localizations
Target Membership
Calculator
Objects
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-digitPressed:
0
7
8
9
4
5
6
1
2
3
0
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
    userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
Drag a Round Rect Button from the Object Library to your View.
Identity and Type
File Name
CalculatorViewController.m
File Type
Default – Objective-...
Location
Relative to Group
CalculatorViewController.m
Full Path
/Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button
Do NOT copy and paste a digit button to make this first operation button.
Copying and pasting buttons brings the button's action message along with it
and we want operation buttons to send a different message than digit buttons!
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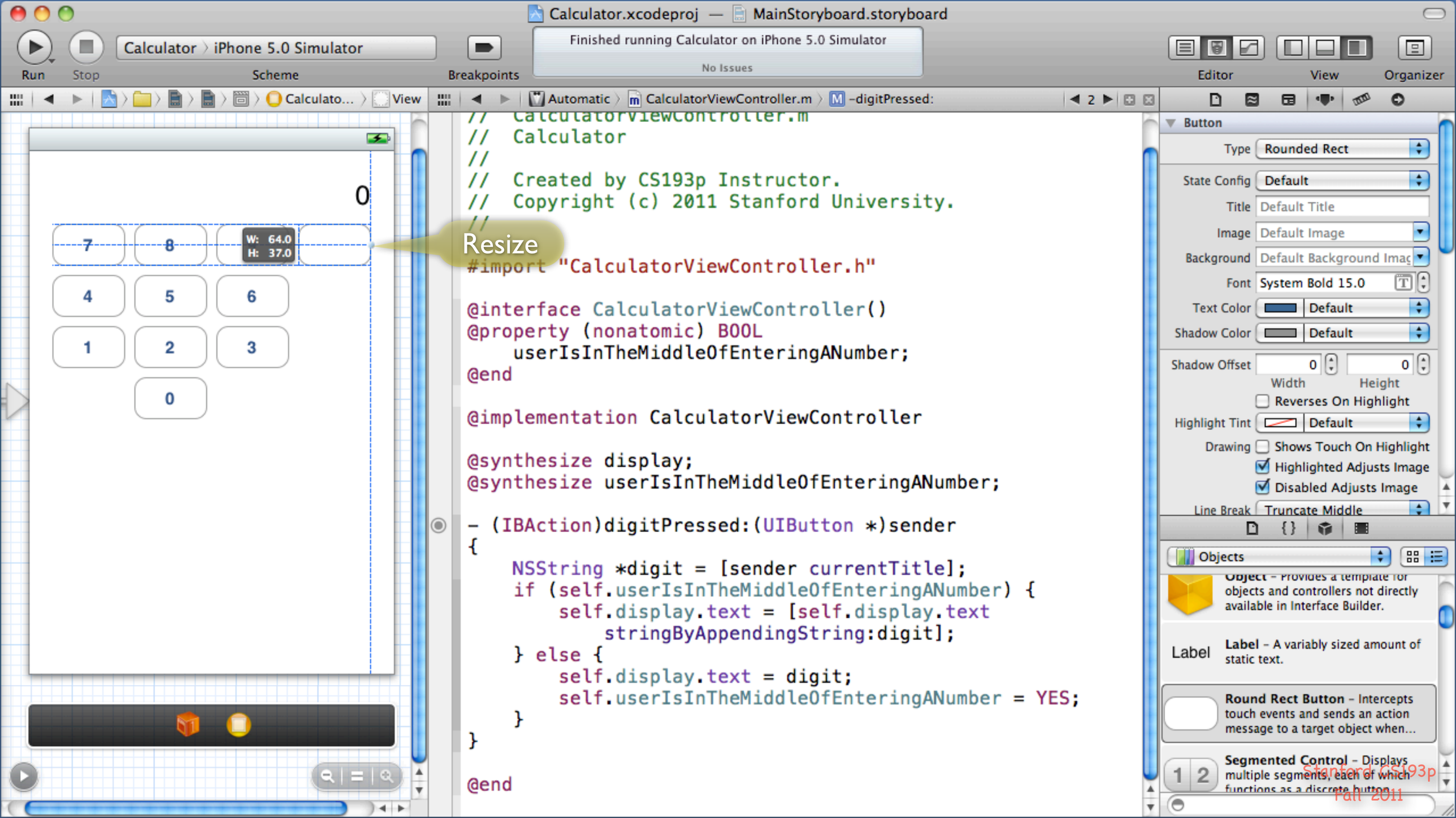
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-digitPressed:
0
7
8
W: 64.0
H: 37.0
4
5
6
1
2
3
0
Resize
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
    userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}
@end
Button
Type
Rounded Rect
State Config
Default
Title
Default Title
Image
Default Image
Background
Default Background Imag
Font
System Bold 15.0
Text Color
Default
Shadow Color
Default
Shadow Offset
0
0
Width
Height
Reverses On Highlight
Highlight Tint
Default
Drawing
Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break
Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
1 2
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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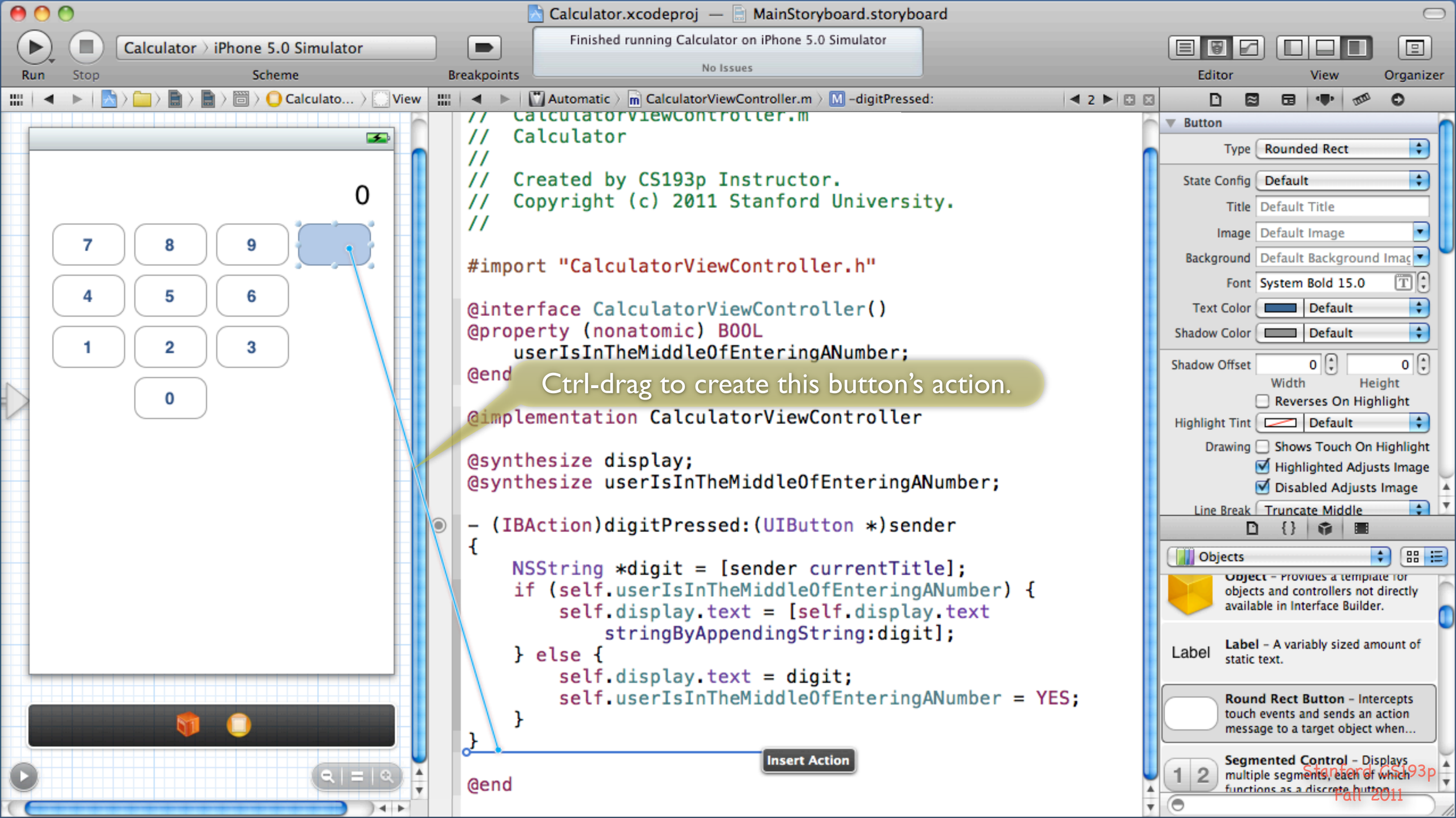
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-digitPressed:
0
7
8
9
4
5
6
1
2
3
0
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
    userIsInTheMiddleOfEnteringANumber;
@end
Ctrl-drag to create this button's action.
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}
Insert Action
@end
Button
Type
Rounded Rect
State Config
Default
Title
Default Title
Image
Default Image
Background
Default Background Imag
Font
System Bold 15.0
Text Color
Default
Shadow Color
Default
Shadow Offset
0
0
Width
Height
Reverses On Highlight
Highlight Tint
Default
Drawing
Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break
Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
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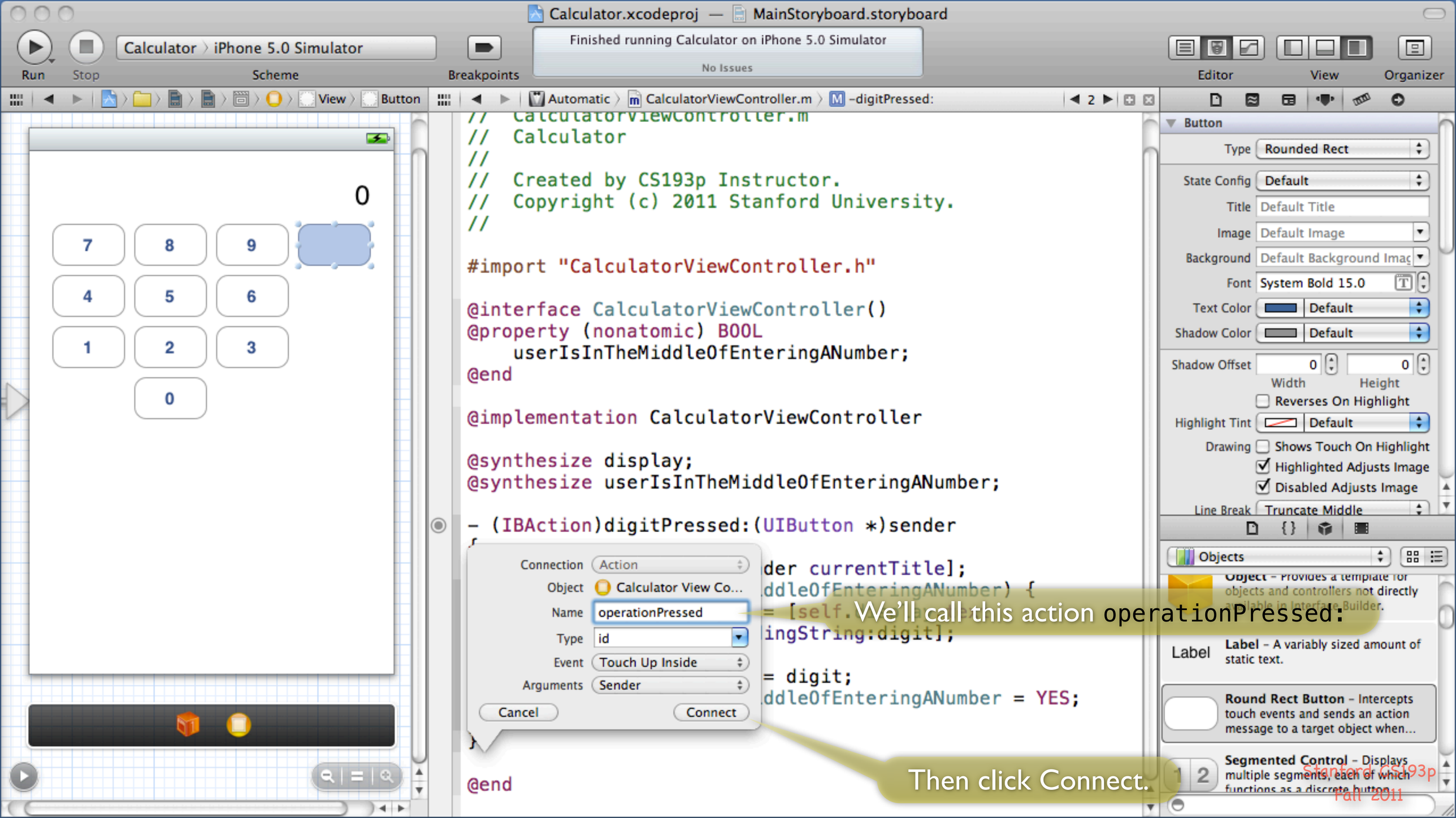
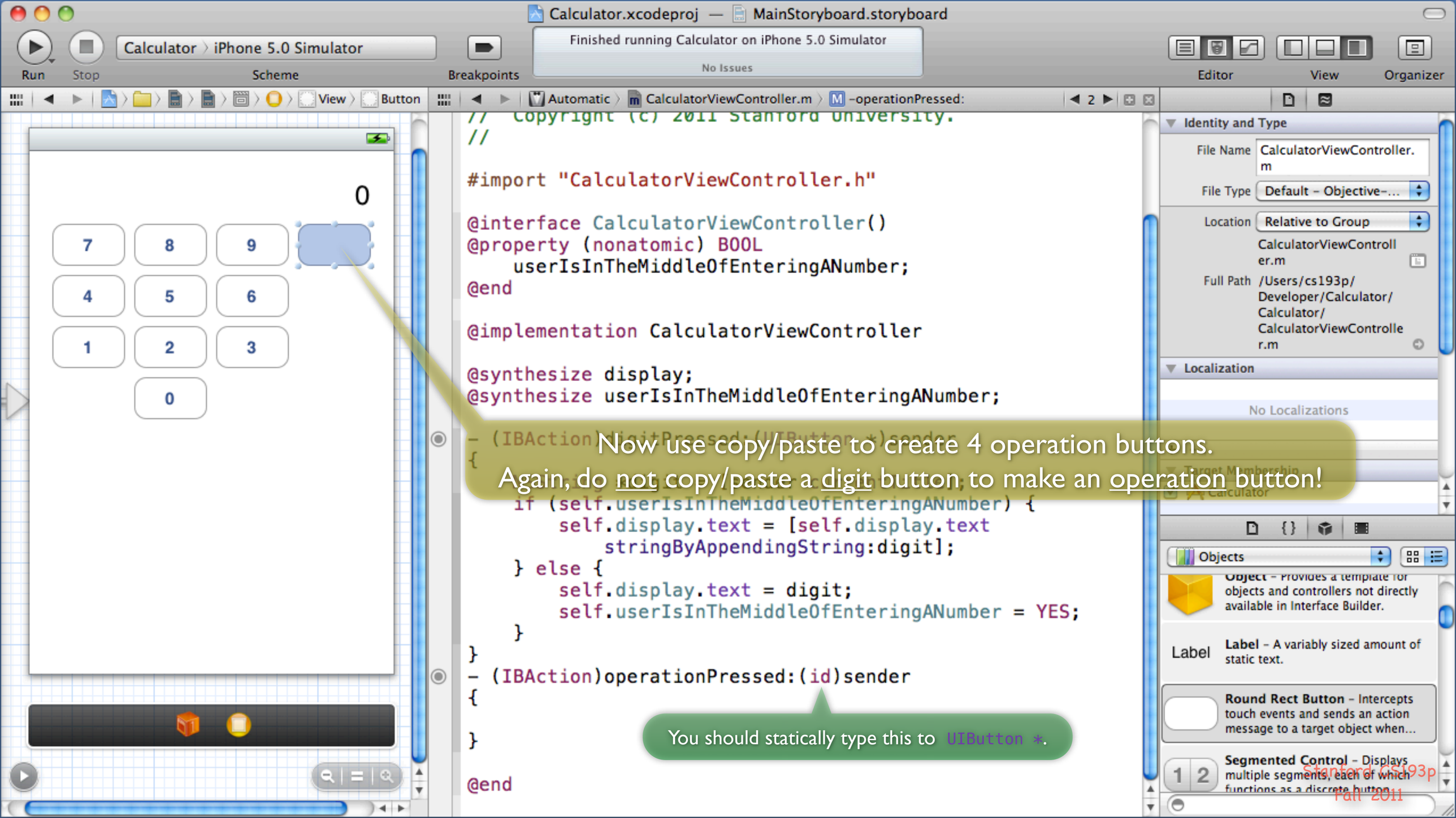
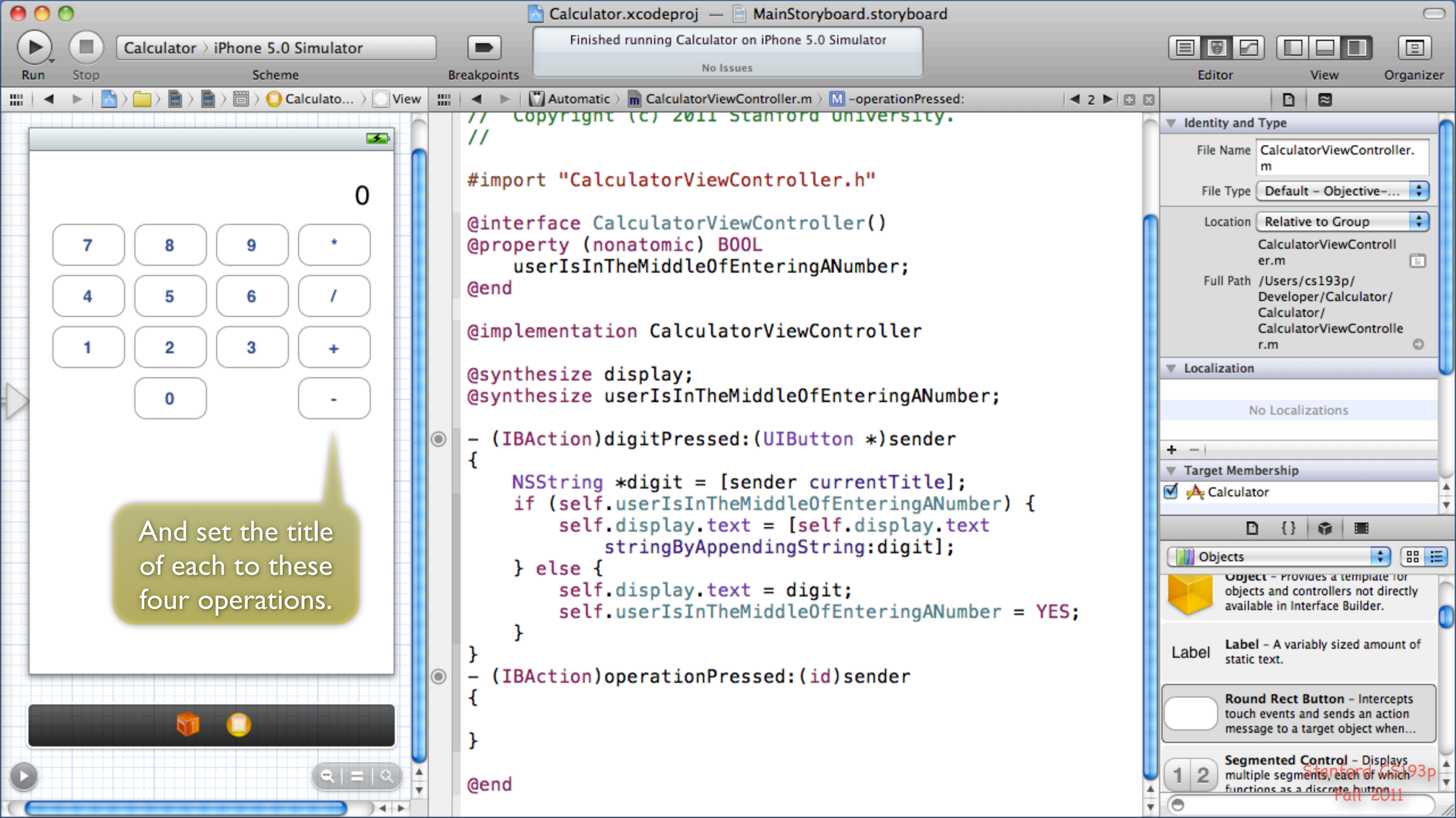
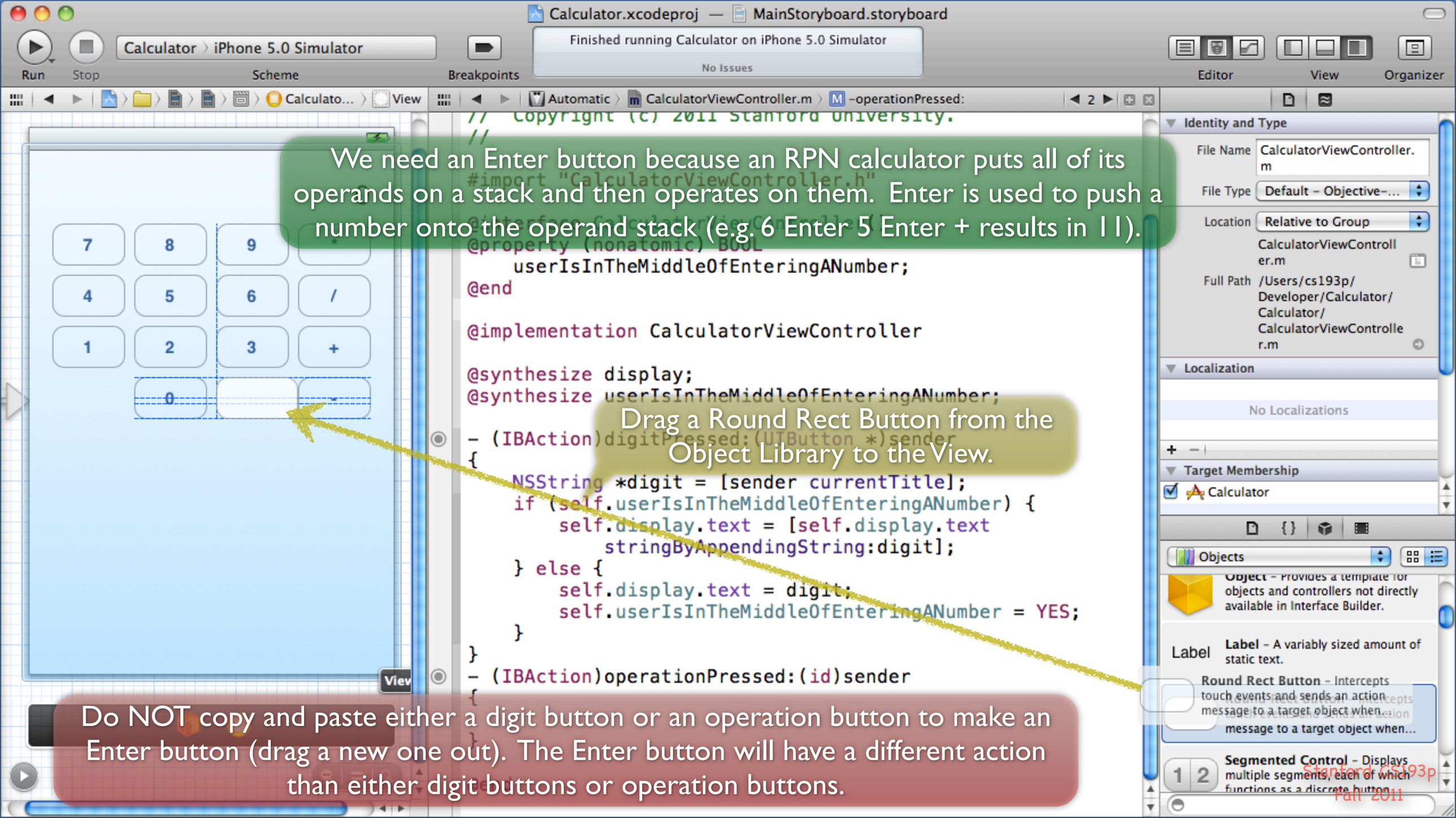
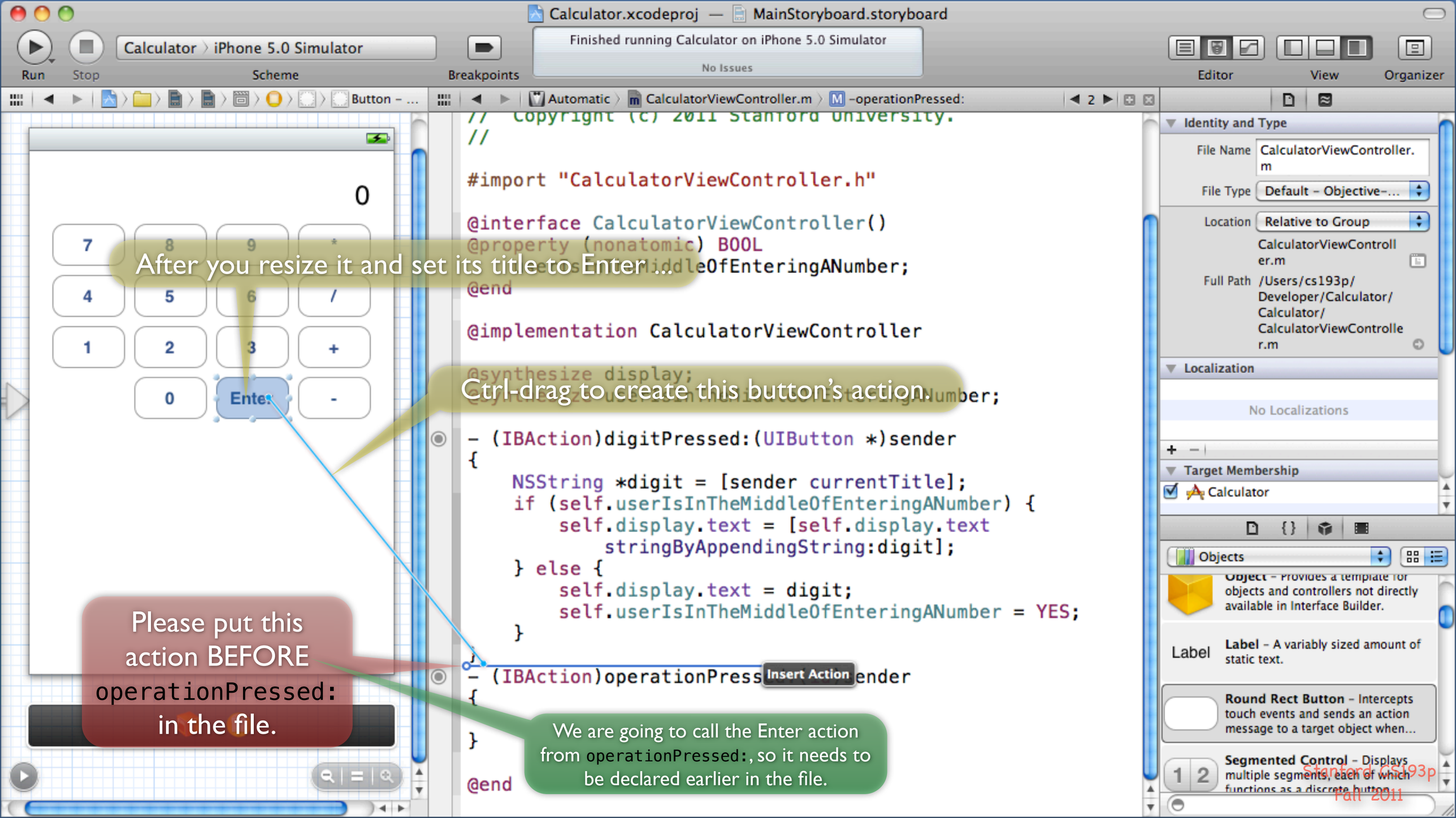
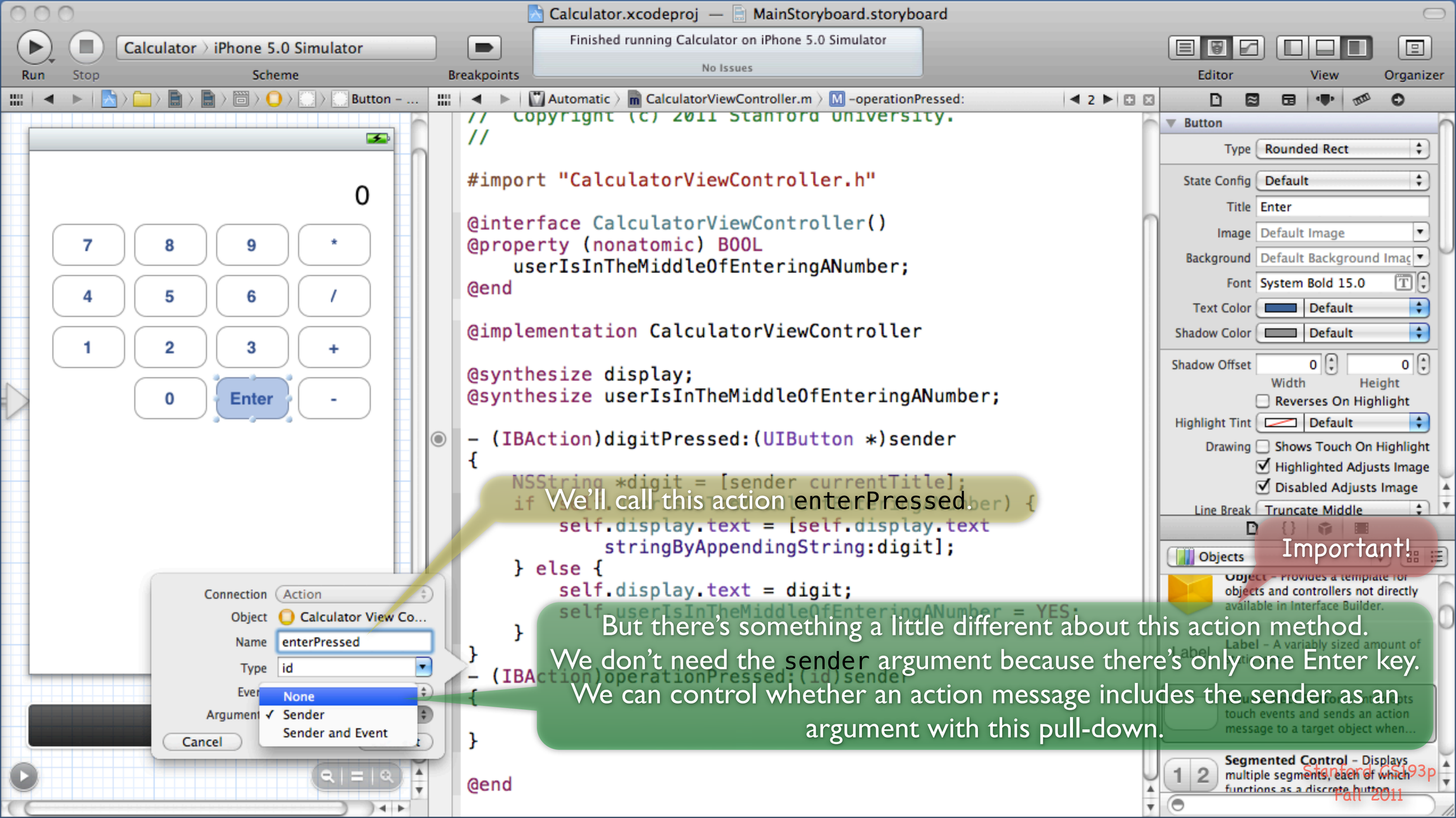

Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -digitPressed:
0
7 8 9
4 5 6
1 2 3
0
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
Connection Action
Object Calculator View Co...
Name operationPressed
Type id
Event Touch Up Inside
Arguments Sender
Cancel
Connect
@end
We'll call this action operationPressed:
Then click Connect.
Button
Type Rounded Rect
State Config Default
Title Default Title
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
View › Button
Automatic › CalculatorViewController.m › -operationPressed:
0
7 8 9
4 5 6
1 2 3
0
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)operationPressed:(id)sender
{
}
@end
Now use copy/paste to create 4 operation buttons.
Again, do not copy/paste a digit button to make an operation button!
You should statically type this to UIButton *.
Identity and Type
File Name CalculatorViewController.m
File Type Default – Objective-...
Location Relative to Group
CalculatorViewControlller.m
Full Path /Users/cs193p/Developer/Calculator/Calculator/CalculatorViewControlle r.m
Localization
No Localizations
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Calculato...
View
Automatic
CalculatorViewController.m
-operationPressed:
0
7
8
9
*
4
5
6
/
1
2
3
+
0
-
And set the title of each to these four operations.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)operationPressed:(id)sender
{
}
@end
Identity and Type
File Name
CalculatorViewController.m
File Type
Default - Objective-...
Location
Relative to Group
CalculatorViewController.m
Full Path
/Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator
Objects
Object - Provides a template for objects and controllers not directly available in Interface Builder.
Label
Label - A variably sized amount of static text.
Round Rect Button - Intercepts touch events and sends an action message to a target object when...
Segmented Control - Displays multiple segments, each of which functions as a discrete button...
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Automatic › CalculatorViewController.m › -operationPressed:
We need an Enter button because an RPN calculator puts all of its operands on a stack and then operates on them. Enter is used to push a number onto the operand stack (e.g. 6 Enter 5 Enter + results in 11).
Drag a Round Rect Button from the Object Library to the View.
Do NOT copy and paste either a digit button or an operation button to make an Enter button (drag a new one out). The Enter button will have a different action than either digit buttons or operation buttons.
Identity and Type
File Name
CalculatorViewController.m
File Type
Default – Objective-...
Location
Relative to Group
Full Path
/Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator
Objects
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Button – ...
Automatic › CalculatorViewController.m › -operationPressed:
0
7
8
9
*
4
5
6
/
1
2
3
+
0
Enter
-
After you resize it and set its title to Enter ...
Ctrl-drag to create this button's action.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
eOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
umber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)operationPress
Insert Action
ender
{
}
@end
Please put this action BEFORE operationPressed: in the file.
We are going to call the Enter action from operationPressed:, so it needs to be declared earlier in the file.
Identity and Type
File Name
CalculatorViewController.m
File Type
Default – Objective-...
Location
Relative to Group
CalculatorViewController.m
Full Path
/Users/cs193p/Developer/Calculator/Calculator/CalculatorViewController.m
Localization
No Localizations
Target Membership
Calculator
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which functions as a discrete button...
Stanford CS193p
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Button – ...
Automatic › CalculatorViewController.m › -operationPressed:
0
7 8 9 *
4 5 6 /
1 2 3 +
0 Enter -
Connection Action
Object Calculator View Co...
Name enterPressed
Type id
Event
Argument
None
Sender
Sender and Event
Cancel
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)operationPressed:(id)sender
{
}
@end
Button
Type Rounded Rect
State Config Default
Title Enter
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Label – A variably sized amount of
Segmented Control – Displays multiple segments, each of which
We'll call this action enterPressed.
Important!
But there's something a little different about this action method.
We don't need the sender argument because there's only one Enter key.
We can control whether an action message includes the sender as an argument with this pull-down.
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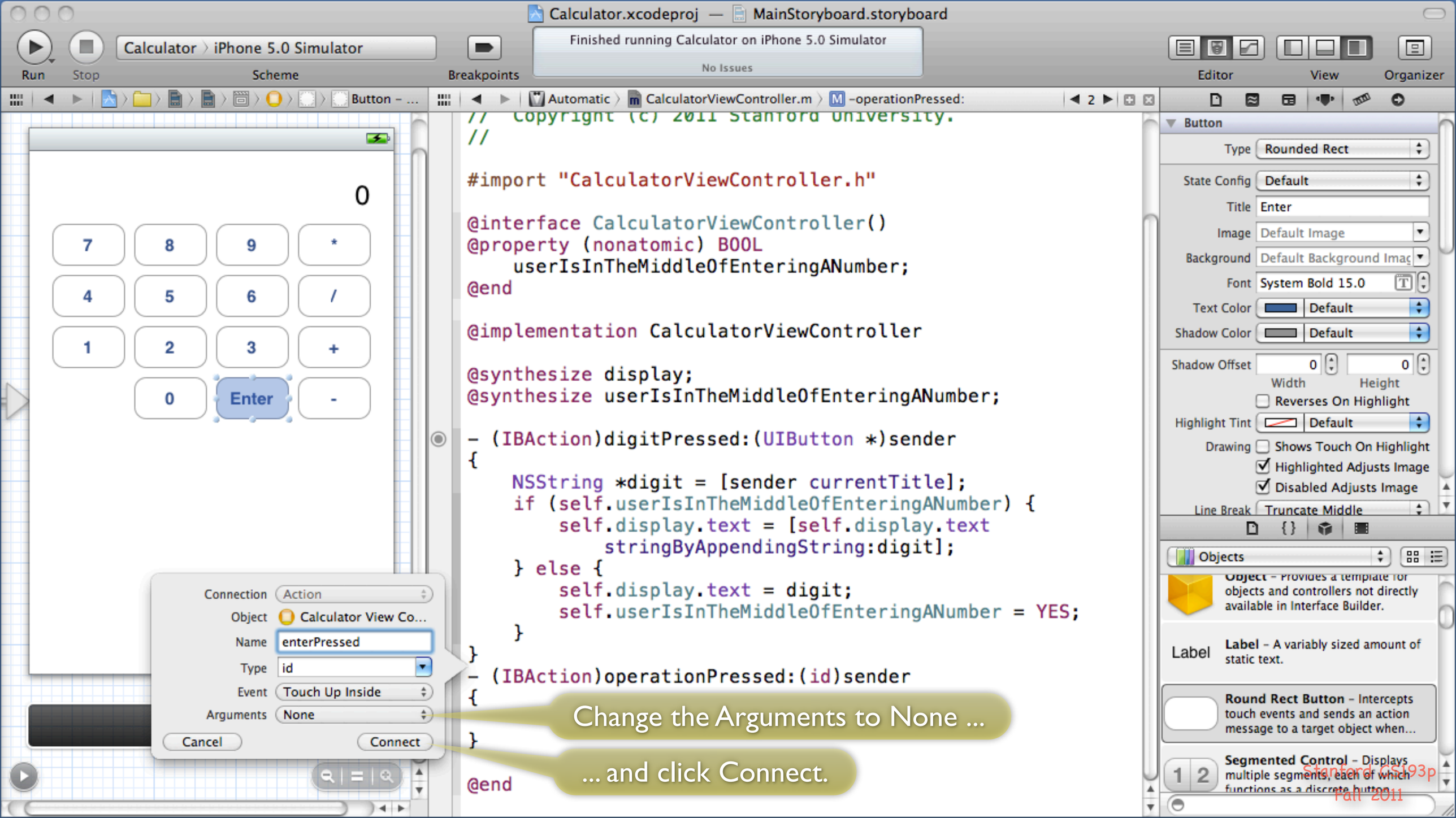
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Button – ...
Automatic › CalculatorViewController.m › -operationPressed:
0
7 8 9 *
4 5 6 /
1 2 3 +
0 Enter -
Connection Action
Object Calculator View Co...
Name enterPressed
Type id
Event Touch Up Inside
Arguments None
Cancel
Connect
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)operationPressed:(id)sender
{
}
@end
Change the Arguments to None ...
... and click Connect.
Button
Type Rounded Rect
State Config Default
Title Enter
Image Default Image
Background Default Background Imag
Font System Bold 15.0
Text Color Default
Shadow Color Default
Shadow Offset 0 0
Width Height
Reverses On Highlight
Highlight Tint Default
Drawing Shows Touch On Highlight
Highlighted Adjusts Image
Disabled Adjusts Image
Line Break Truncate Middle
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
Segmented Control – Displays multiple segments, each of which
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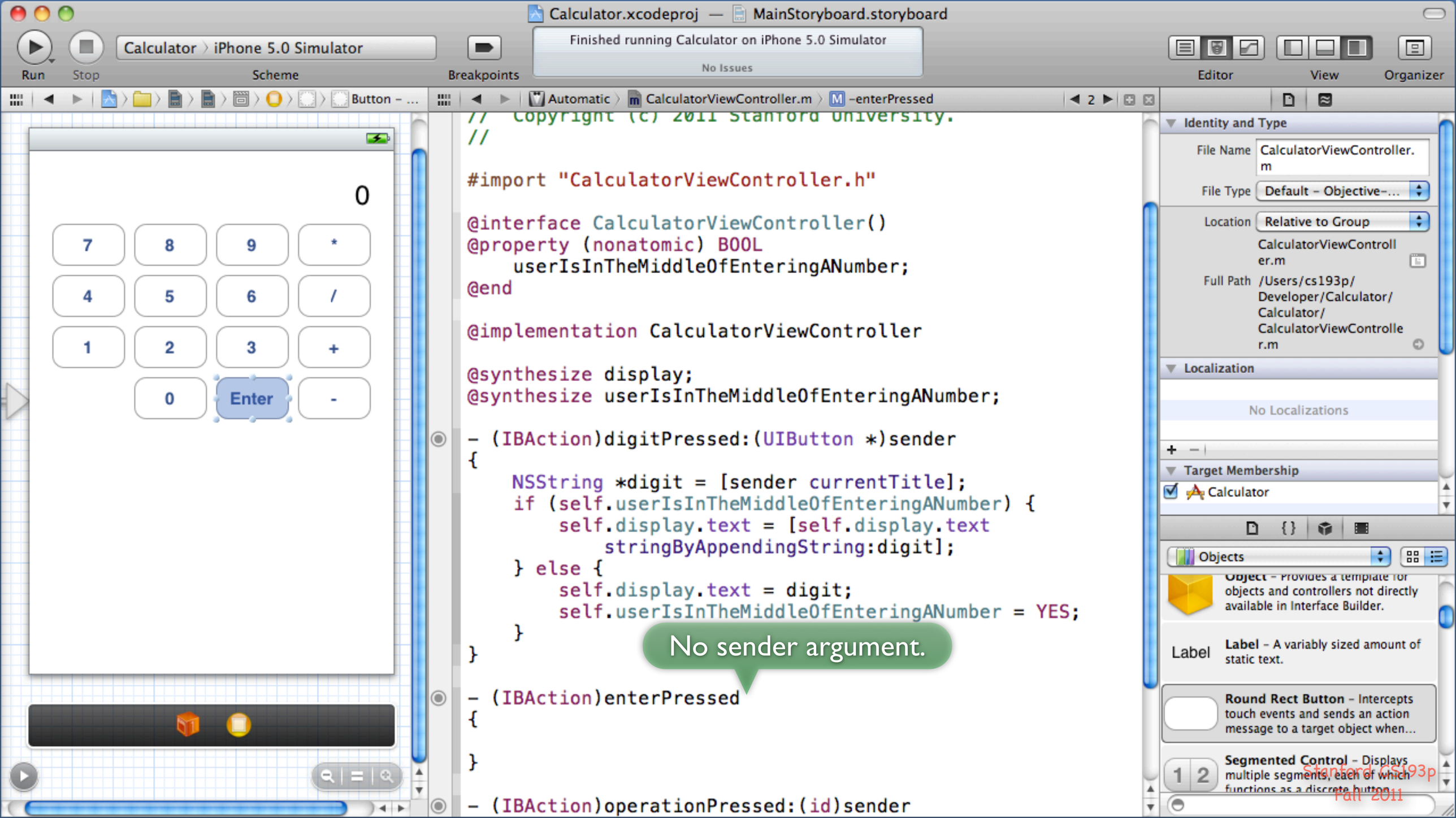
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Button – ...
Automatic › CalculatorViewController.m › -enterPressed
0
7 8 9 *
4 5 6 /
1 2 3 +
0 Enter -
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL
userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
No sender argument.
- (IBAction)enterPressed
{
}
- (IBAction)operationPressed:(id)sender
Identity and Type
File Name CalculatorViewController.m
File Type Default – Objective-...
Location Relative to Group
CalculatorViewControlller.m
Full Path /Users/cs193p/Developer/Calculator/Calculator/CalculatorViewControlle r.m
Localization
No Localizations
Target Membership
Calculator
Objects
Object – Provides a template for objects and controllers not directly available in Interface Builder.
Label – A variably sized amount of static text.
Round Rect Button – Intercepts touch events and sends an action message to a target object when...
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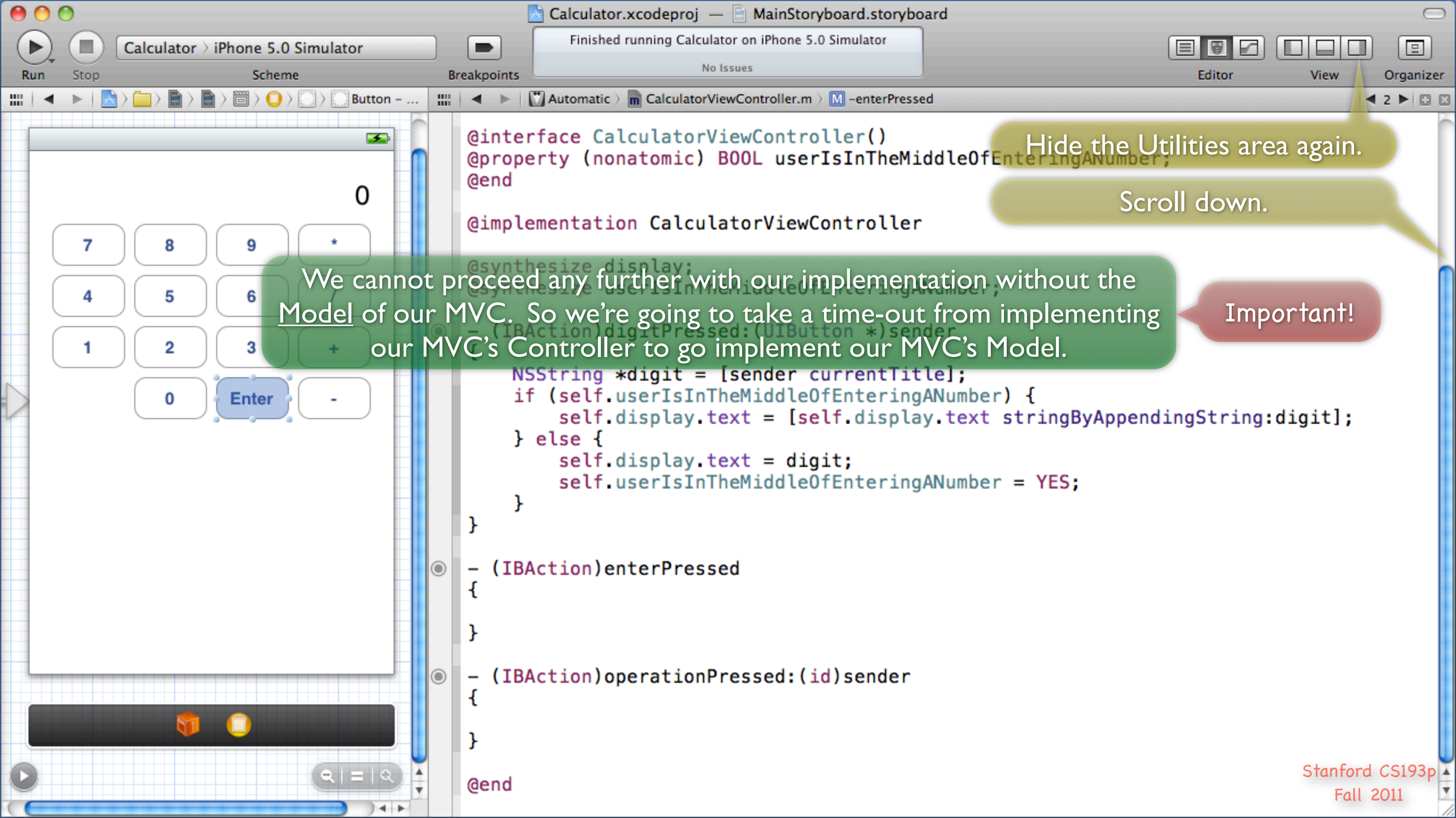
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
Button – ...
Automatic › CalculatorViewController.m › -enterPressed
0
7
8
9
*
4
5
6
/
1
2
3
+
0
Enter
-
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
}
- (IBAction)operationPressed:(id)sender
{
}
@end
Hide the Utilities area again.
Scroll down.
We cannot proceed any further with our implementation without the Model of our MVC. So we're going to take a time-out from implementing our MVC's Controller to go implement our MVC's Model.
Important!
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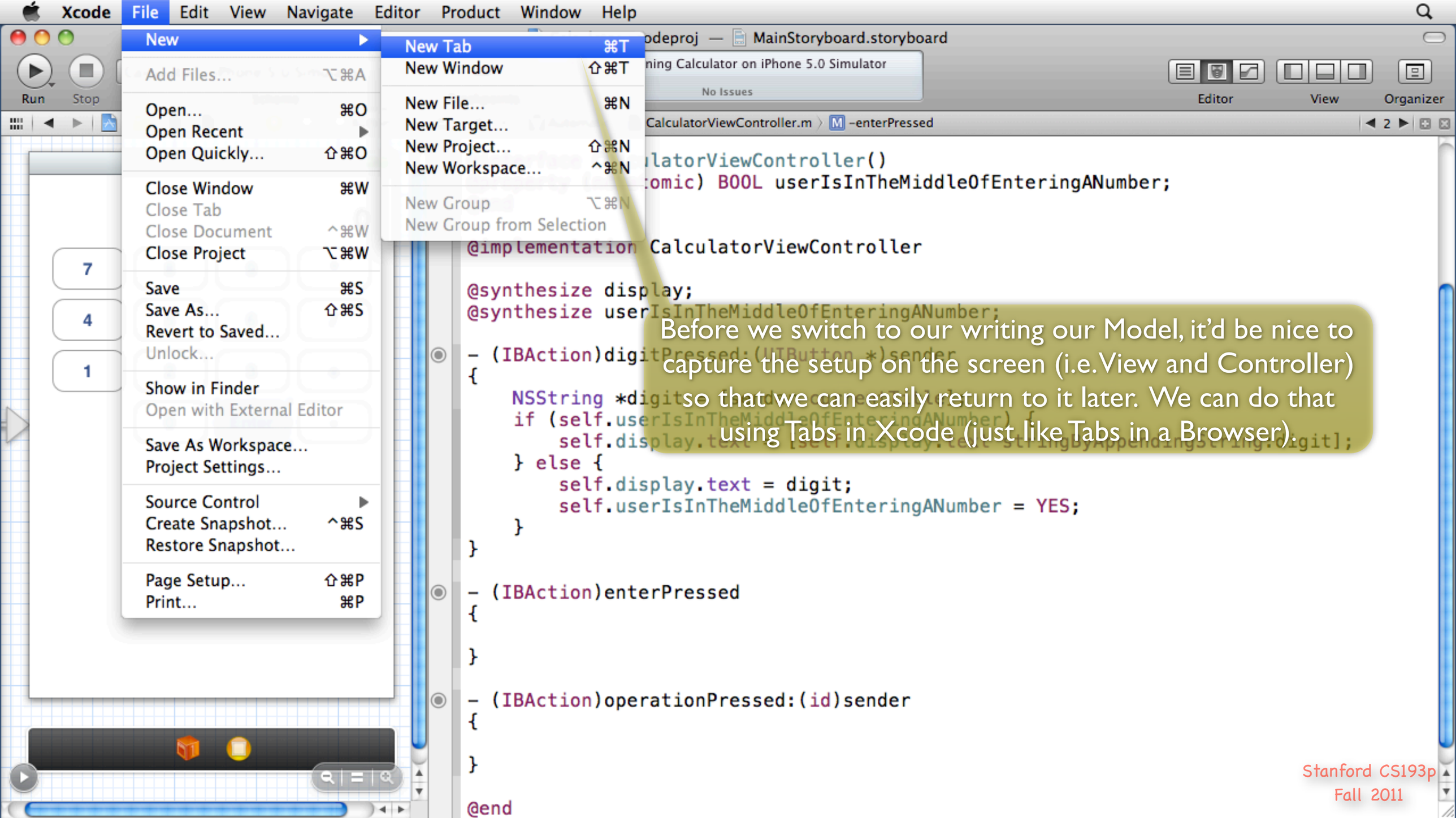
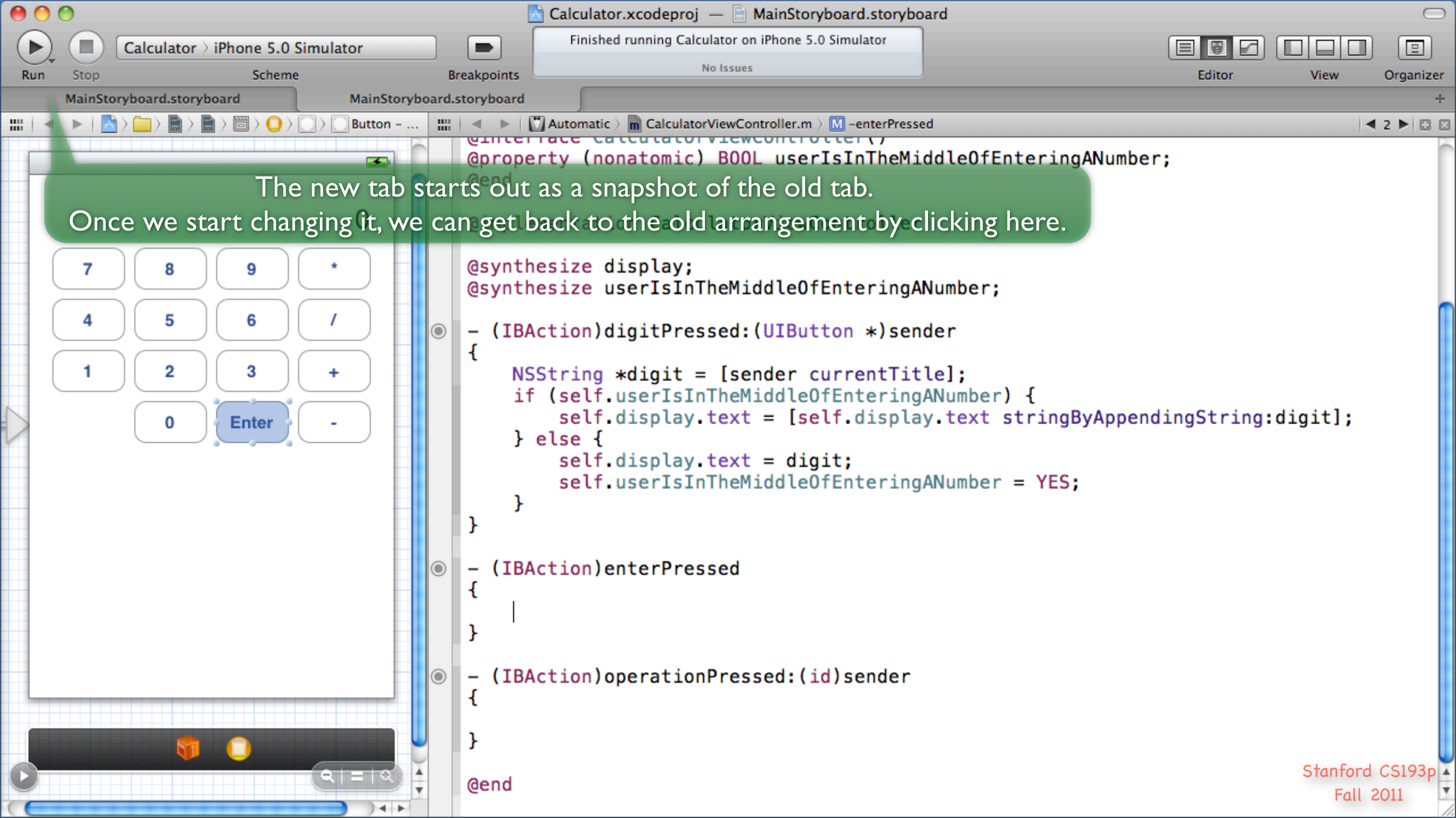


Before we switch to our writing our Model, it'd be nice to capture the setup on the screen (i.e. View and Controller) so that we can easily return to it later. We can do that using Tabs in Xcode (just like Tabs in a Browser).


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
MainStoryboard.storyboard
MainStoryboard.storyboard
Button – ...
Automatic 〉 CalculatorViewController.m 〉 -enterPressed
The new tab starts out as a snapshot of the old tab.
Once we start changing it, we can get back to the old arrangement by clicking here.
7
8
9
*
4
5
6
/
1
2
3
+
0
Enter
-
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
}
- (IBAction)operationPressed:(id)sender
{
}
@end
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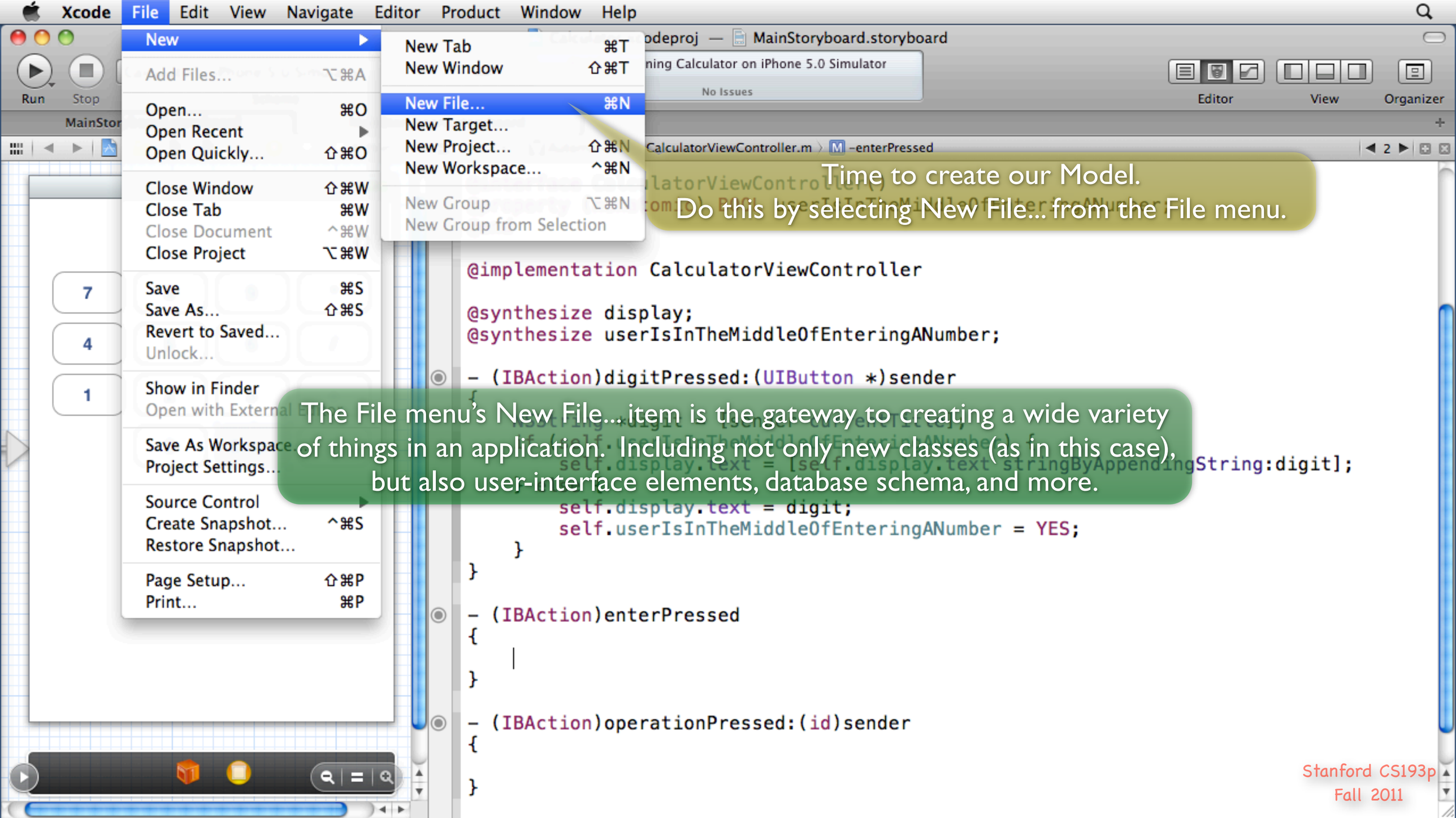
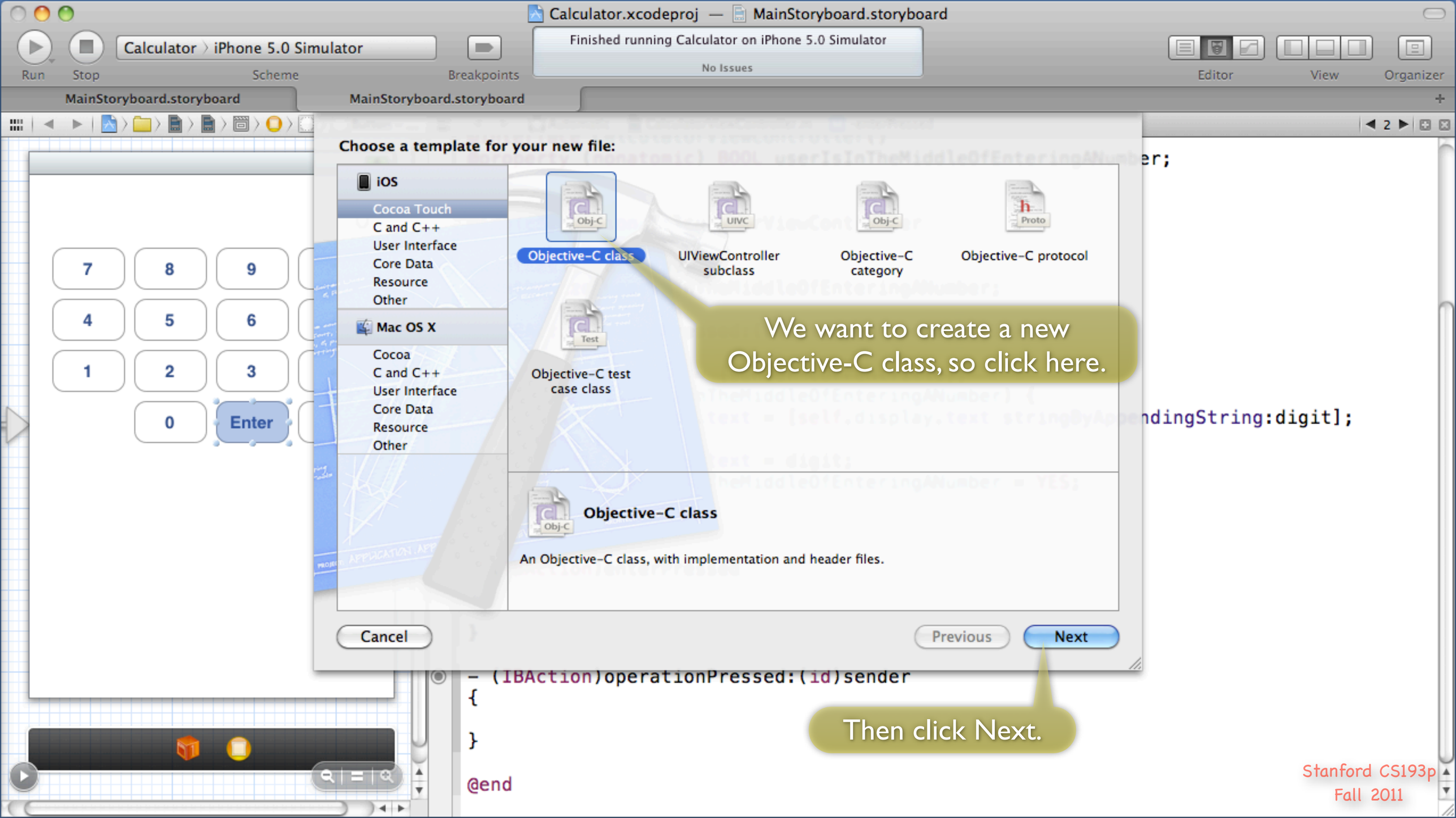

Xcode File Edit View Navigate Editor Product Window Help
New
Add Files... ⌥⌘A
Open... ⌘O
Open Recent
Open Quickly... ⇧⌘O
Close Window ⇧⌘W
Close Tab ⌘W
Close Document ^⌘W
Close Project ⌥⌘W
Save ⌘S
Save As... ⇧⌘S
Revert to Saved...
Unlock...
Show in Finder
Open with External E
Save As Workspace
Project Settings...
Source Control
Create Snapshot... ^⌘S
Restore Snapshot...
Page Setup... ⇧⌘P
Print... ⌘P
New Tab ⌘T
New Window ⇧⌘T
New File... ⌘N
New Target...
New Project... ⇧⌘N
New Workspace... ^⌘N
New Group ⌥⌘N
New Group from Selection
MainStoryboard.storyboard
No Issues
Run
Stop
Editor
View
Organizer
CalculatorViewController.m
-enterPressed
Time to create our Model.
Do this by selecting New File... from the File menu.
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
self.display.text = [self.display.text stringByAppendingString:digit];
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
- (IBAction)enterPressed
- (IBAction)operationPressed:(id)sender
The File menu's New File... item is the gateway to creating a wide variety of things in an application. Including not only new classes (as in this case), but also user-interface elements, database schema, and more.


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
MainStoryboard.storyboard
MainStoryboard.storyboard
Choose a template for your new file:
iOS
Cocoa Touch
C and C++
User Interface
Core Data
Resource
Other
Mac OS X
Cocoa
C and C++
User Interface
Core Data
Resource
Other
Objective-C class
UIViewController subclass
Objective-C category
Objective-C protocol
Objective-C test case class
Objective-C class
An Objective-C class, with implementation and header files.
Cancel
Previous
Next
We want to create a new Objective-C class, so click here.
Then click Next.
7
8
9
4
5
6
1
2
3
0
Enter
- (IBAction)operationPressed:(id)sender
{
}
@end
ndingString:digit];
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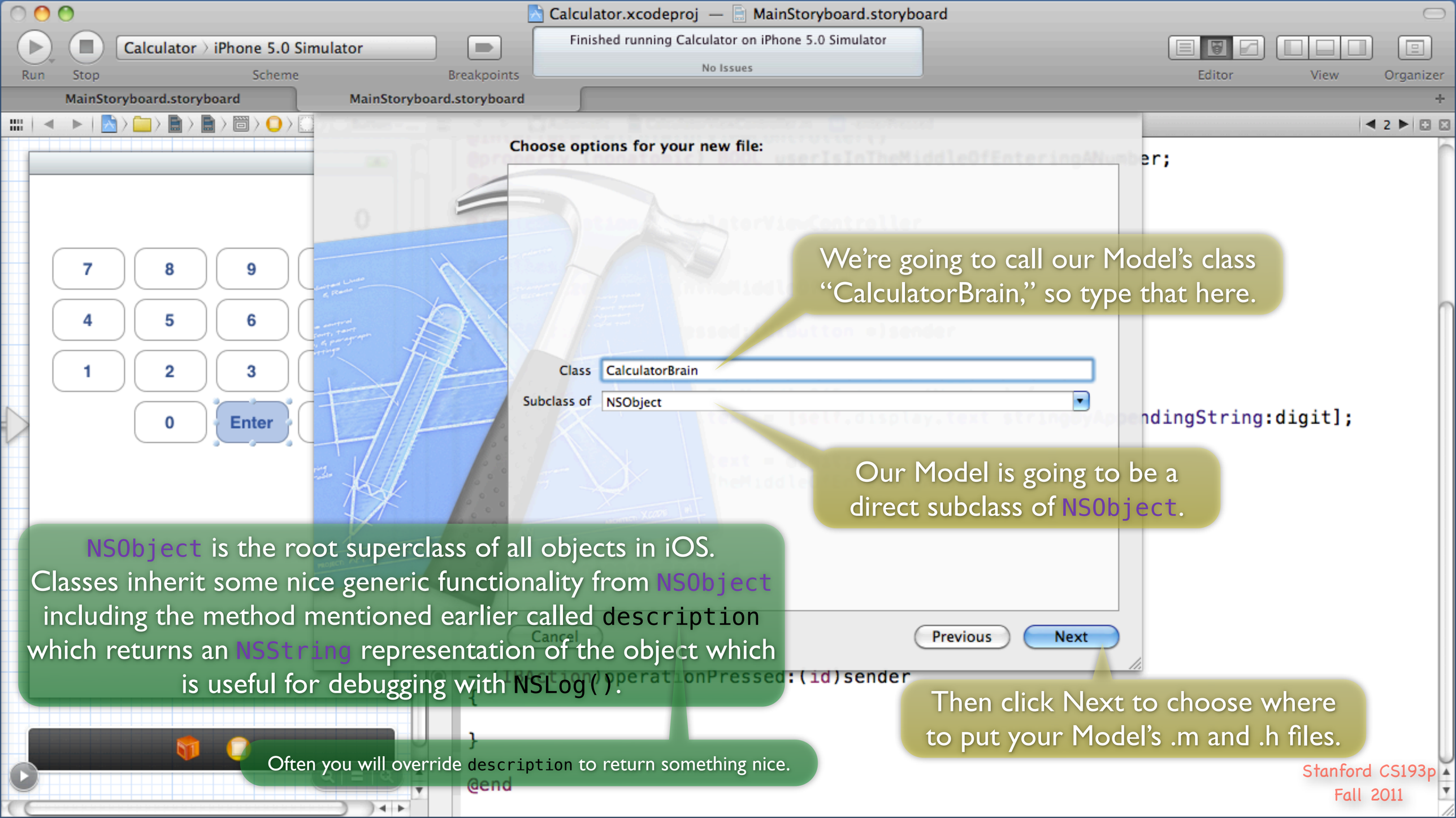
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
MainStoryboard.storyboard
MainStoryboard.storyboard
Choose options for your new file:
Class
CalculatorBrain
Subclass of
NSObject
Cancel
Previous
Next
7
8
9
4
5
6
1
2
3
0
Enter
We're going to call our Model's class "CalculatorBrain," so type that here.
Our Model is going to be a direct subclass of NSObject.
NSObject is the root superclass of all objects in iOS. Classes inherit some nice generic functionality from NSObject including the method mentioned earlier called description which returns an NSString representation of the object which is useful for debugging with NSLog().
Then click Next to choose where to put your Model's .m and .h files.
Often you will override description to return something nice.
@end
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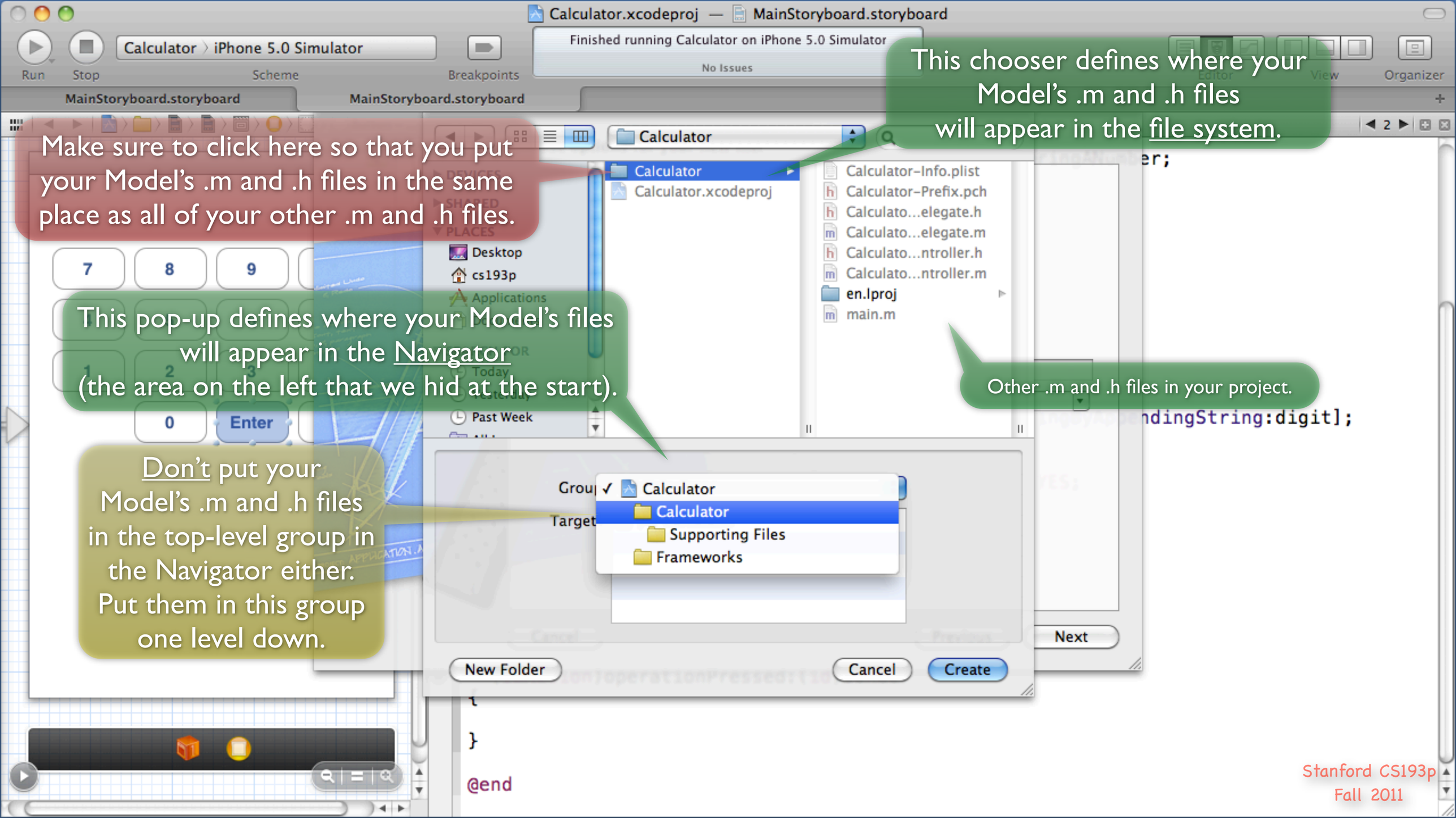
Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
MainStoryboard.storyboard
MainStoryboard.storyboard
This chooser defines where your Model's .m and .h files will appear in the file system.
Make sure to click here so that you put your Model's .m and .h files in the same place as all of your other .m and .h files.
This pop-up defines where your Model's files will appear in the Navigator (the area on the left that we hid at the start).
Don't put your Model's .m and .h files in the top-level group in the Navigator either. Put them in this group one level down.
Other .m and .h files in your project.
Calculator
Calculator
Calculator.xcodeproj
Calculator-Info.plist
Calculator-Prefix.pch
Calculato...elegate.h
Calculato...elegate.m
Calculato...ntroller.h
Calculato...ntroller.m
en.lproj
main.m
Desktop
cs193p
Applications
Past Week
Group
Target
Calculator
Calculator
Supporting Files
Frameworks
New Folder
Cancel
Create
Next
7
8
9
0
Enter
er;
ndingString:digit];
}
@end
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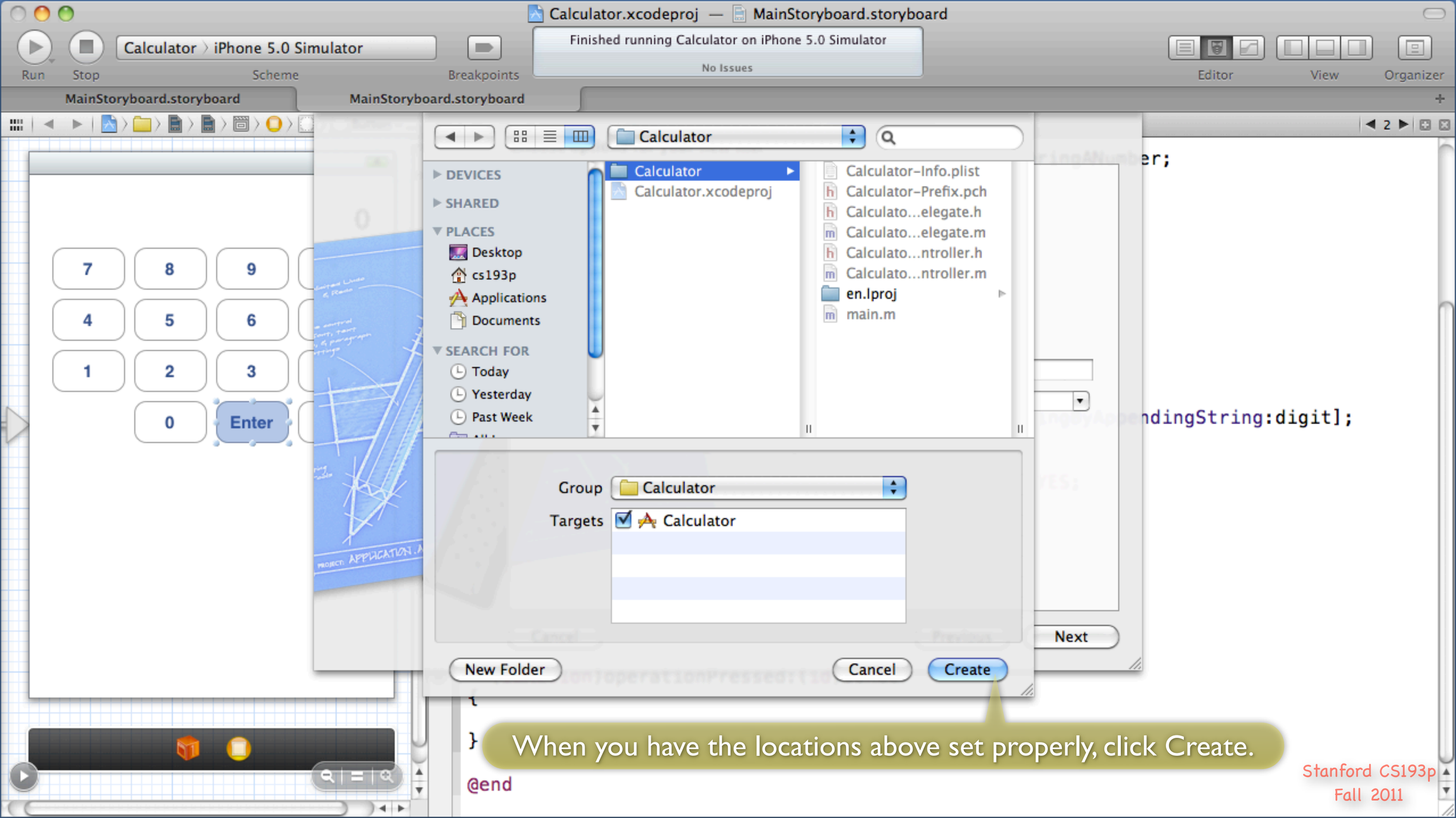
Fall 2011


Calculator.xcodeproj — MainStoryboard.storyboard
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
MainStoryboard.storyboard
MainStoryboard.storyboard
7
8
9
4
5
6
1
2
3
0
Enter
Calculator
DEVICES
SHARED
PLACES
Desktop
cs193p
Applications
Documents
SEARCH FOR
Today
Yesterday
Past Week
Calculator
Calculator.xcodeproj
Calculator-Info.plist
Calculator-Prefix.pch
Calculato...elegate.h
Calculato...elegate.m
Calculato...ntroller.h
Calculato...ntroller.m
en.lproj
main.m
Group
Calculator
Targets
Calculator
New Folder
Cancel
Create
Next
er;
ndingString:digit];
}
@end
When you have the locations above set properly, click Create.
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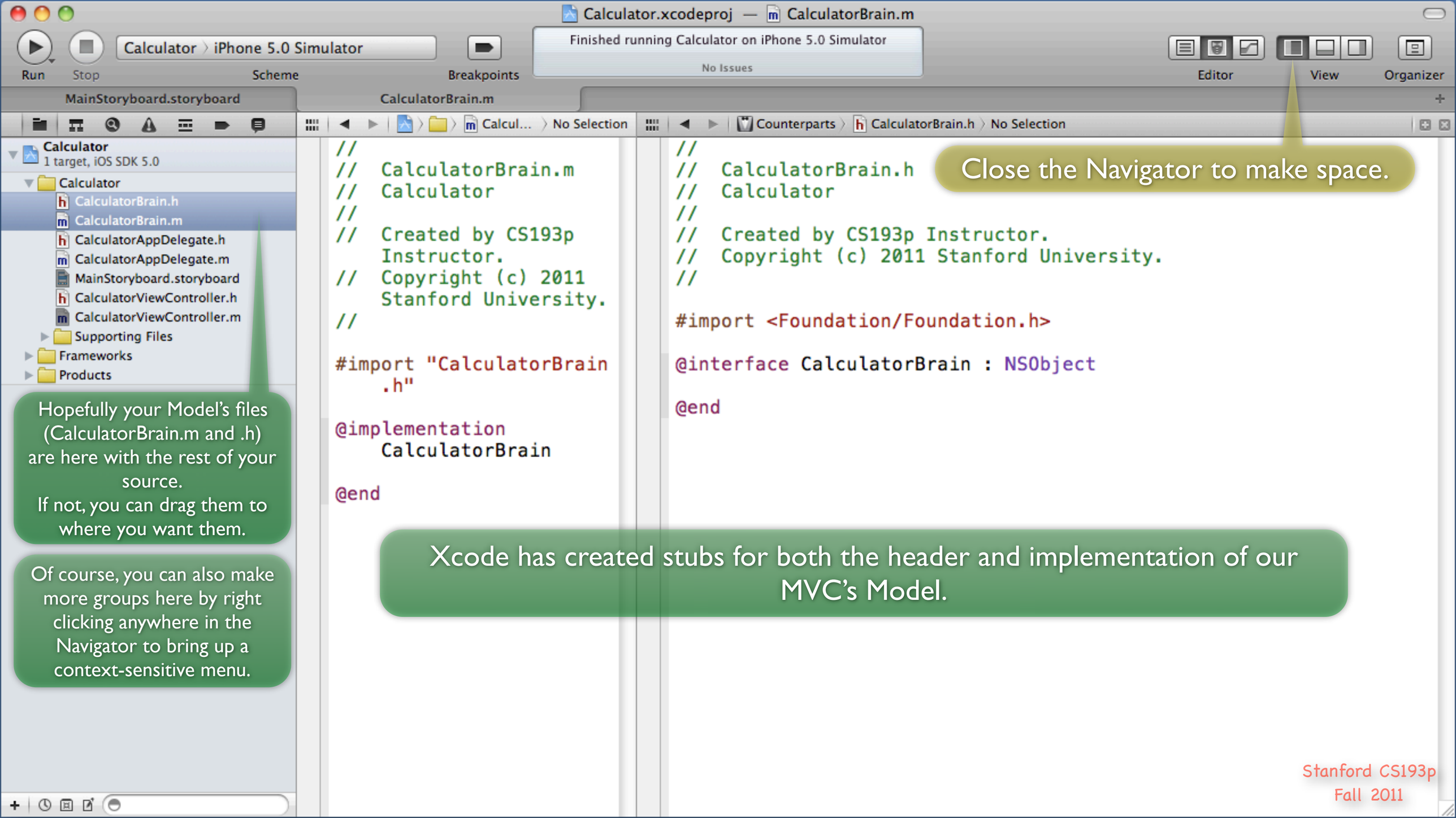
Calculator.xcodeproj — CalculatorBrain.m
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
MainStoryboard.storyboard
CalculatorBrain.m
Calculator
1 target, iOS SDK 5.0
Calculator
CalculatorBrain.h
CalculatorBrain.m
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Frameworks
Products
Calcul... › No Selection
Counterparts › CalculatorBrain.h › No Selection
// CalculatorBrain.m // Calculator // // Created by CS193p Instructor. // Copyright (c) 2011 Stanford University. //
#import "CalculatorBrain.h"
@implementation CalculatorBrain
@end
// CalculatorBrain.h // Calculator // // Created by CS193p Instructor. // Copyright (c) 2011 Stanford University. //
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
@end
Close the Navigator to make space.
Hopefully your Model's files (CalculatorBrain.m and .h) are here with the rest of your source.
If not, you can drag them to where you want them.
Of course, you can also make more groups here by right clicking anywhere in the Navigator to bring up a context-sensitive menu.
Xcode has created stubs for both the header and implementation of our MVC's Model.
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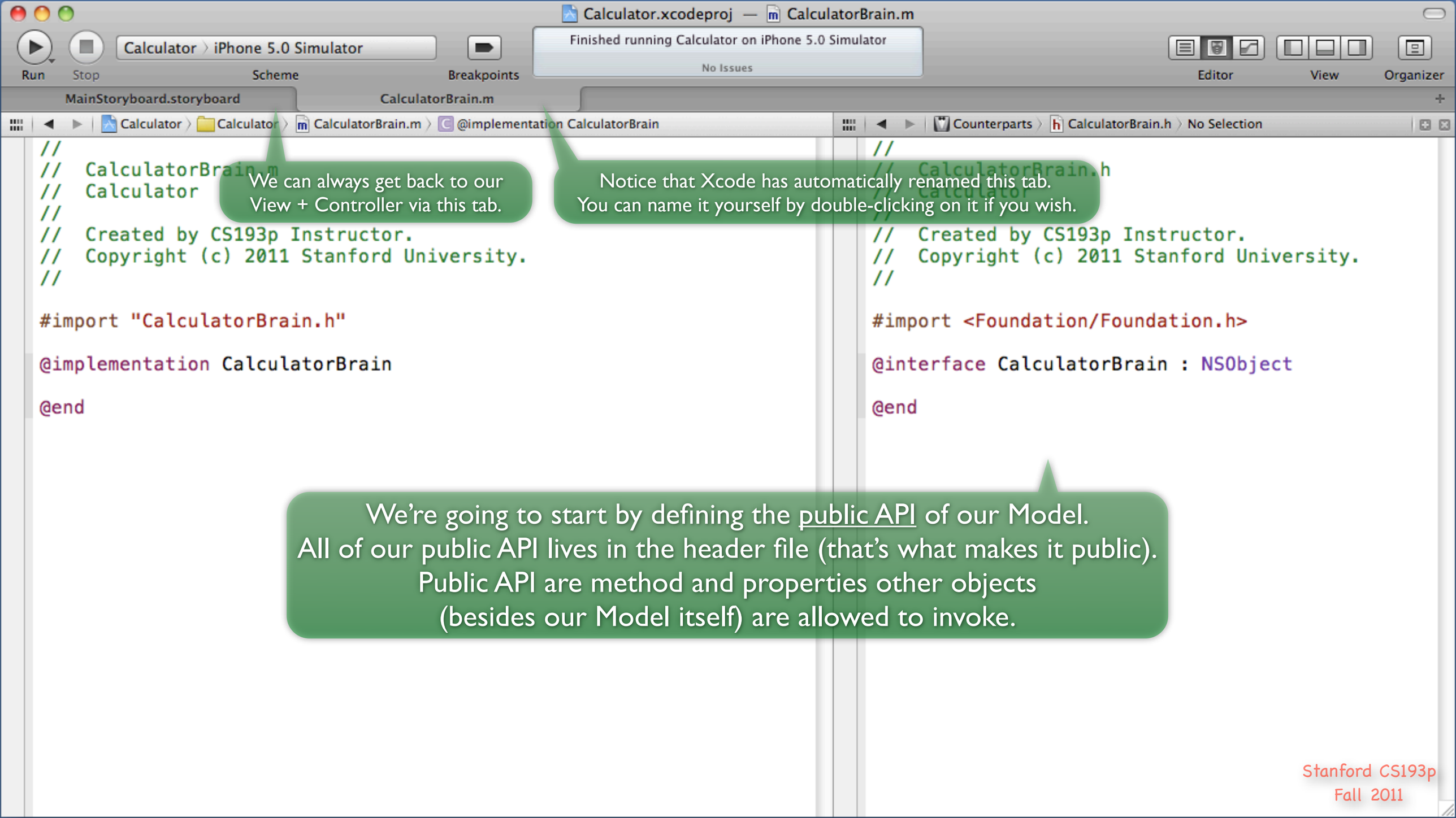
Calculator.xcodeproj — CalculatorBrain.m
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
Organizer
MainStoryboard.storyboard
CalculatorBrain.m
Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 @implementation CalculatorBrain
Counterparts 〉 CalculatorBrain.h 〉 No Selection
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@implementation CalculatorBrain
@end
We can always get back to our View + Controller via this tab.
Notice that Xcode has automatically renamed this tab. You can name it yourself by double-clicking on it if you wish.
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
@end
We're going to start by defining the public API of our Model.
All of our public API lives in the header file (that's what makes it public).
Public API are method and properties other objects
(besides our Model itself) are allowed to invoke.
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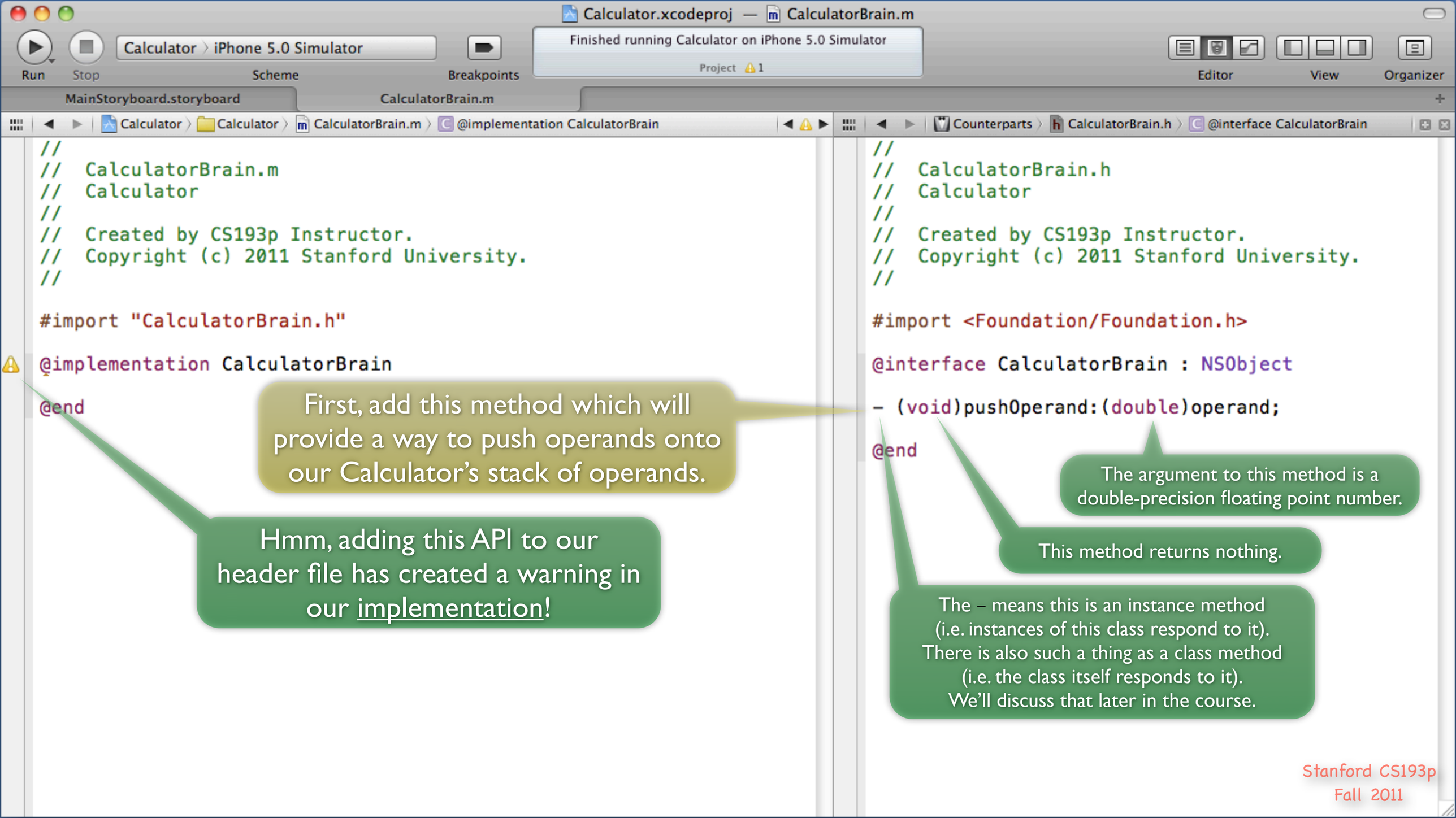
Calculator.xcodeproj — CalculatorBrain.m
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project 1
Editor
View
Organizer
MainStoryboard.storyboard
CalculatorBrain.m
Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 @implementation CalculatorBrain
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@implementation CalculatorBrain
@end
First, add this method which will provide a way to push operands onto our Calculator's stack of operands.
Hmm, adding this API to our header file has created a warning in our implementation!
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
@end
The argument to this method is a double-precision floating point number.
This method returns nothing.
The – means this is an instance method (i.e. instances of this class respond to it). There is also such a thing as a class method (i.e. the class itself responds to it). We'll discuss that later in the course.
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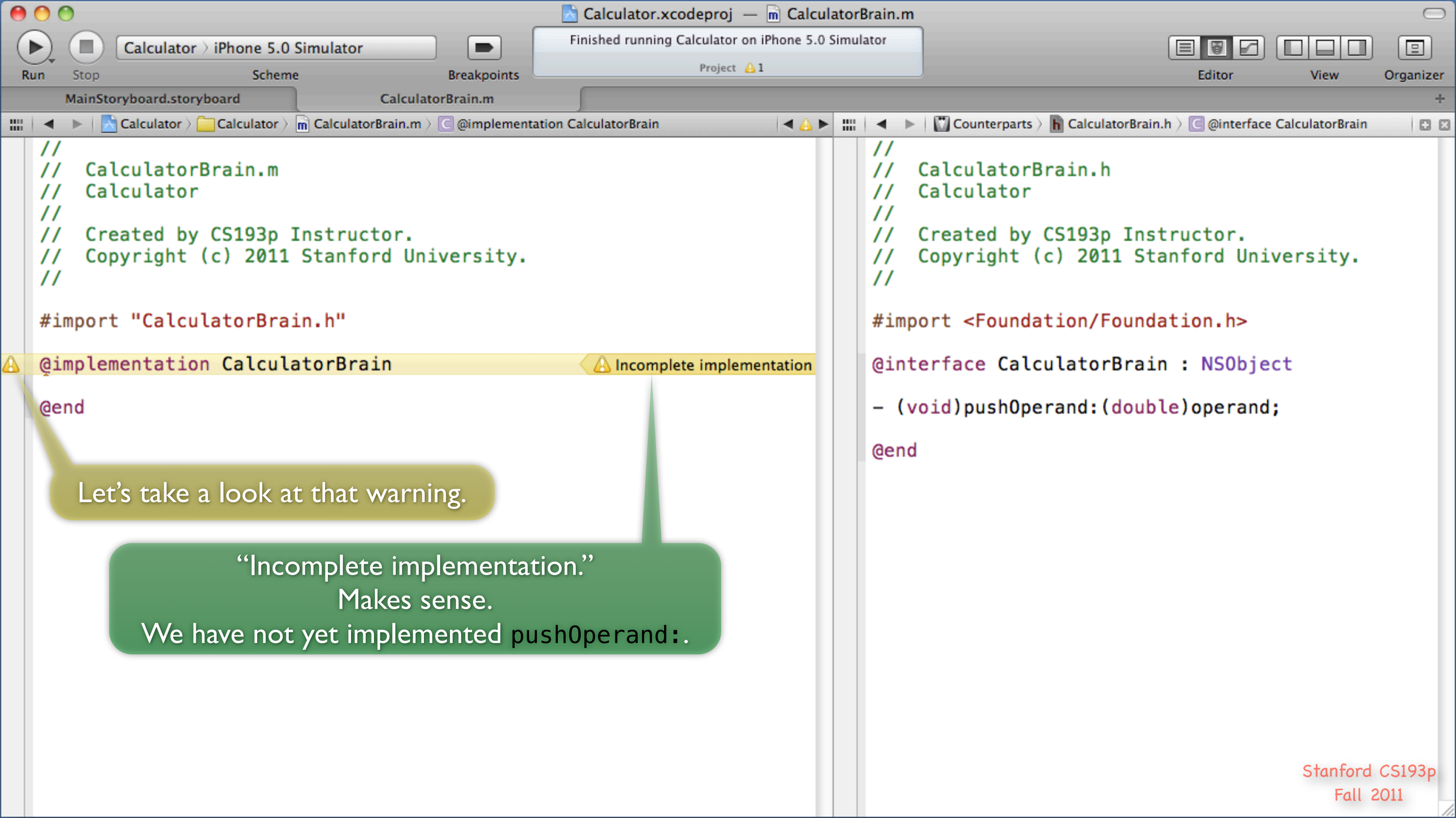
Calculator.xcodeproj — CalculatorBrain.m
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project 1
Editor
View
Organizer
MainStoryboard.storyboard
CalculatorBrain.m
Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 @implementation CalculatorBrain
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@implementation CalculatorBrain
Incomplete implementation
@end
Let's take a look at that warning.
"Incomplete implementation."
Makes sense.
We have not yet implemented pushOperand:.
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
@end
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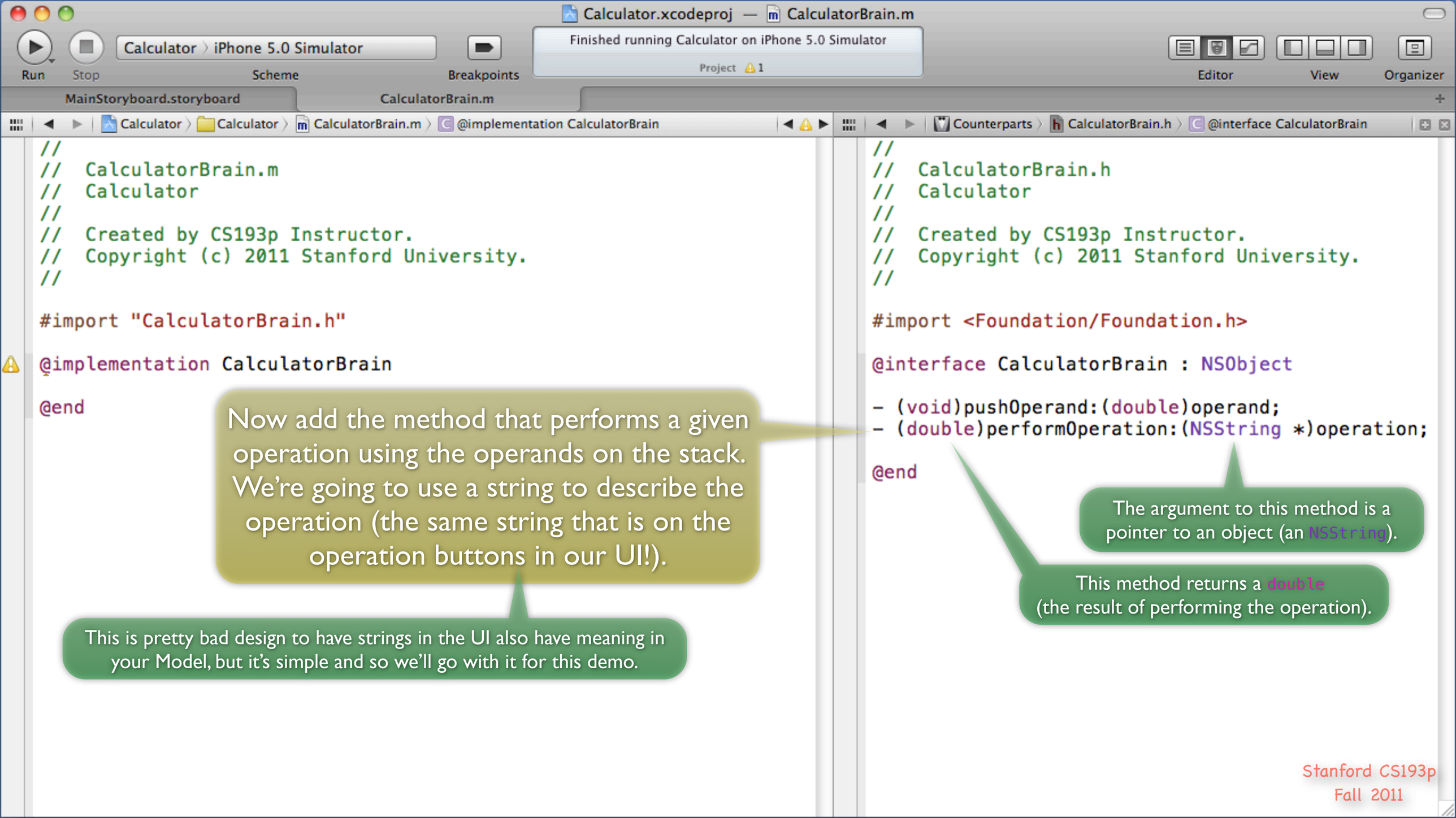
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Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 @implementation CalculatorBrain
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@implementation CalculatorBrain
@end
Now add the method that performs a given operation using the operands on the stack. We're going to use a string to describe the operation (the same string that is on the operation buttons in our UI!).
This is pretty bad design to have strings in the UI also have meaning in your Model, but it's simple and so we'll go with it for this demo.
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
The argument to this method is a pointer to an object (an NSString).
This method returns a double (the result of performing the operation).
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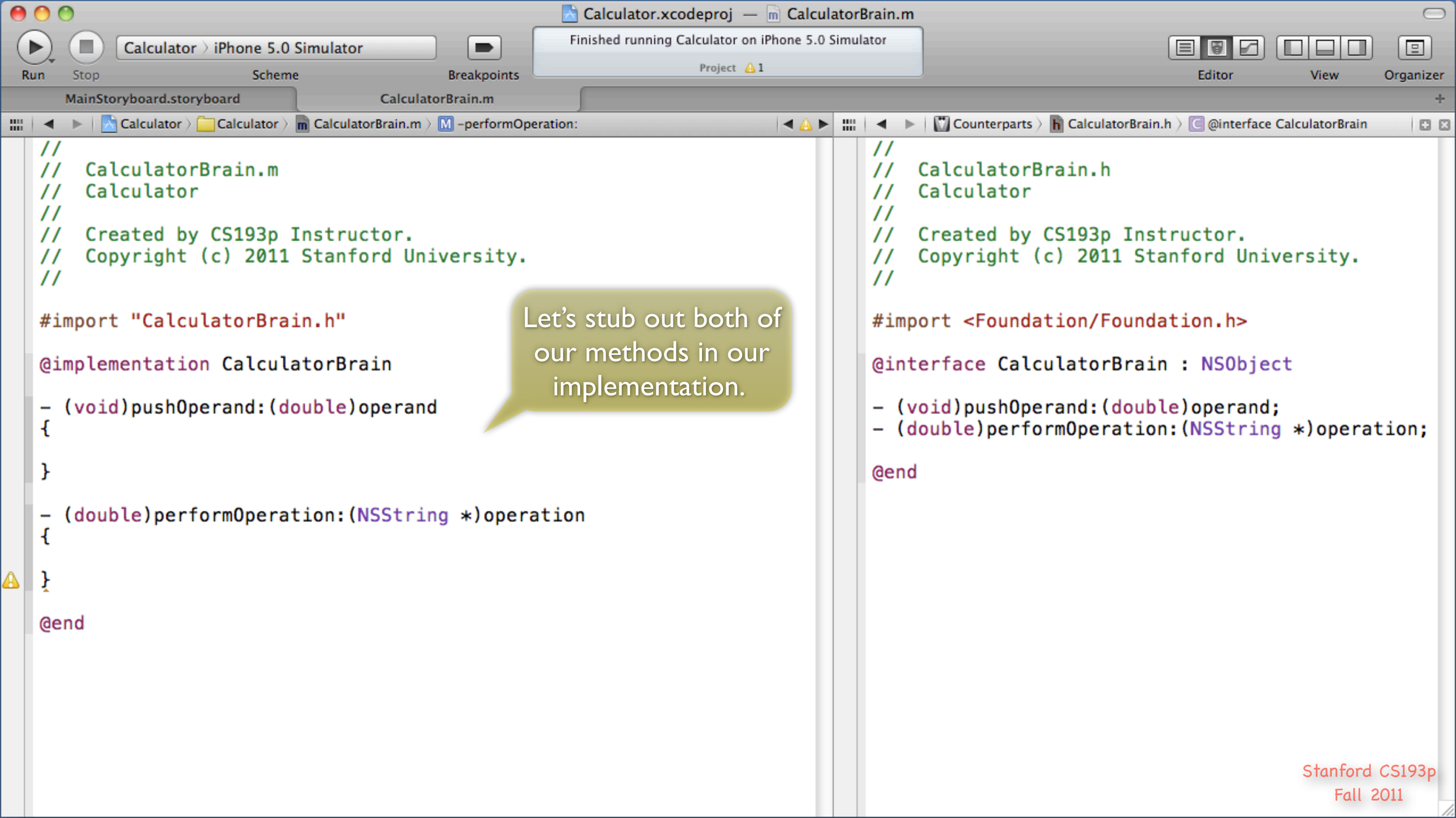
Calculator.xcodeproj — CalculatorBrain.m
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CalculatorBrain.m
Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 -performOperation:
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@implementation CalculatorBrain
- (void)pushOperand:(double)operand
{
}
- (double)performOperation:(NSString *)operation
{
}
@end
Let's stub out both of our methods in our implementation.
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
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Calculator.xcodeproj — CalculatorBrain.m

Run | Stop | Calculator › iPhone 5.0 Simulator (Scheme) | Breakpoints | Finished running Calculator on iPhone 5.0 Simulator — No Issues | Editor | View | Organizer

MainStoryboard.storyboard | CalculatorBrain.m

Calculator › Calculator › CalculatorBrain.m › -performOperation:

```
//
//  CalculatorBrain.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorBrain.h"

@implementation CalculatorBrain

- (void)pushOperand:(double)operand
{

}

- (double)performOperation:(NSString *)operation
{
    double result = 0;

    // perform the operation here, store answer in result

    return result;
}

@end
```

Let's have this return a default value of zero for now. We'll put the actual guts of this in here in a moment.

Counterparts › CalculatorBrain.h › @interface CalculatorBrain

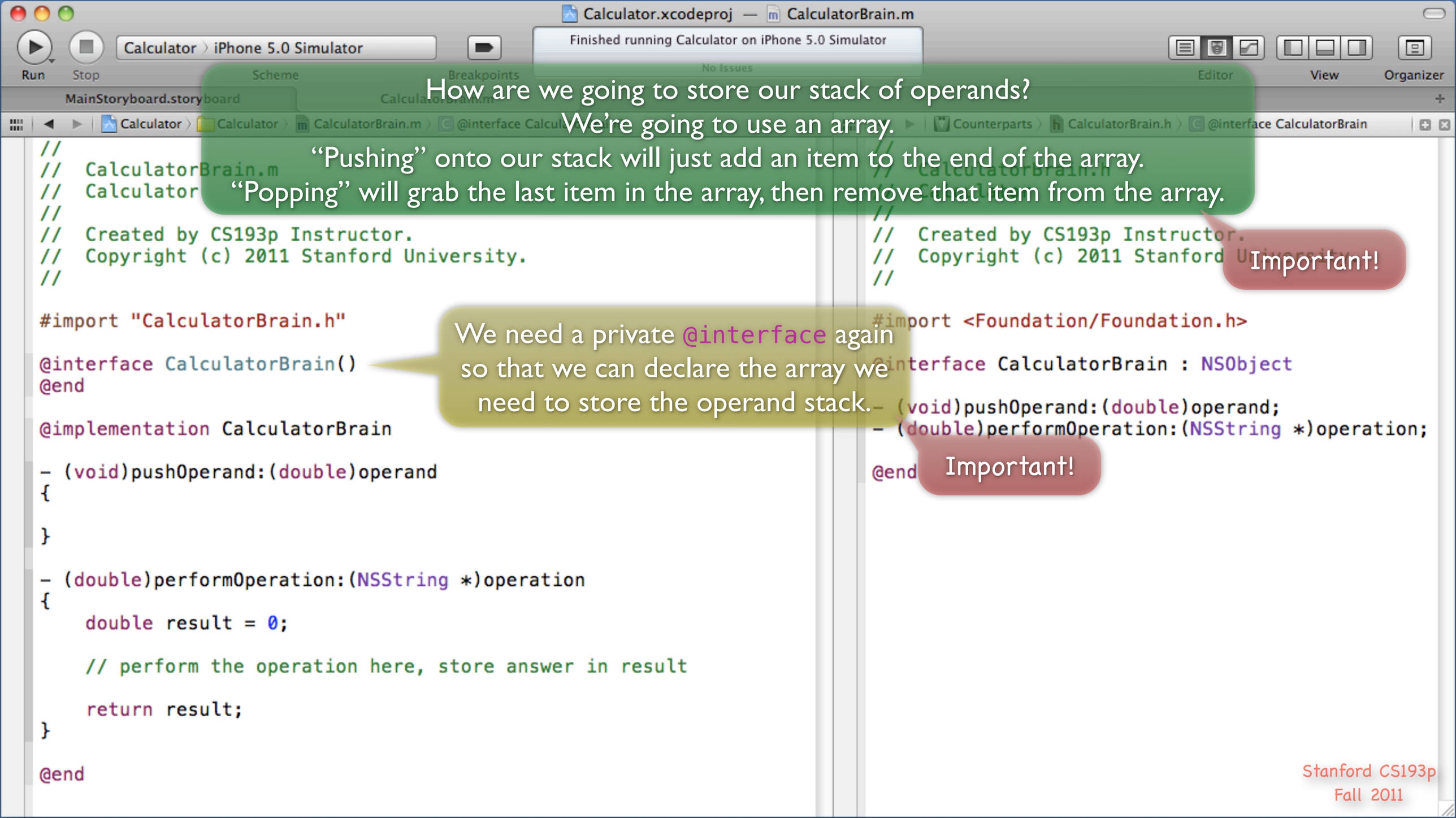
```
//
//  CalculatorBrain.h
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import <Foundation/Foundation.h>

@interface CalculatorBrain : NSObject

- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;

@end
```


Calculator.xcodeproj — CalculatorBrain.m
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Finished running Calculator on iPhone 5.0 Simulator
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How are we going to store our stack of operands?
We're going to use an array.
"Pushing" onto our stack will just add an item to the end of the array.
"Popping" will grab the last item in the array, then remove that item from the array.
Important!
We need a private @interface again so that we can declare the array we need to store the operand stack.
Important!
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@interface CalculatorBrain()
@end
@implementation CalculatorBrain
- (void)pushOperand:(double)operand
{
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
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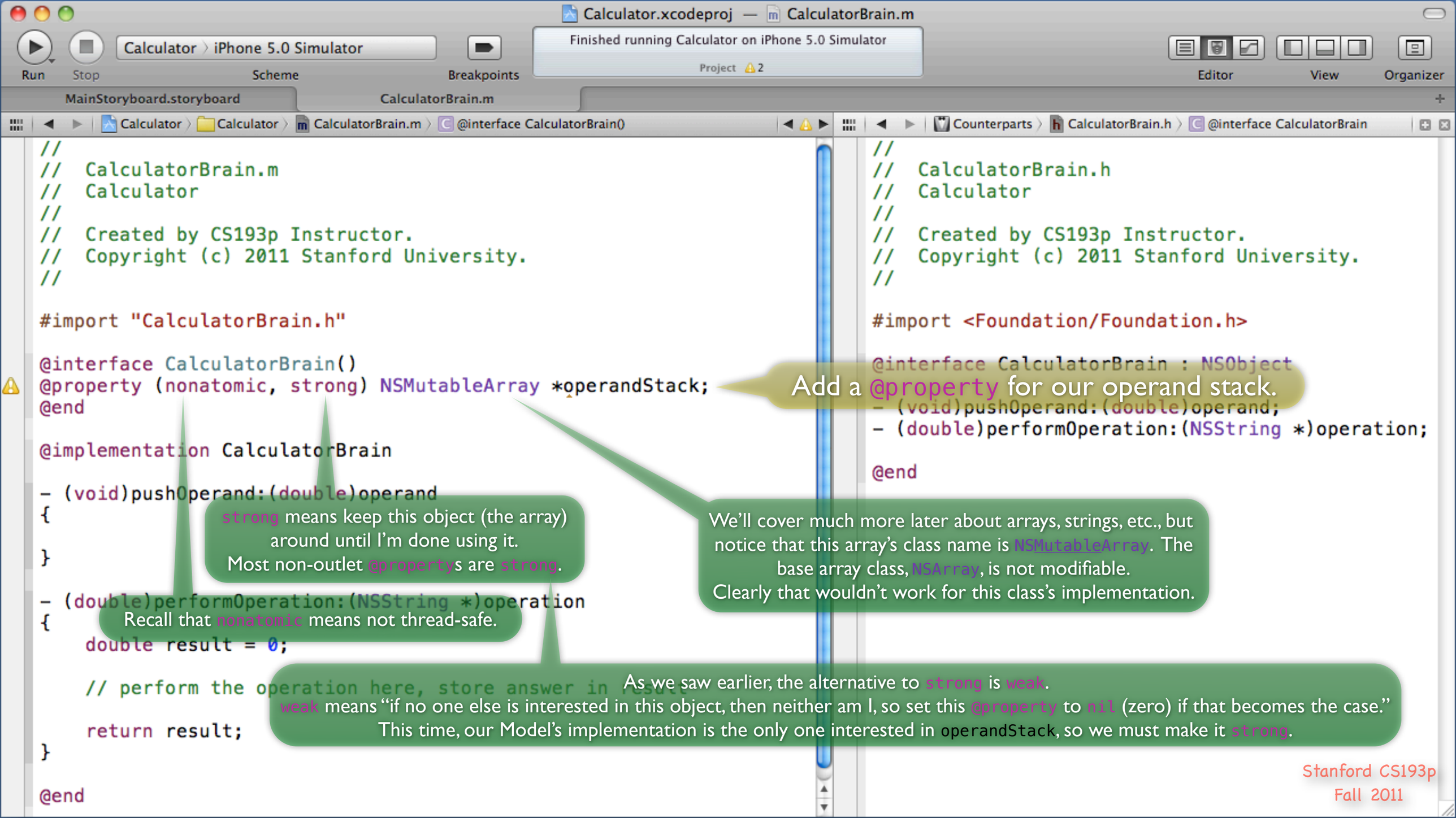
Fall 2011


Calculator.xcodeproj — CalculatorBrain.m
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CalculatorBrain.m
Calculator › Calculator › CalculatorBrain.m › @interface CalculatorBrain()
Counterparts › CalculatorBrain.h › @interface CalculatorBrain
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@interface CalculatorBrain()
@property (nonatomic, strong) NSMutableArray *operandStack;
@end
@implementation CalculatorBrain
- (void)pushOperand:(double)operand
{
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Add a @property for our operand stack.
strong means keep this object (the array) around until I'm done using it.
Most non-outlet @propertys are strong.
We'll cover much more later about arrays, strings, etc., but notice that this array's class name is NSMutableArray. The base array class, NSArray, is not modifiable.
Clearly that wouldn't work for this class's implementation.
Recall that nonatomic means not thread-safe.
As we saw earlier, the alternative to strong is weak.
weak means "if no one else is interested in this object, then neither am I, so set this @property to nil (zero) if that becomes the case."
This time, our Model's implementation is the only one interested in operandStack, so we must make it strong.
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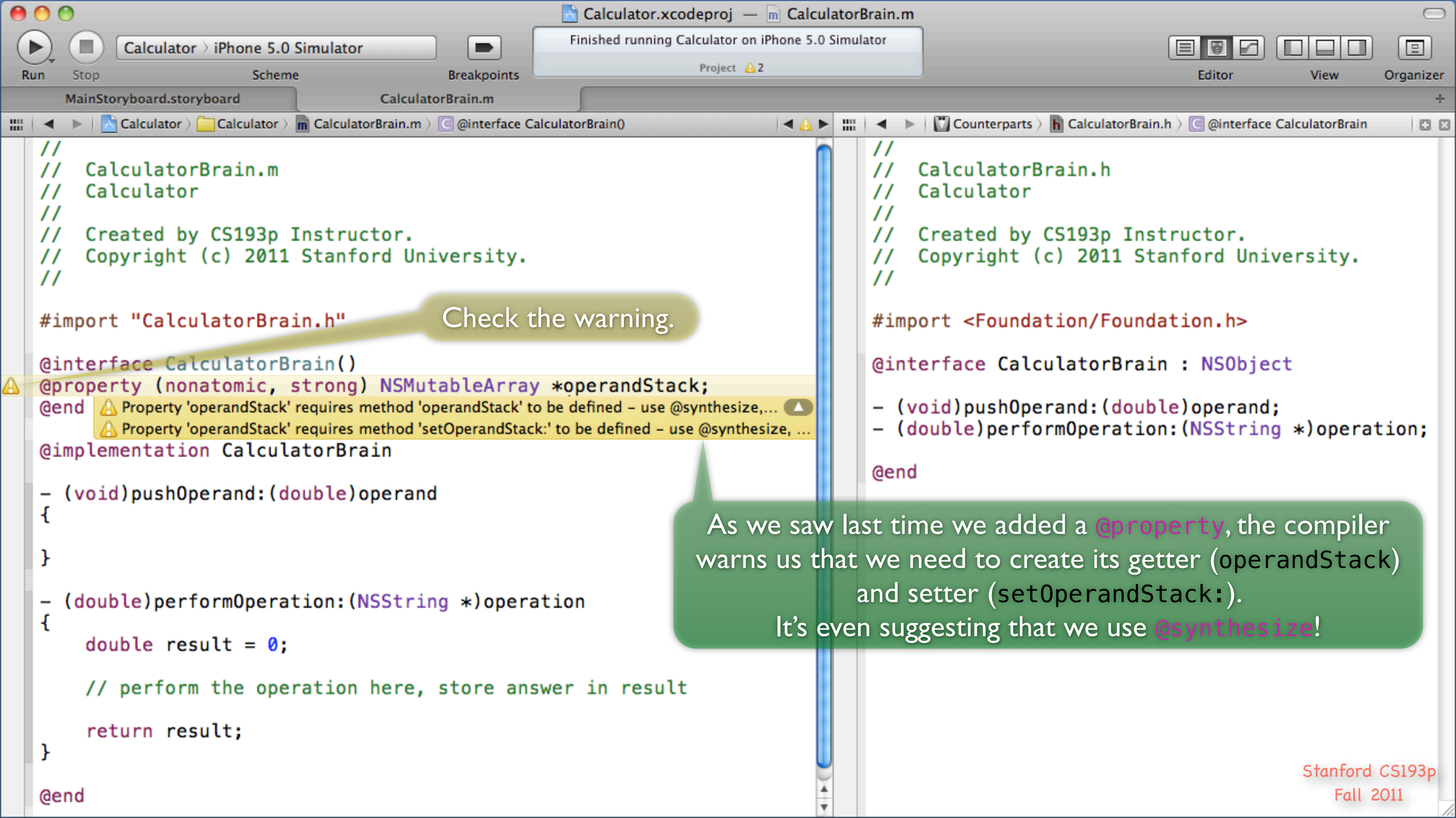
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Calculator › Calculator › CalculatorBrain.m › @interface CalculatorBrain()
Counterparts › CalculatorBrain.h › @interface CalculatorBrain
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@interface CalculatorBrain()
@property (nonatomic, strong) NSMutableArray *operandStack;
@end
Property 'operandStack' requires method 'operandStack' to be defined - use @synthesize,...
Property 'operandStack' requires method 'setOperandStack:' to be defined - use @synthesize, ...
@implementation CalculatorBrain
- (void)pushOperand:(double)operand
{
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Check the warning.
As we saw last time we added a @property, the compiler warns us that we need to create its getter (operandStack) and setter (setOperandStack:).
It's even suggesting that we use @synthesize!
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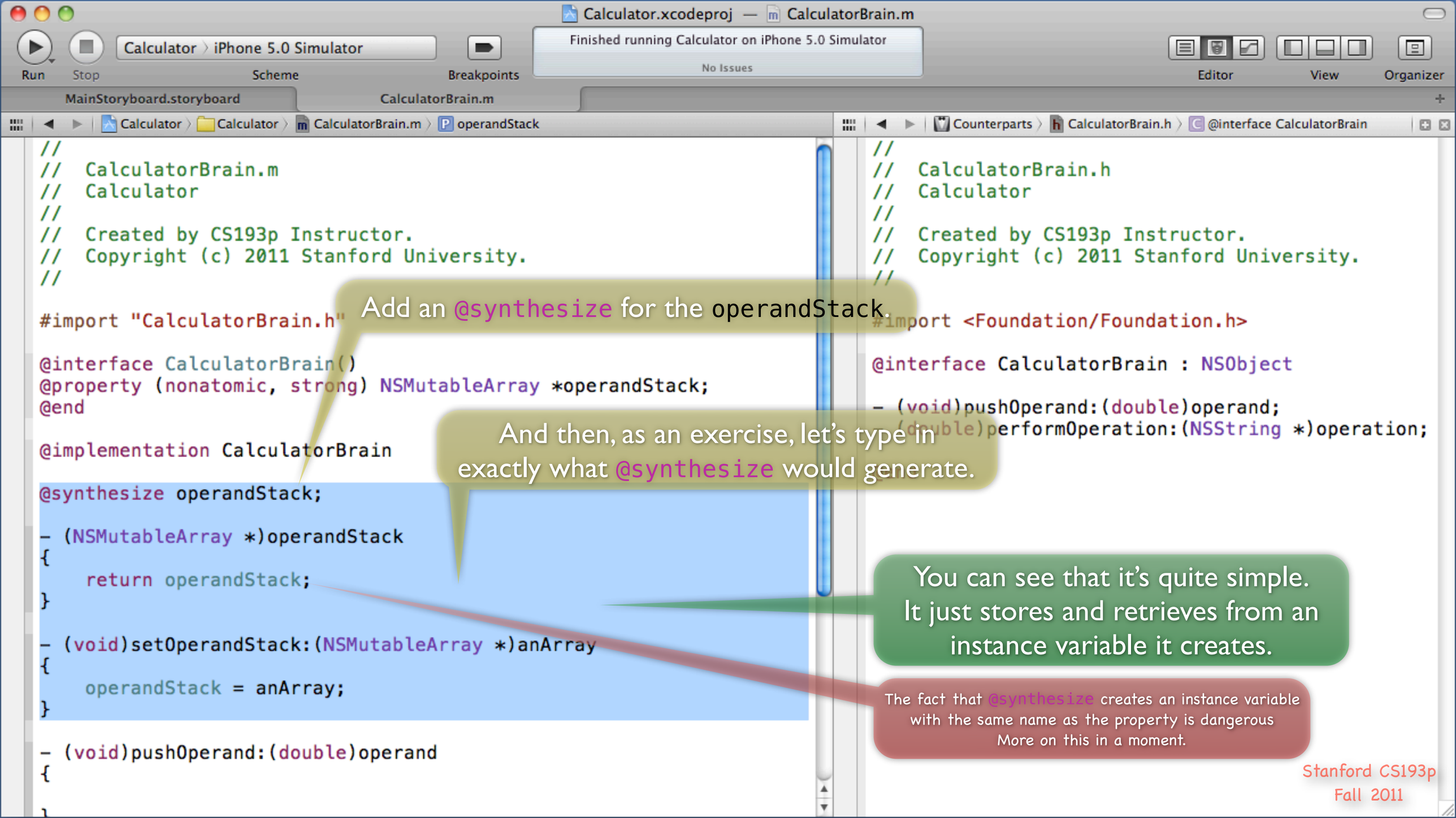
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Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 operandStack
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
//
// CalculatorBrain.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorBrain.h"
@interface CalculatorBrain()
@property (nonatomic, strong) NSMutableArray *operandStack;
@end
@implementation CalculatorBrain
@synthesize operandStack;
- (NSMutableArray *)operandStack
{
return operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
}
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
Add an @synthesize for the operandStack.
And then, as an exercise, let's type in exactly what @synthesize would generate.
You can see that it's quite simple. It just stores and retrieves from an instance variable it creates.
The fact that @synthesize creates an instance variable with the same name as the property is dangerous
More on this in a moment.
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Calculator.xcodeproj — CalculatorBrain.m

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MainStoryboard.storyboard | CalculatorBrain.m

Calculator › Calculator › CalculatorBrain.m › -pushOperand:

```
@interface CalculatorBrain()
@property (nonatomic, strong) NSMutableArray *operandStack;
@end

@implementation CalculatorBrain

@synthesize operandStack;

- (NSMutableArray *)operandStack
{
    return operandStack;
}

- (void)setOperandStack:(NSMutableArray *)anArray
{
    operandStack = anArray;
}

- (void)pushOperand:(double)operand
{
    [self.operandStack addObject:operand];
}

- (double)performOperation:(NSString *)operation
{
    double result = 0;

    // perform the operation here, store answer in result

    return result;
}
```

Uh oh.

Counterparts › CalculatorBrain.h › @interface CalculatorBrain

```
//
//  CalculatorBrain.h
//  Calculator
//
//  Created by CS193p Instructor.
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//

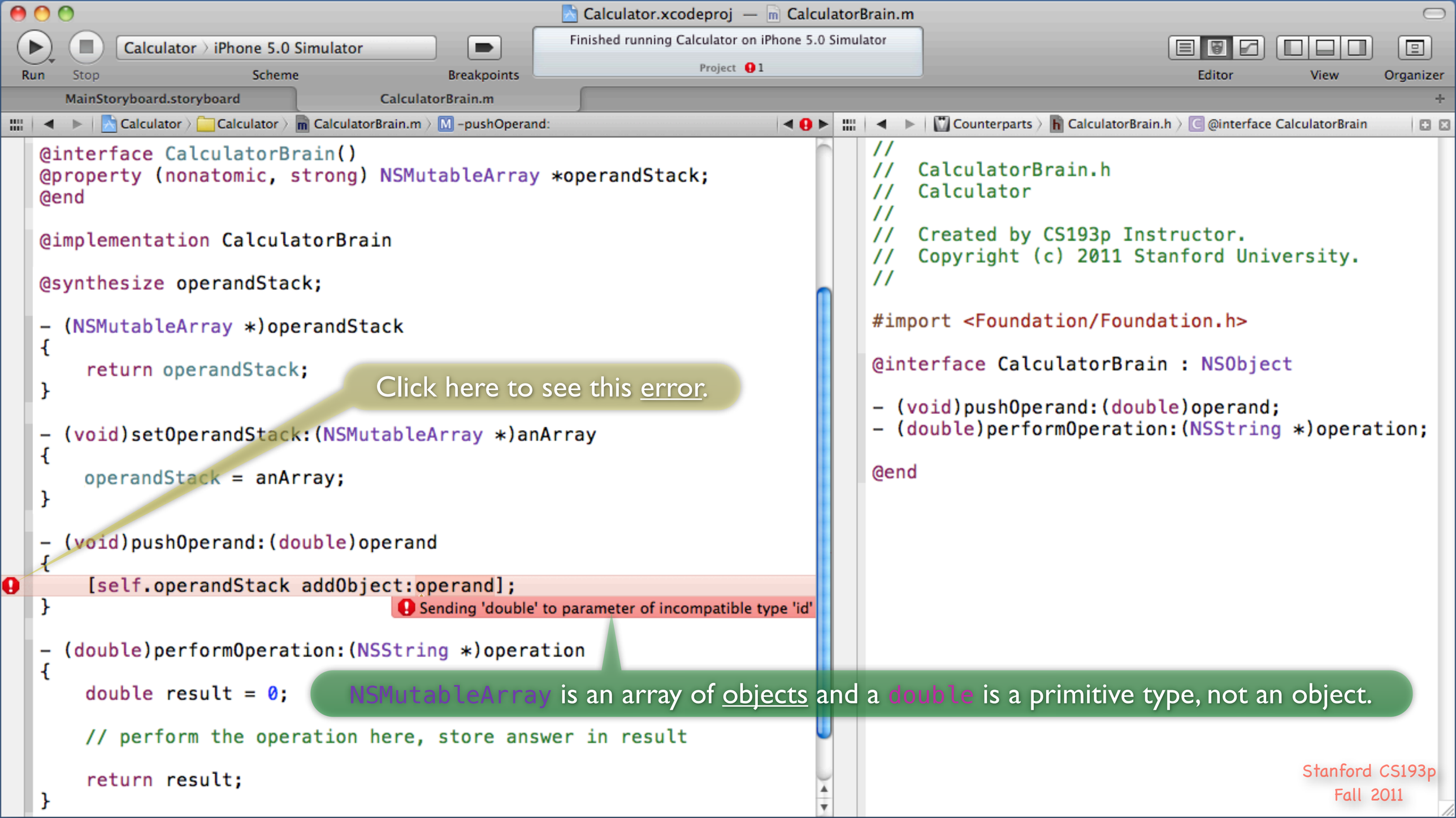
#import <Foundation/Foundation.h>

@interface CalculatorBrain : NSObject

- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;

@end
```

Now that we have a stack,
let's try to push an operand onto it.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CalculatorBrain.m
Calculator › Calculator › CalculatorBrain.m › -pushOperand:
Counterparts › CalculatorBrain.h › @interface CalculatorBrain
@interface CalculatorBrain()
@property (nonatomic, strong) NSMutableArray *operandStack;
@end
@implementation CalculatorBrain
@synthesize operandStack;
- (NSMutableArray *)operandStack
{
return operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
[self.operandStack addObject:operand];
}
Sending 'double' to parameter of incompatible type 'id'
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
}
Click here to see this error.
NSMutableArray is an array of objects and a double is a primitive type, not an object.
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
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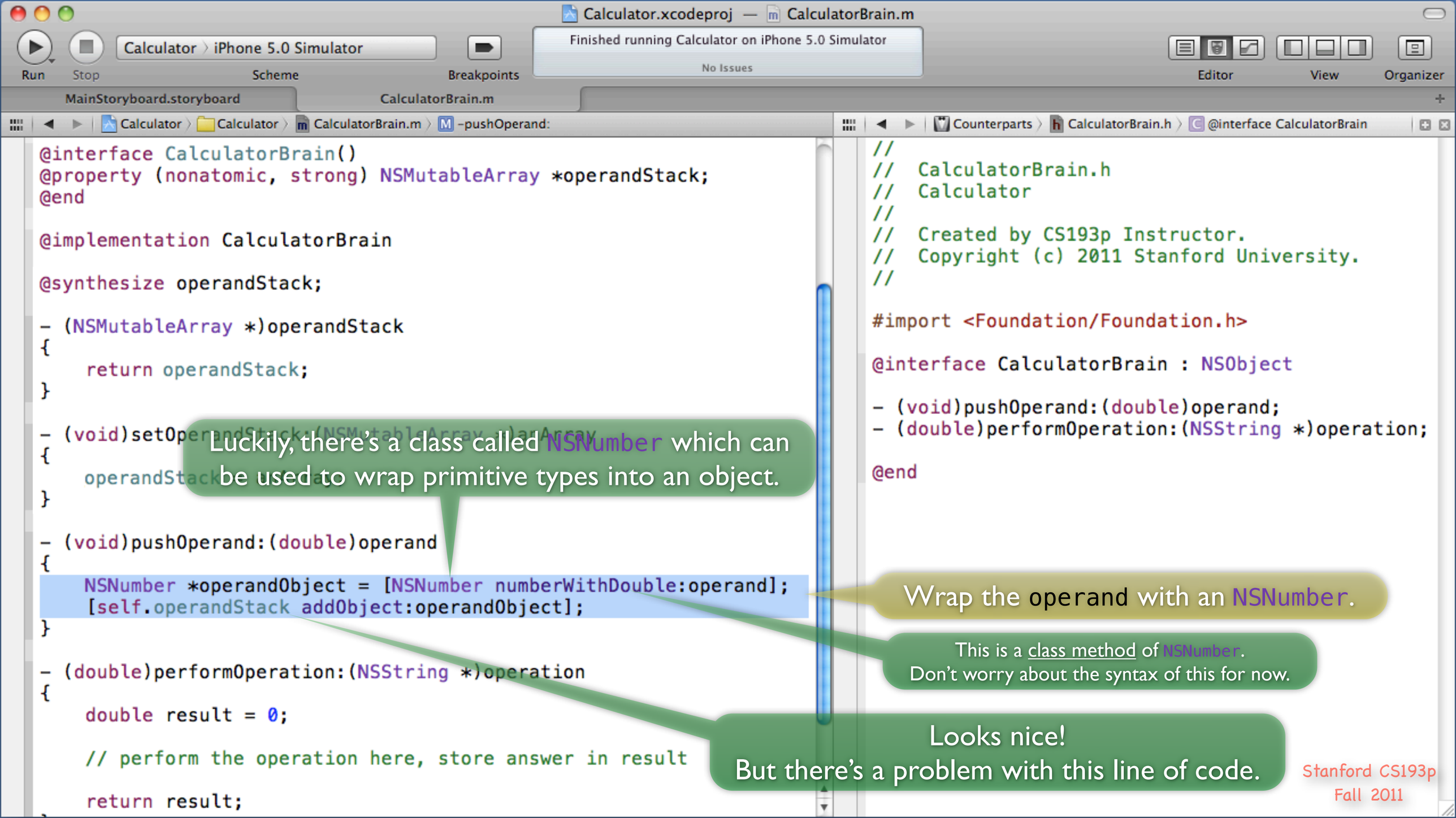
Fall 2011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Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 -pushOperand:
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
@interface CalculatorBrain()
@property (nonatomic, strong) NSMutableArray *operandStack;
@end
@implementation CalculatorBrain
@synthesize operandStack;
- (NSMutableArray *)operandStack
{
return operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Luckily, there's a class called NSNumber which can be used to wrap primitive types into an object.
Wrap the operand with an NSNumber.
This is a class method of NSNumber.
Don't worry about the syntax of this for now.
Looks nice!
But there's a problem with this line of code.
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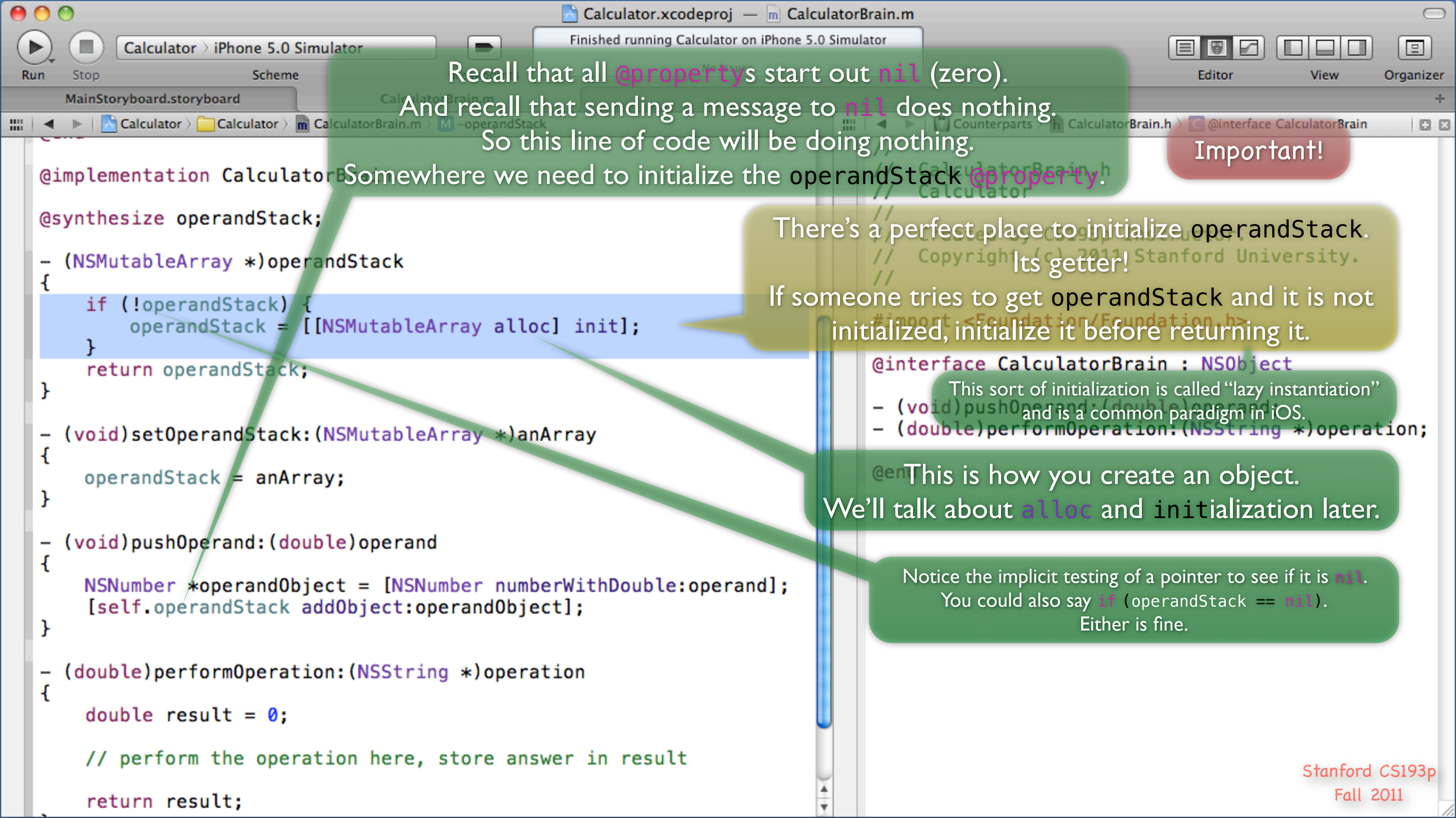
Fall 2011


Calculator.xcodeproj — CalculatorBrain.m
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Calculator › Calculator › CalculatorBrain.m › -operandStack
Counterparts › CalculatorBrain.h › @interface CalculatorBrain
@implementation CalculatorBrain
@synthesize operandStack;
- (NSMutableArray *)operandStack
{
if (!operandStack) {
operandStack = [[NSMutableArray alloc] init];
}
return operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
Recall that all @propertys start out nil (zero).
And recall that sending a message to nil does nothing.
So this line of code will be doing nothing.
Somewhere we need to initialize the operandStack @property.
Important!
There's a perfect place to initialize operandStack.
Its getter!
If someone tries to get operandStack and it is not initialized, initialize it before returning it.
This sort of initialization is called "lazy instantiation" and is a common paradigm in iOS.
This is how you create an object.
We'll talk about alloc and initialization later.
Notice the implicit testing of a pointer to see if it is nil.
You could also say if (operandStack == nil).
Either is fine.
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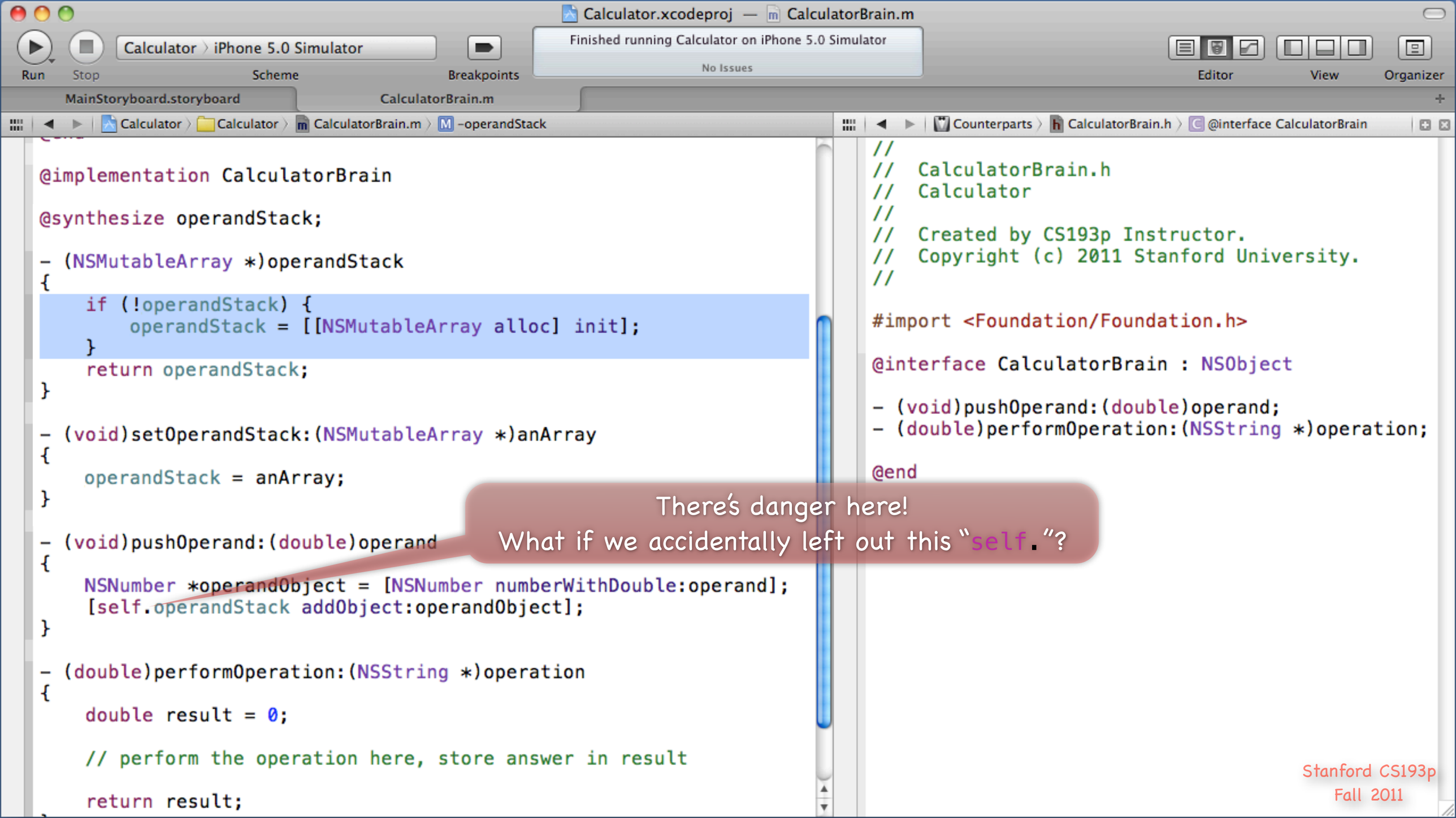
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Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 -operandStack
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
@implementation CalculatorBrain
@synthesize operandStack;
- (NSMutableArray *)operandStack
{
if (!operandStack) {
operandStack = [[NSMutableArray alloc] init];
}
return operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
There's danger here!
What if we accidentally left out this "self."?
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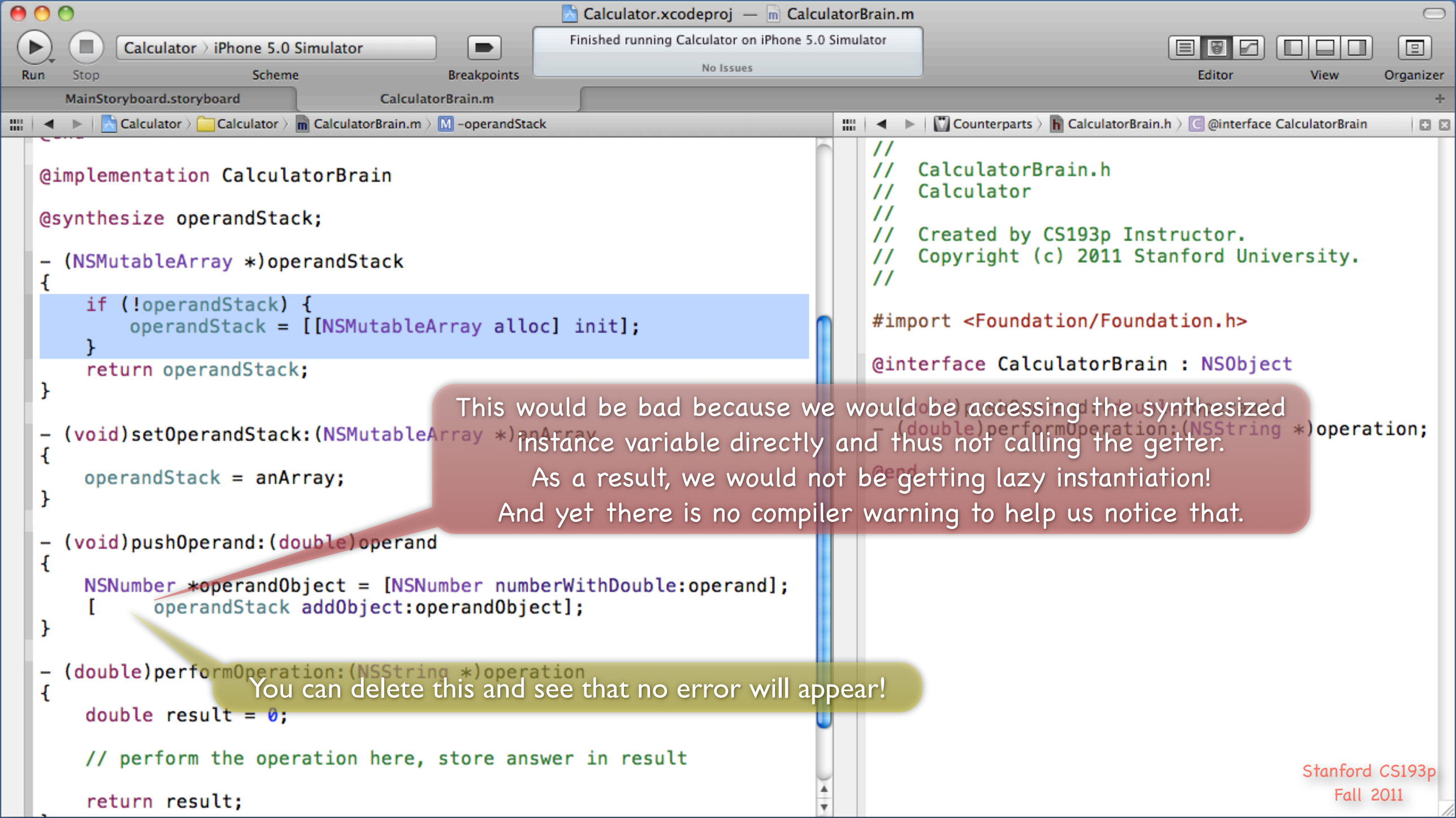
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Calculator › Calculator › CalculatorBrain.m › -operandStack
Counterparts › CalculatorBrain.h › @interface CalculatorBrain
@implementation CalculatorBrain
@synthesize operandStack;
- (NSMutableArray *)operandStack
{
if (!operandStack) {
operandStack = [[NSMutableArray alloc] init];
}
return operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
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//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (double)performOperation:(NSString *)operation;
@end
This would be bad because we would be accessing the synthesized instance variable directly and thus not calling the getter.
As a result, we would not be getting lazy instantiation!
And yet there is no compiler warning to help us notice that.
You can delete this and see that no error will appear!
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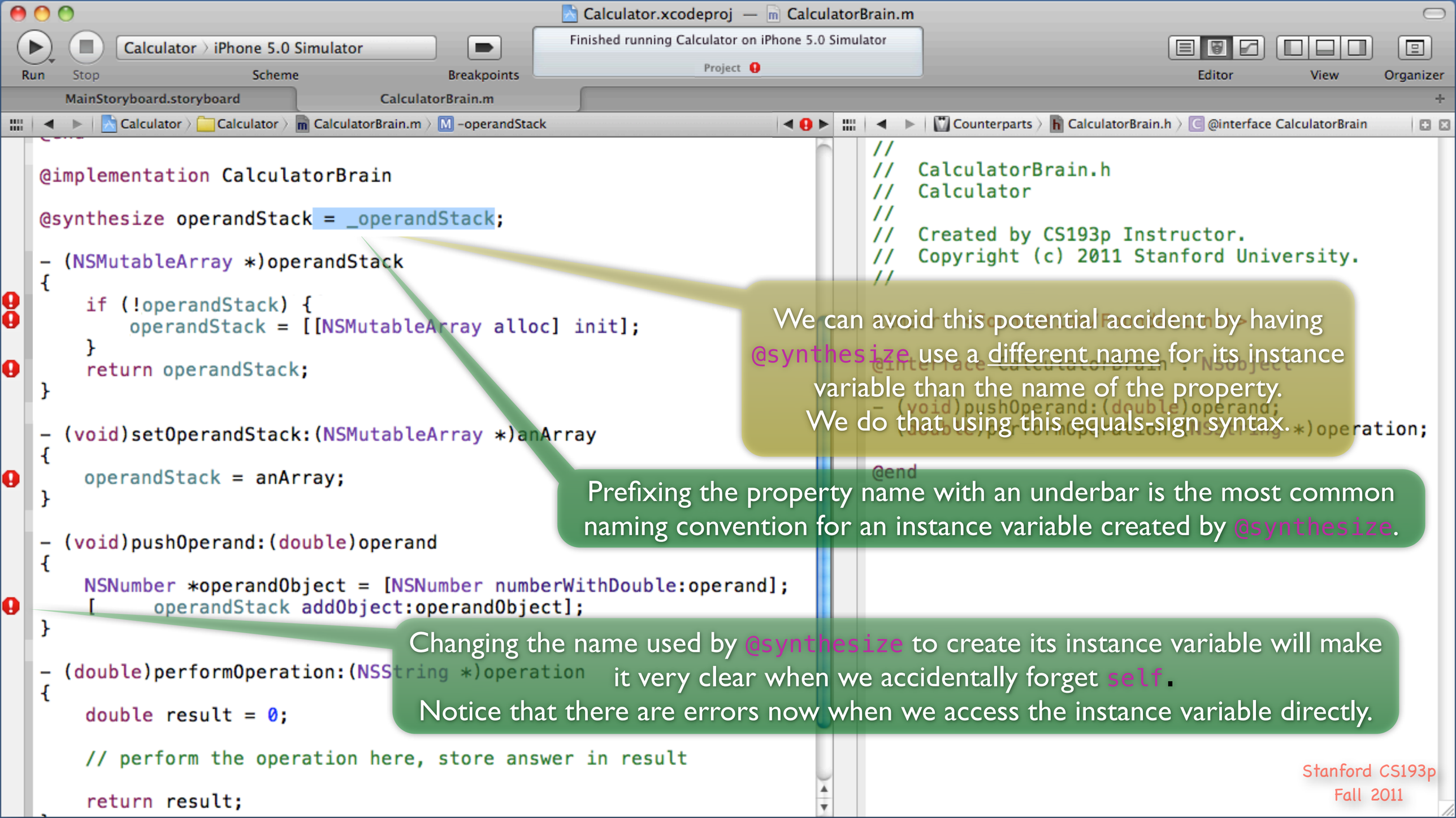
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Calculator › Calculator › CalculatorBrain.m › -operandStack
Counterparts › CalculatorBrain.h › @interface CalculatorBrain
@implementation CalculatorBrain
@synthesize operandStack = _operandStack;
- (NSMutableArray *)operandStack
{
if (!operandStack) {
operandStack = [[NSMutableArray alloc] init];
}
return operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
//
// CalculatorBrain.h
// Calculator
//
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//
@end
We can avoid this potential accident by having @synthesize use a different name for its instance variable than the name of the property.
We do that using this equals-sign syntax.
Prefixing the property name with an underbar is the most common naming convention for an instance variable created by @synthesize.
Changing the name used by @synthesize to create its instance variable will make it very clear when we accidentally forget self.
Notice that there are errors now when we access the instance variable directly.
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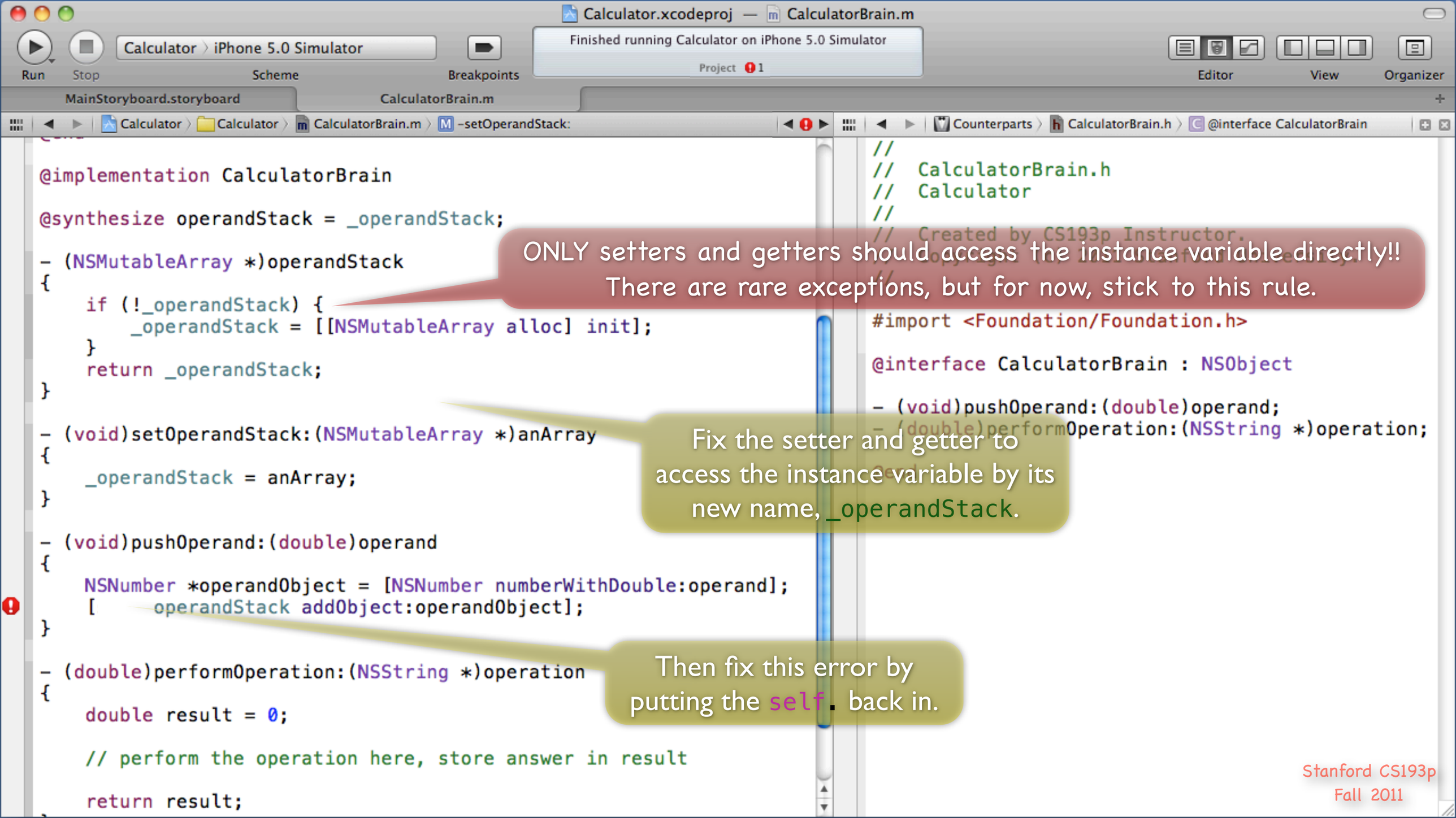
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@implementation CalculatorBrain
@synthesize operandStack = _operandStack;
- (NSMutableArray *)operandStack
{
if (!_operandStack) {
_operandStack = [[NSMutableArray alloc] init];
}
return _operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
_operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
ONLY setters and getters should access the instance variable directly!!
There are rare exceptions, but for now, stick to this rule.
Fix the setter and getter to access the instance variable by its new name, _operandStack.
Then fix this error by putting the self. back in.
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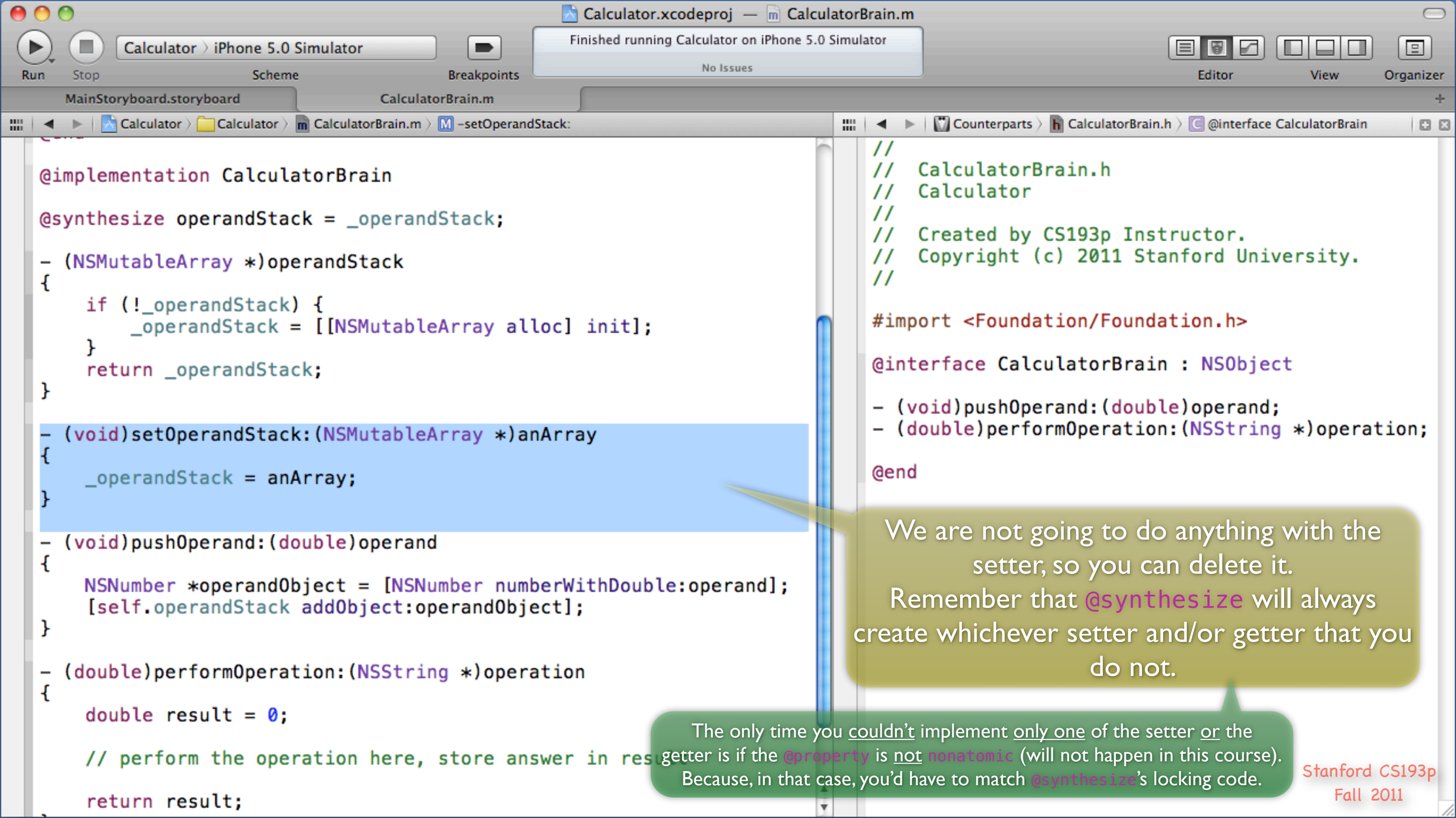
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Calculator 〉 Calculator 〉 CalculatorBrain.m 〉 -setOperandStack:
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
@implementation CalculatorBrain
@synthesize operandStack = _operandStack;
- (NSMutableArray *)operandStack
{
if (!_operandStack) {
_operandStack = [[NSMutableArray alloc] init];
}
return _operandStack;
}
- (void)setOperandStack:(NSMutableArray *)anArray
{
_operandStack = anArray;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in res
return result;
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
We are not going to do anything with the setter, so you can delete it.
Remember that @synthesize will always create whichever setter and/or getter that you do not.
The only time you couldn't implement only one of the setter or the getter is if the @property is not nonatomic (will not happen in this course). Because, in that case, you'd have to match @synthesize's locking code.
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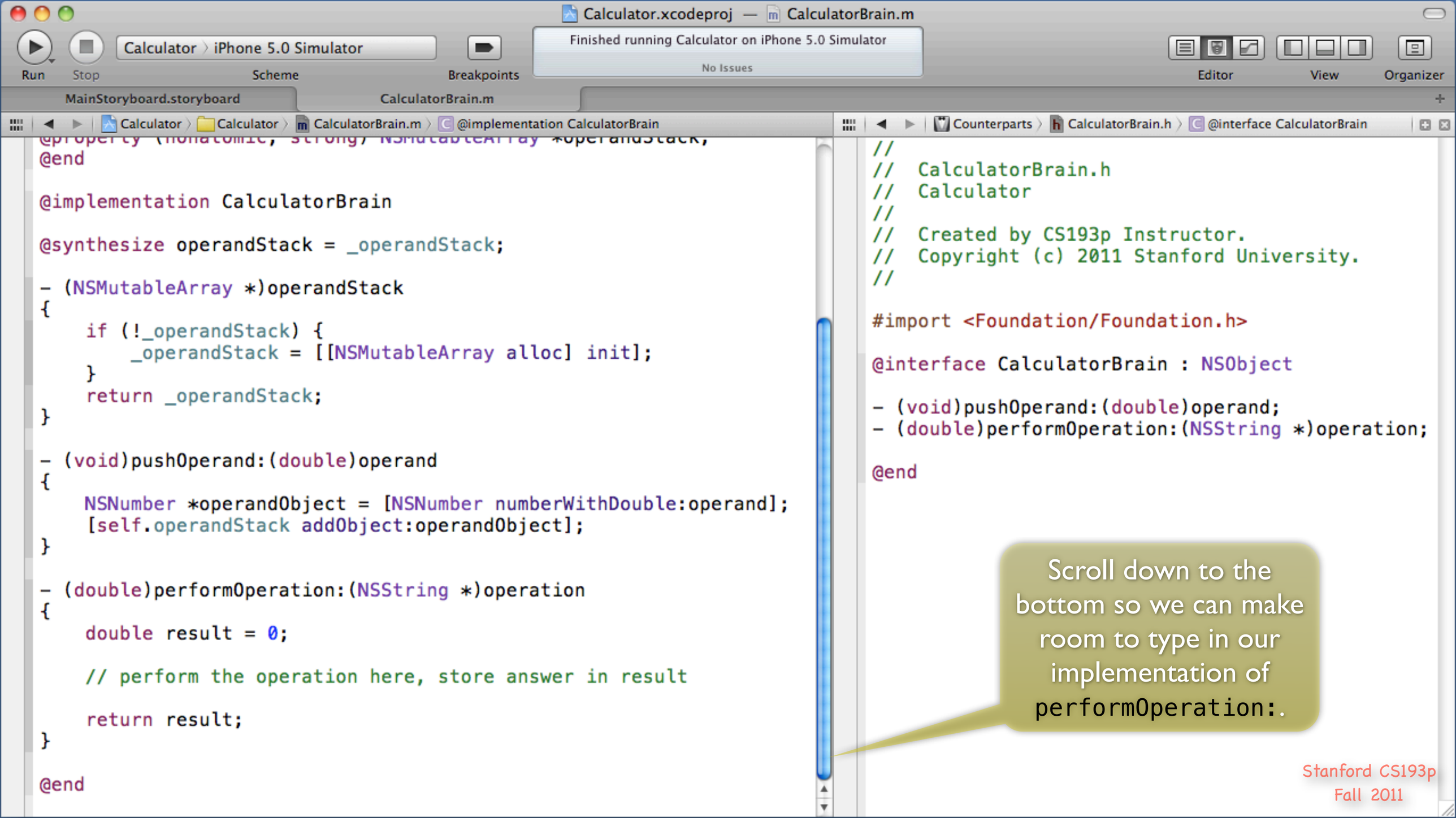
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@end
@implementation CalculatorBrain
@synthesize operandStack = _operandStack;
- (NSMutableArray *)operandStack
{
if (!_operandStack) {
_operandStack = [[NSMutableArray alloc] init];
}
return _operandStack;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
// perform the operation here, store answer in result
return result;
}
@end
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//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
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//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Scroll down to the bottom so we can make room to type in our implementation of performOperation:.
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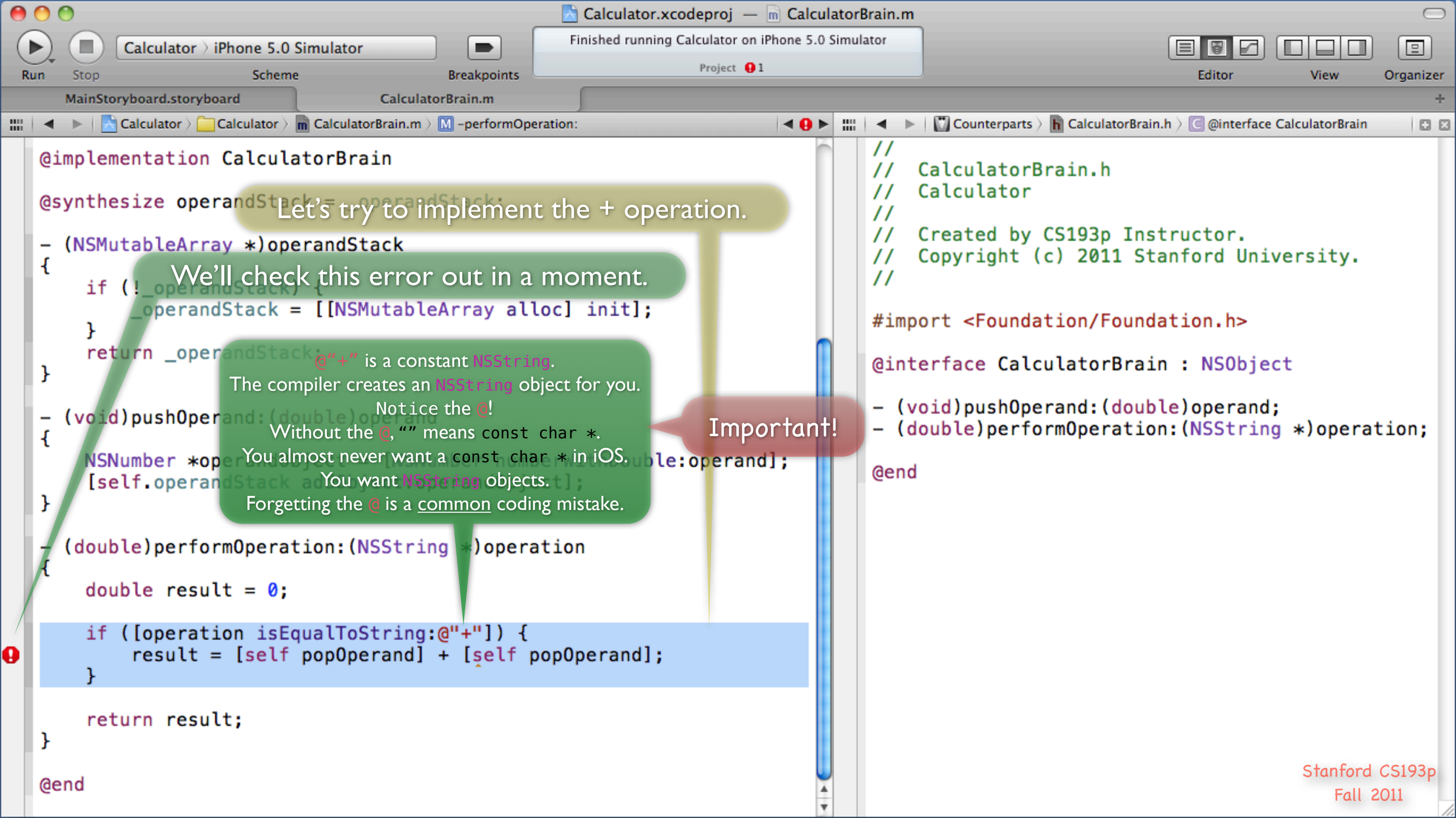
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Let's try to implement the + operation.
We'll check this error out in a moment.
@"+" is a constant NSString.
The compiler creates an NSString object for you.
Notice the @!
Without the @, "" means const char *.
You almost never want a const char * in iOS.
You want NSString objects.
Forgetting the @ is a common coding mistake.
Important!
@implementation CalculatorBrain
@synthesize operandStack = _operandStack;
- (NSMutableArray *)operandStack
{
if (!_operandStack) {
_operandStack = [[NSMutableArray alloc] init];
}
return _operandStack;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
if ([operation isEqualToString:@"+"]) {
result = [self popOperand] + [self popOperand];
}
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
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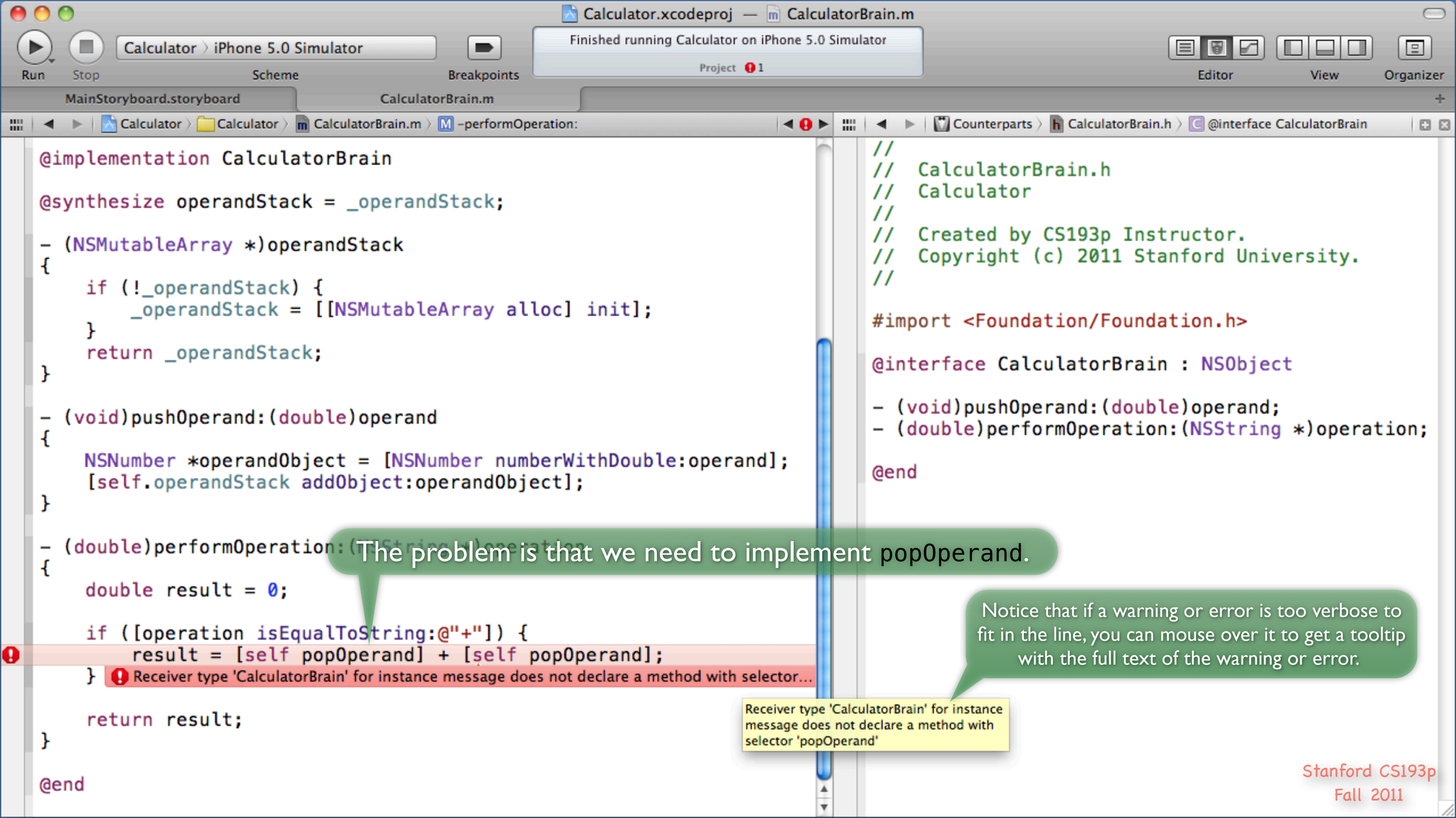
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Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
@implementation CalculatorBrain
@synthesize operandStack = _operandStack;
- (NSMutableArray *)operandStack
{
if (!_operandStack) {
_operandStack = [[NSMutableArray alloc] init];
}
return _operandStack;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)performOperation:
{
double result = 0;
if ([operation isEqualToString:@"+"]) {
result = [self popOperand] + [self popOperand];
}
Receiver type 'CalculatorBrain' for instance message does not declare a method with selector...
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
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//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
The problem is that we need to implement popOperand.
Notice that if a warning or error is too verbose to fit in the line, you can mouse over it to get a tooltip with the full text of the warning or error.
Receiver type 'CalculatorBrain' for instance message does not declare a method with selector 'popOperand'
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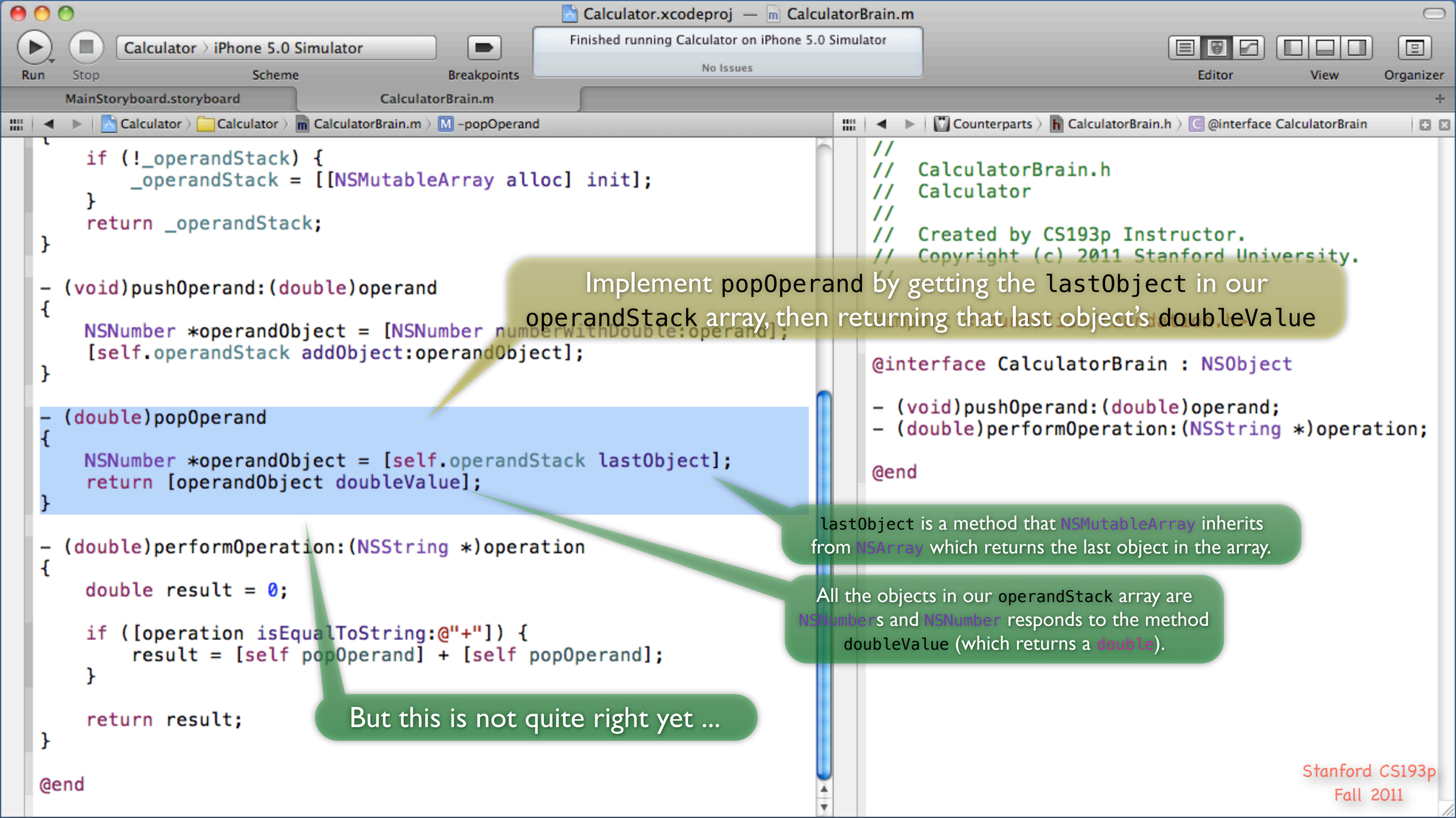
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Counterparts › CalculatorBrain.h › @interface CalculatorBrain
if (!_operandStack) {
_operandStack = [[NSMutableArray alloc] init];
}
return _operandStack;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)popOperand
{
NSNumber *operandObject = [self.operandStack lastObject];
return [operandObject doubleValue];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
if ([operation isEqualToString:@"+"]) {
result = [self popOperand] + [self popOperand];
}
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Implement popOperand by getting the lastObject in our operandStack array, then returning that last object's doubleValue
lastObject is a method that NSMutableArray inherits from NSArray which returns the last object in the array.
All the objects in our operandStack array are NSNumbers and NSNumber responds to the method doubleValue (which returns a double).
But this is not quite right yet ...
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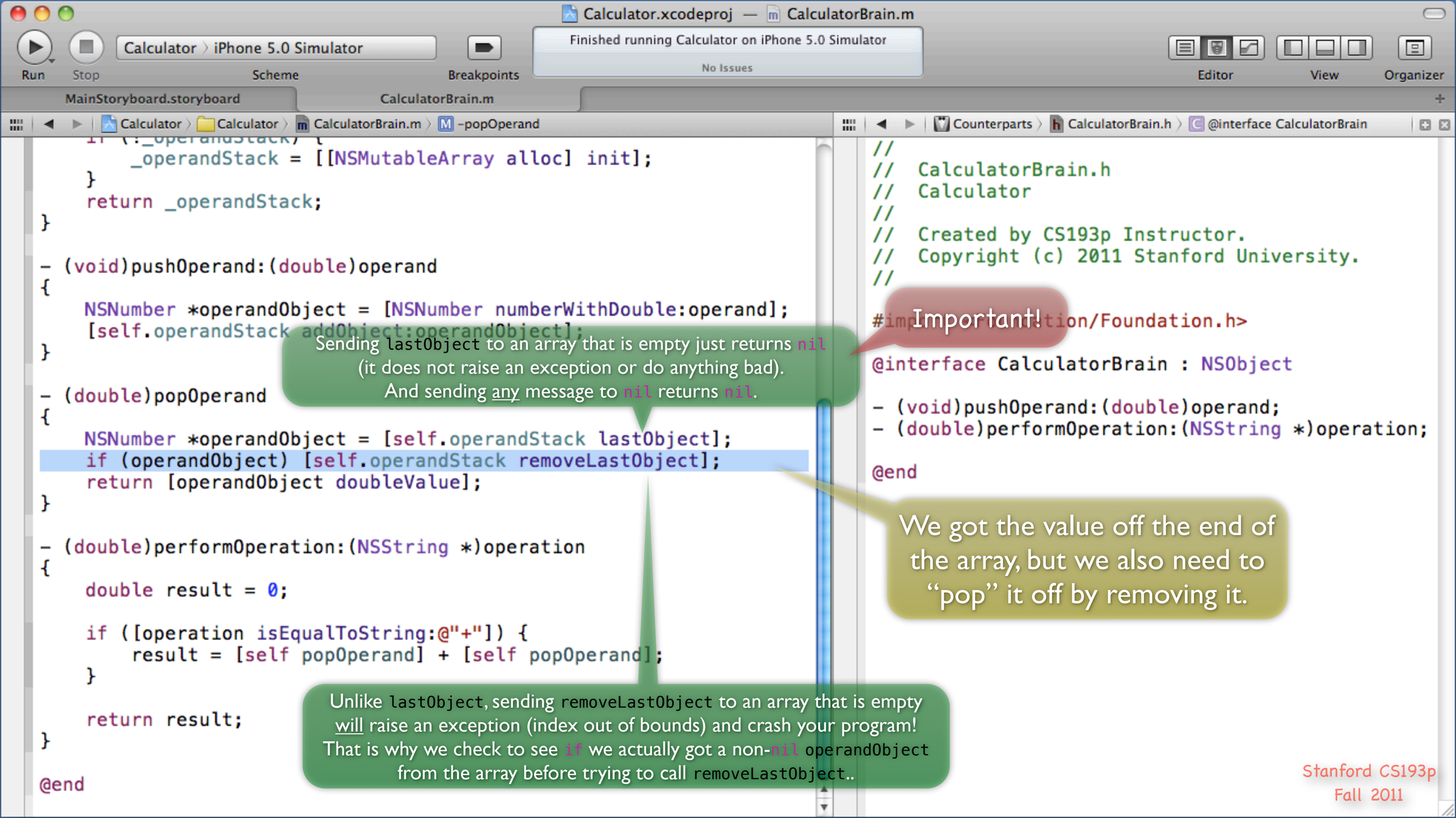
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Calculator › Calculator › CalculatorBrain.m › -popOperand
Counterparts › CalculatorBrain.h › @interface CalculatorBrain
_operandStack = [[NSMutableArray alloc] init];
}
return _operandStack;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)popOperand
{
NSNumber *operandObject = [self.operandStack lastObject];
if (operandObject) [self.operandStack removeLastObject];
return [operandObject doubleValue];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
if ([operation isEqualToString:@"+"]) {
result = [self popOperand] + [self popOperand];
}
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Important!
Sending lastObject to an array that is empty just returns nil
(it does not raise an exception or do anything bad).
And sending any message to nil returns nil.
We got the value off the end of the array, but we also need to "pop" it off by removing it.
Unlike lastObject, sending removeLastObject to an array that is empty will raise an exception (index out of bounds) and crash your program!
That is why we check to see if we actually got a non-nil operandObject from the array before trying to call removeLastObject..
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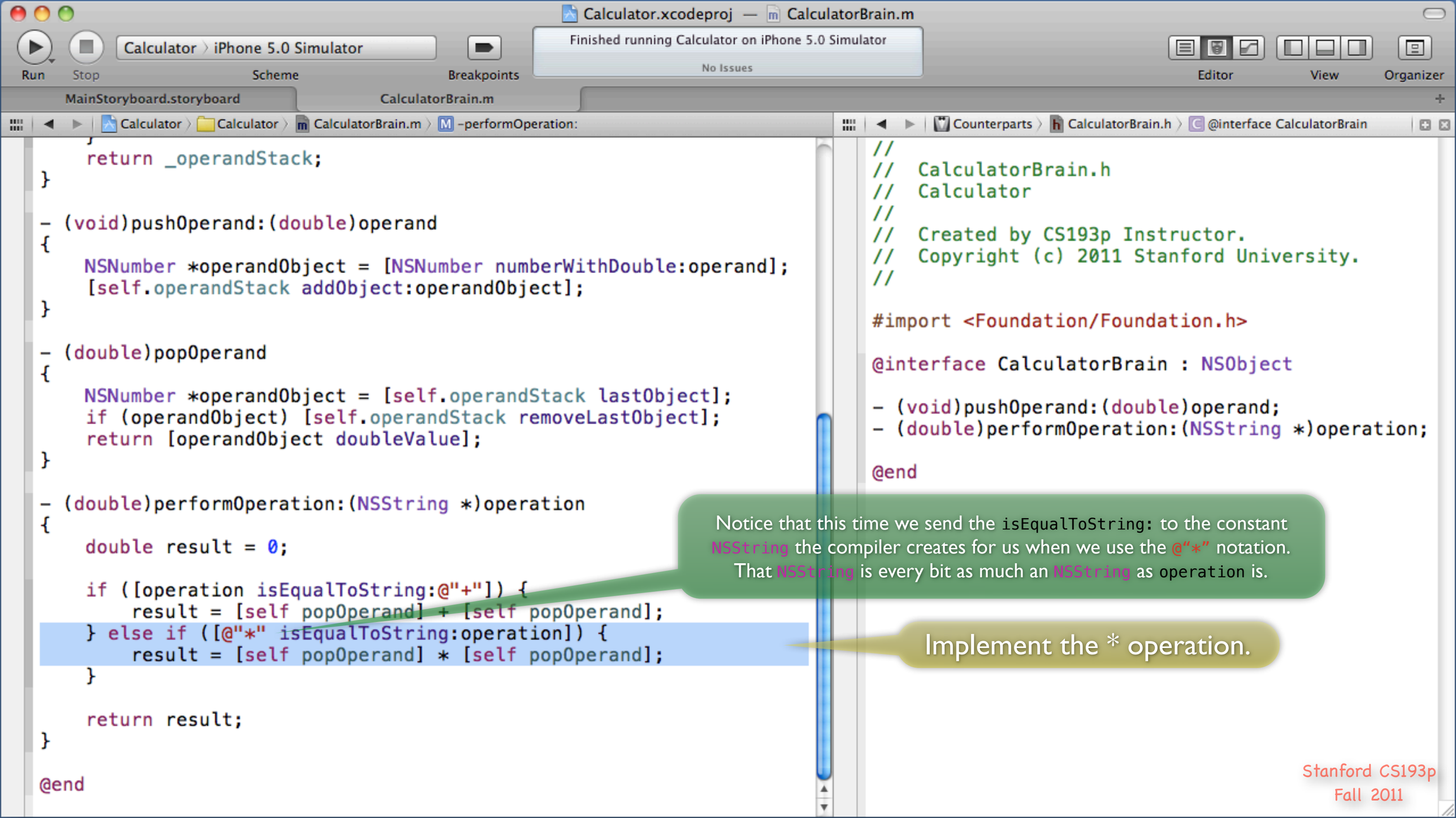
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return _operandStack;
}
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)popOperand
{
NSNumber *operandObject = [self.operandStack lastObject];
if (operandObject) [self.operandStack removeLastObject];
return [operandObject doubleValue];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
if ([operation isEqualToString:@"+"]) {
result = [self popOperand] + [self popOperand];
} else if ([@"*" isEqualToString:operation]) {
result = [self popOperand] * [self popOperand];
}
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Notice that this time we send the isEqualToString: to the constant NSString the compiler creates for us when we use the @"*" notation. That NSString is every bit as much an NSString as operation is.
Implement the * operation.
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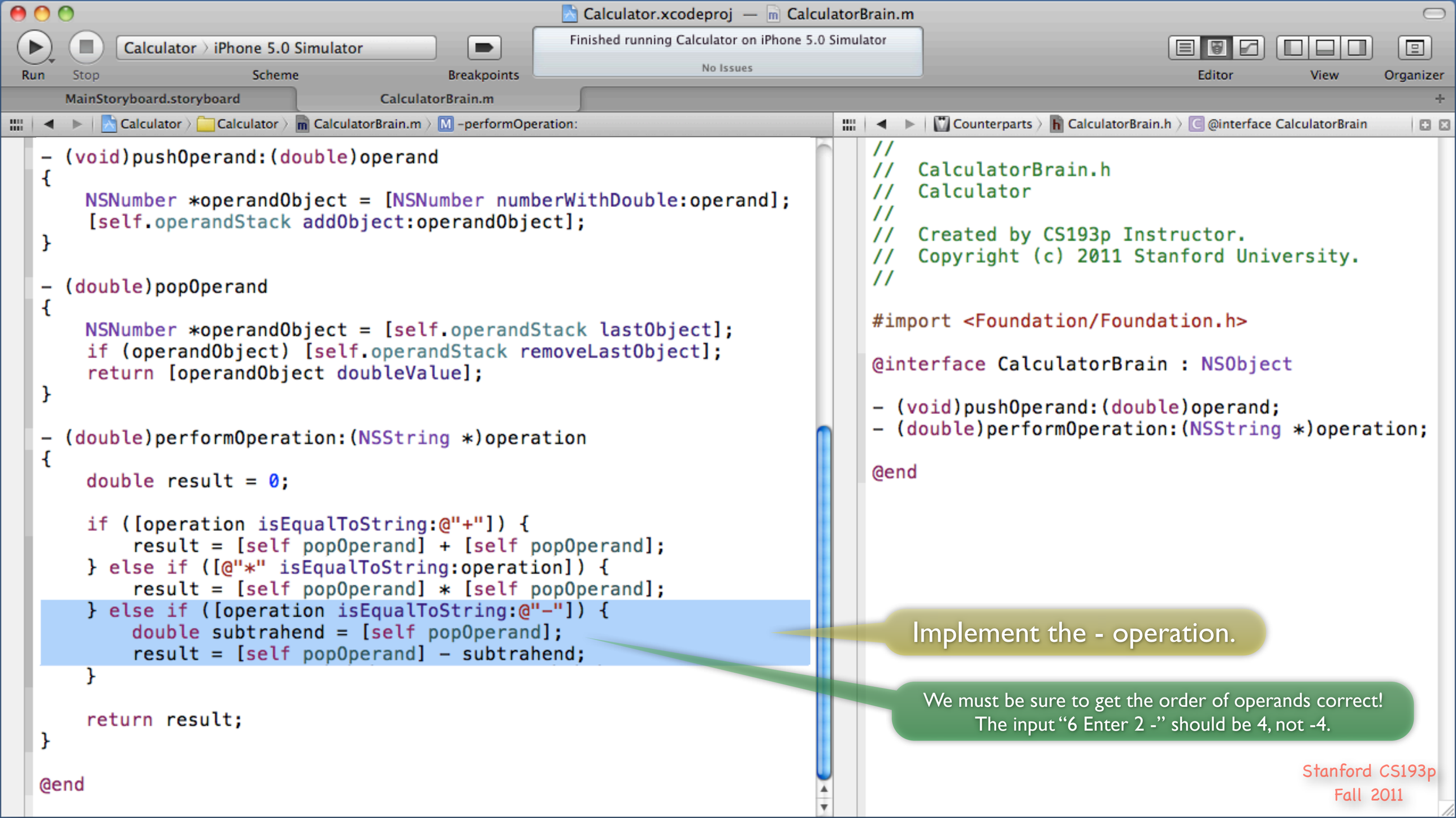
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Counterparts › CalculatorBrain.h › @interface CalculatorBrain
- (void)pushOperand:(double)operand
{
NSNumber *operandObject = [NSNumber numberWithDouble:operand];
[self.operandStack addObject:operandObject];
}
- (double)popOperand
{
NSNumber *operandObject = [self.operandStack lastObject];
if (operandObject) [self.operandStack removeLastObject];
return [operandObject doubleValue];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
if ([operation isEqualToString:@"+"]) {
result = [self popOperand] + [self popOperand];
} else if ([@"*" isEqualToString:operation]) {
result = [self popOperand] * [self popOperand];
} else if ([operation isEqualToString:@"-"]) {
double subtrahend = [self popOperand];
result = [self popOperand] - subtrahend;
}
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Implement the - operation.
We must be sure to get the order of operands correct!
The input "6 Enter 2 -" should be 4, not -4.
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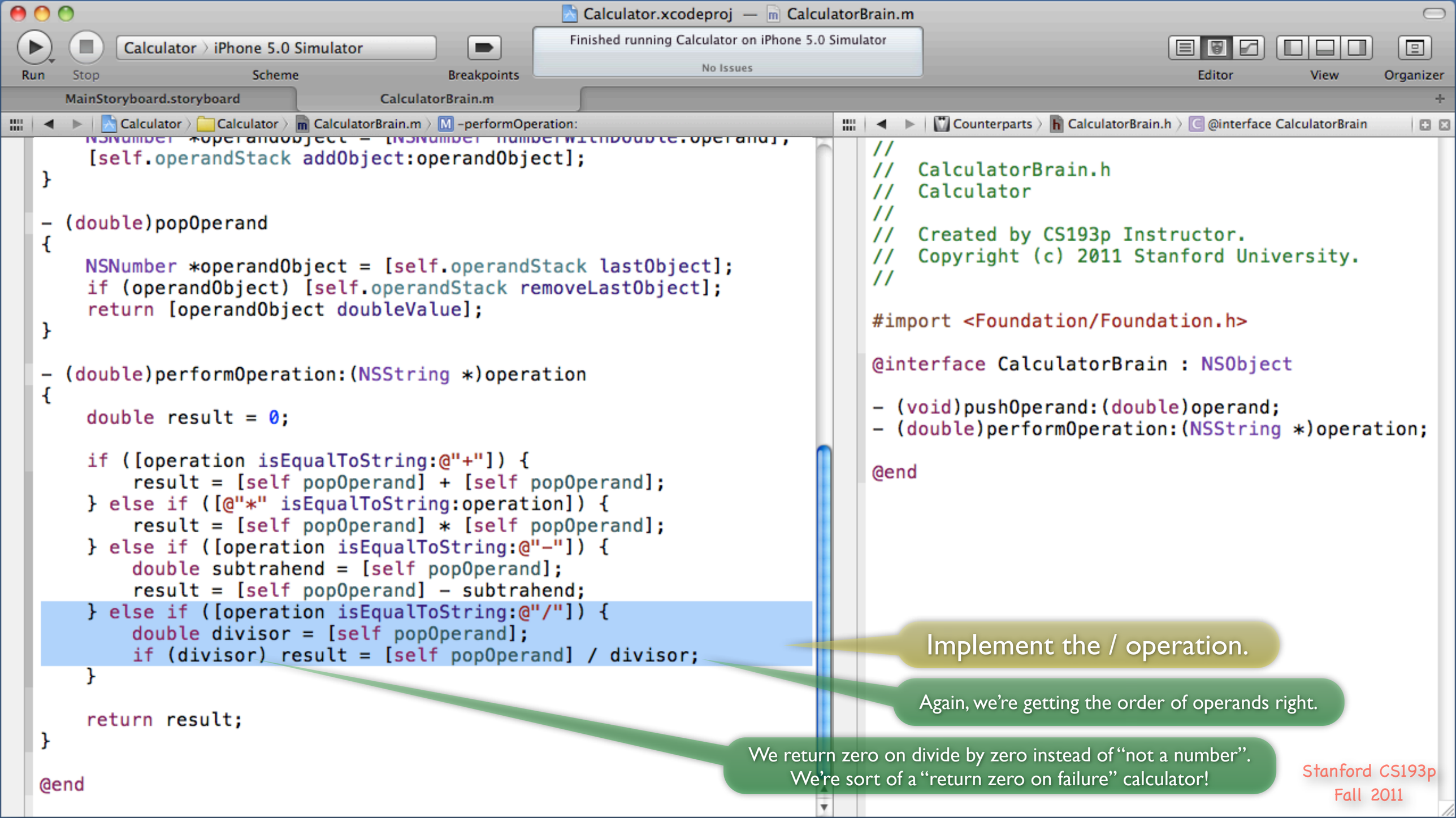
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[self.operandStack addObject:operandObject];
}
- (double)popOperand
{
NSNumber *operandObject = [self.operandStack lastObject];
if (operandObject) [self.operandStack removeLastObject];
return [operandObject doubleValue];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
if ([operation isEqualToString:@"+"]) {
result = [self popOperand] + [self popOperand];
} else if ([@"*" isEqualToString:operation]) {
result = [self popOperand] * [self popOperand];
} else if ([operation isEqualToString:@"-"]) {
double subtrahend = [self popOperand];
result = [self popOperand] - subtrahend;
} else if ([operation isEqualToString:@"/"]) {
double divisor = [self popOperand];
if (divisor) result = [self popOperand] / divisor;
}
return result;
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Implement the / operation.
Again, we're getting the order of operands right.
We return zero on divide by zero instead of "not a number".
We're sort of a "return zero on failure" calculator!
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Calculator.xcodeproj — CalculatorBrain.m

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MainStoryboard.storyboard | CalculatorBrain.m

Calculator › Calculator › CalculatorBrain.m › -performOperation:

```
- (double)popOperand
{
    NSNumber *operandObject = [self.operandStack lastObject];
    if (operandObject) [self.operandStack removeLastObject];
    return [operandObject doubleValue];
}

- (double)performOperation:(NSString *)operation
{
    double result = 0;

    if ([operation isEqualToString:@"+"]) {
        result = [self popOperand] + [self popOperand];
    } else if ([@"*" isEqualToString:operation]) {
        result = [self popOperand] * [self popOperand];
    } else if ([operation isEqualToString:@"-"]) {
        double subtrahend = [self popOperand];
        result = [self popOperand] - subtrahend;
    } else if ([operation isEqualToString:@"/"]) {
        double divisor = [self popOperand];
        if (divisor) result = [self popOperand] / divisor;
    }

    [self pushOperand:result];

    return result;
}

@end
```

Counterparts › CalculatorBrain.h › @interface CalculatorBrain

```
//
//  CalculatorBrain.h
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import <Foundation/Foundation.h>

@interface CalculatorBrain : NSObject

- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;

@end
```

Finally, we must be sure to push the result back onto the stack so that the next operation we are asked to do will use it.

Calculator.xcodeproj — CalculatorBrain.m

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MainStoryboard.storyboard | CalculatorBrain.m

Calculator › Calculator › CalculatorBrain.m › -performOperation:

```
- (void)pushOperand:(double)operand
{
    NSNumber *operandObject = [NSNumber numberWithDouble:operand];
    [self.operandStack addObject:operandObject];
}

- (double)popOperand
{
    NSNumber *operandObject = [self.operandStack lastObject];
    if (operandObject) [self.operandStack removeLastObject];
    return [operandObject doubleValue];
}

- (double)performOperation:(NSString *)operation
{
    double result = 0;

    if ([operation isEqualToString:@"+"]) {
        result = [self popOperand] + [self popOperand];
    } else if ([@"*" isEqualToString:operation]) {
        result = [self popOperand] * [self popOperand];
    } else if ([operation isEqualToString:@"-"]) {
        double subtrahend = [self popOperand];
        result = [self popOperand] - subtrahend;
    } else if ([operation isEqualToString:@"/"]) {
        double divisor = [self popOperand];
        if (divisor) result = [self popOperand] / divisor;
    }

    [self pushOperand:result];

    return result;
```

That's it for our Model!
Now we're going to switch back to our Controller to finish it off ...

Counterparts › CalculatorBrain.h › @interface CalculatorBrain

```
//
//  CalculatorBrain.h
//  Calculator
//
//  Created by CS193p Instructor.
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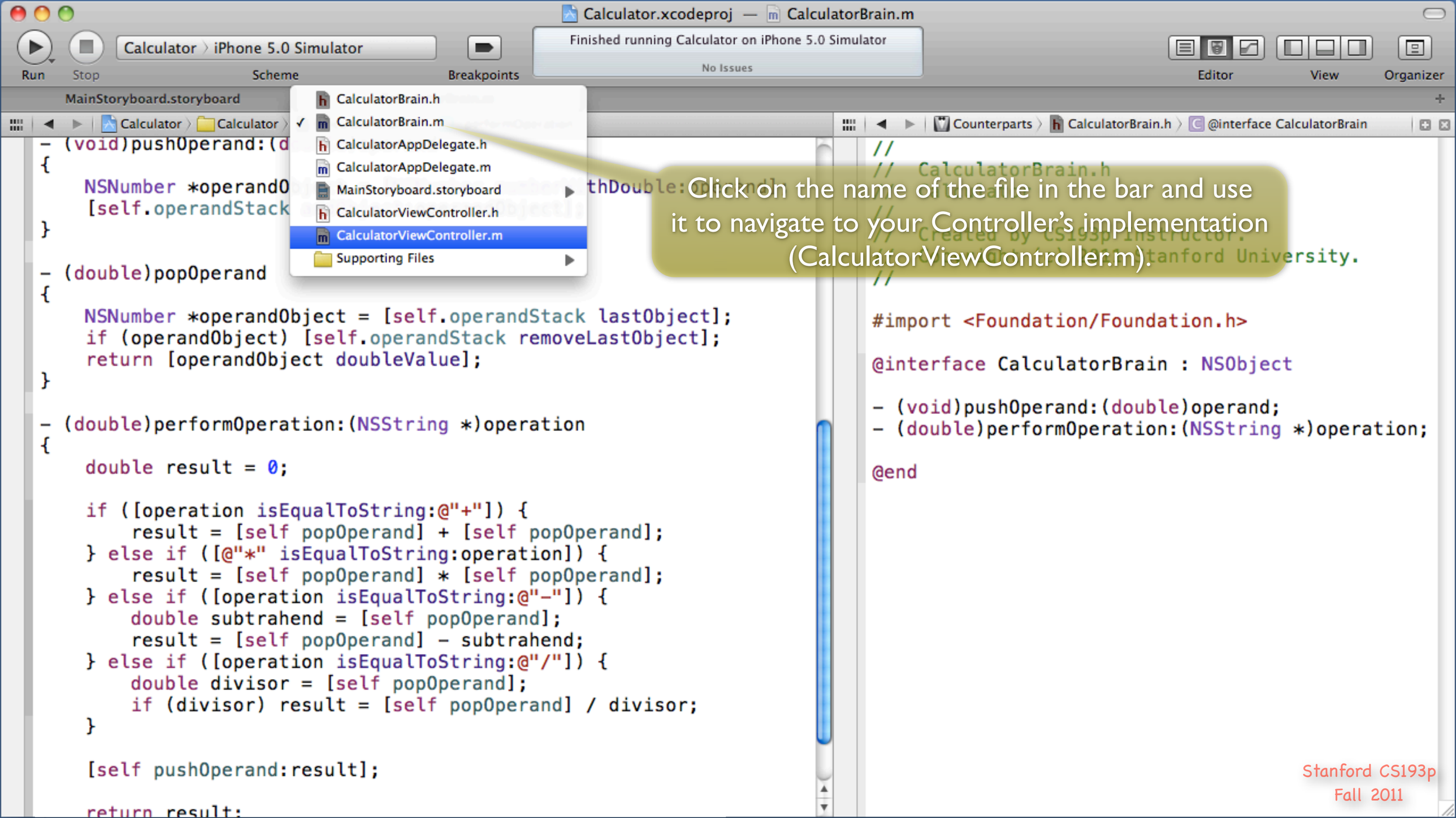
//

#import <Foundation/Foundation.h>

@interface CalculatorBrain : NSObject

- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;

@end
```


Calculator.xcodeproj — CalculatorBrain.m
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
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Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
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Calculator 〉 Calculator
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CalculatorBrain.m
CalculatorAppDelegate.h
CalculatorAppDelegate.m
MainStoryboard.storyboard
CalculatorViewController.h
CalculatorViewController.m
Supporting Files
Click on the name of the file in the bar and use it to navigate to your Controller's implementation (CalculatorViewController.m).
Counterparts 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
- (void)pushOperand:(d
{
NSNumber *operandO
[self.operandStack
}
- (double)popOperand
{
NSNumber *operandObject = [self.operandStack lastObject];
if (operandObject) [self.operandStack removeLastObject];
return [operandObject doubleValue];
}
- (double)performOperation:(NSString *)operation
{
double result = 0;
if ([operation isEqualToString:@"+"]) {
result = [self popOperand] + [self popOperand];
} else if ([@"*" isEqualToString:operation]) {
result = [self popOperand] * [self popOperand];
} else if ([operation isEqualToString:@"-"]) {
double subtrahend = [self popOperand];
result = [self popOperand] - subtrahend;
} else if ([operation isEqualToString:@"/"]) {
double divisor = [self popOperand];
if (divisor) result = [self popOperand] / divisor;
}
[self pushOperand:result];
return result;
//
// CalculatorBrain.h
// Created by CS193p Instructor.
// Copyright Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
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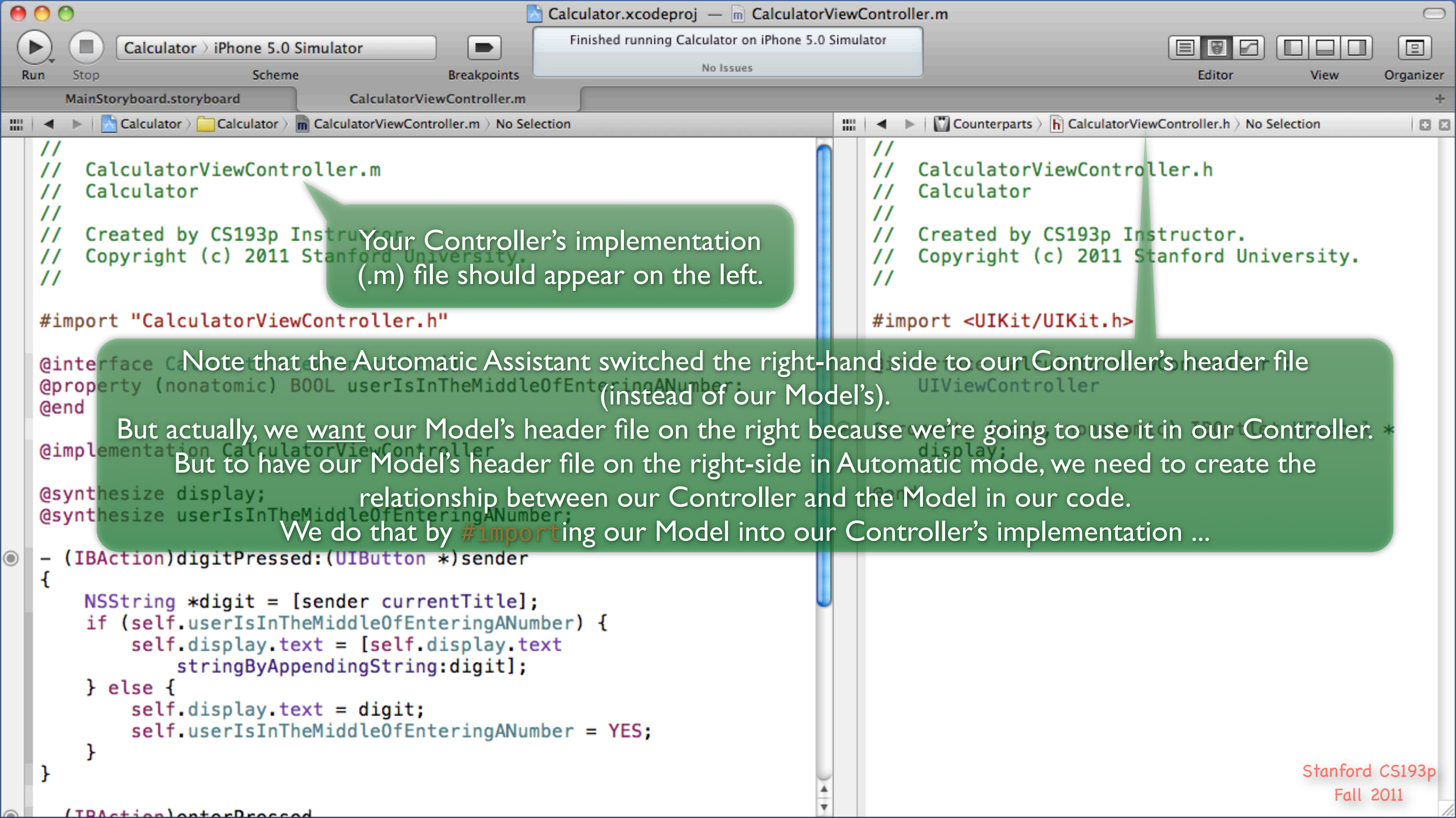
Fall 2011


Calculator.xcodeproj — CalculatorViewController.m
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CalculatorViewController.m
Calculator 〉 Calculator 〉 CalculatorViewController.m 〉 No Selection
Counterparts 〉 CalculatorViewController.h 〉 No Selection
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
@interface CalculatorViewController
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
UIViewController
display;
Your Controller's implementation (.m) file should appear on the left.
Note that the Automatic Assistant switched the right-hand side to our Controller's header file (instead of our Model's).
But actually, we want our Model's header file on the right because we're going to use it in our Controller.
But to have our Model's header file on the right-side in Automatic mode, we need to create the relationship between our Controller and the Model in our code.
We do that by #importing our Model into our Controller's implementation ...
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Calculator.xcodeproj — CalculatorViewController.m

Run | Stop | Calculator › iPhone 5.0 Simulator (Scheme) | Breakpoints | Finished running Calculator on iPhone 5.0 Simulator — No Issues | Editor | View | Organizer

MainStoryboard.storyboard | CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › No Selection

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"
#import "CalculatorBrain.h"

@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end

@implementation CalculatorViewController

@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}
```

Counterparts › CalculatorViewController.h › No Selection

```
//
//  CalculatorViewController.h
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

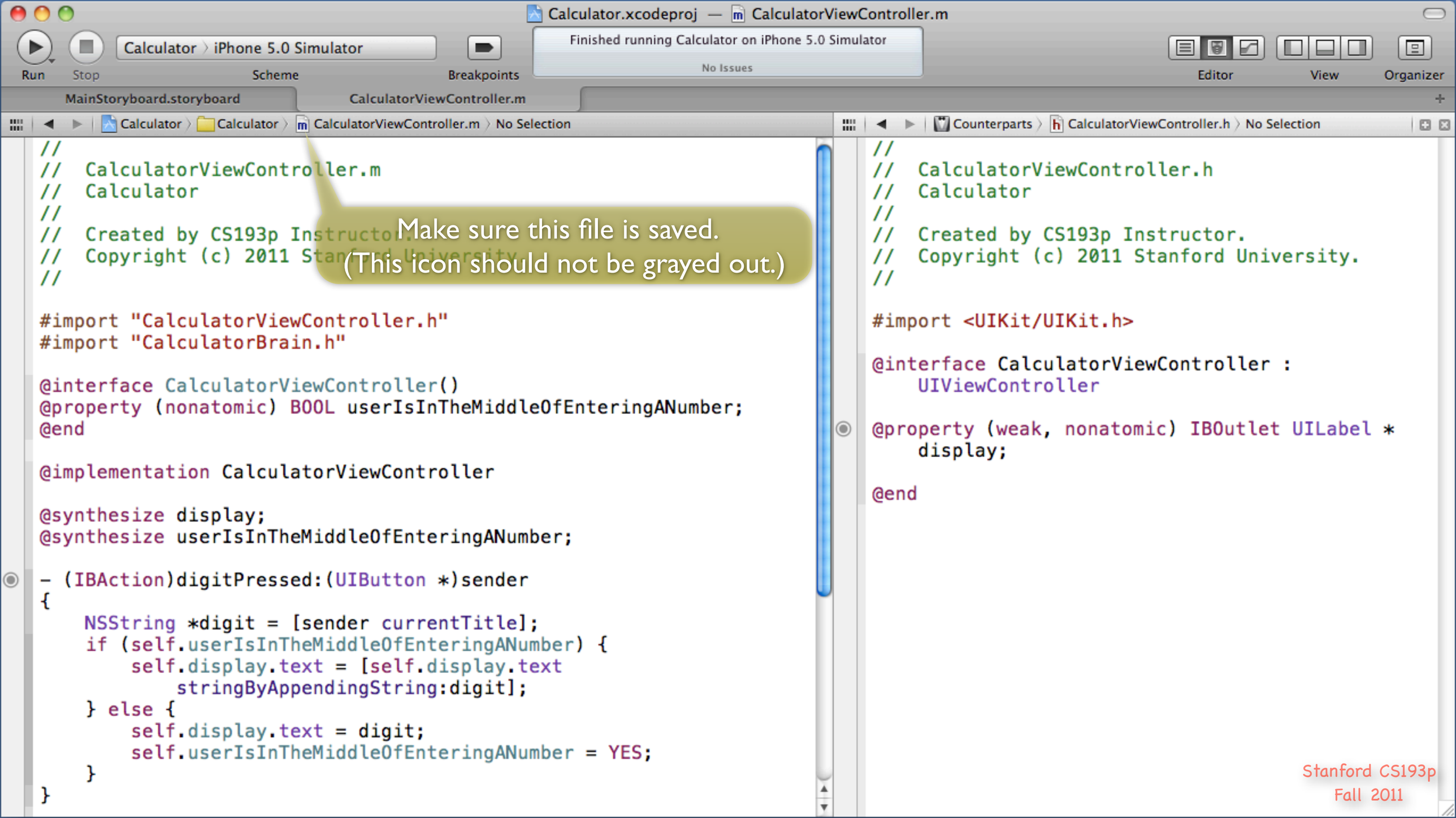
#import <UIKit/UIKit.h>

@interface CalculatorViewController :
    UIViewController

@property (weak, nonatomic) IBOutlet UILabel *
    display;

@end
```

#import the Model's header file into our Controller's implementation.


Calculator.xcodeproj — CalculatorViewController.m
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Calculator 〉 Calculator 〉 CalculatorViewController.m 〉 No Selection
Counterparts 〉 CalculatorViewController.h 〉 No Selection
Make sure this file is saved.
(This icon should not be grayed out.)
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
#import "CalculatorBrain.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
//
// CalculatorViewController.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <UIKit/UIKit.h>
@interface CalculatorViewController :
UIViewController
@property (weak, nonatomic) IBOutlet UILabel *
display;
@end
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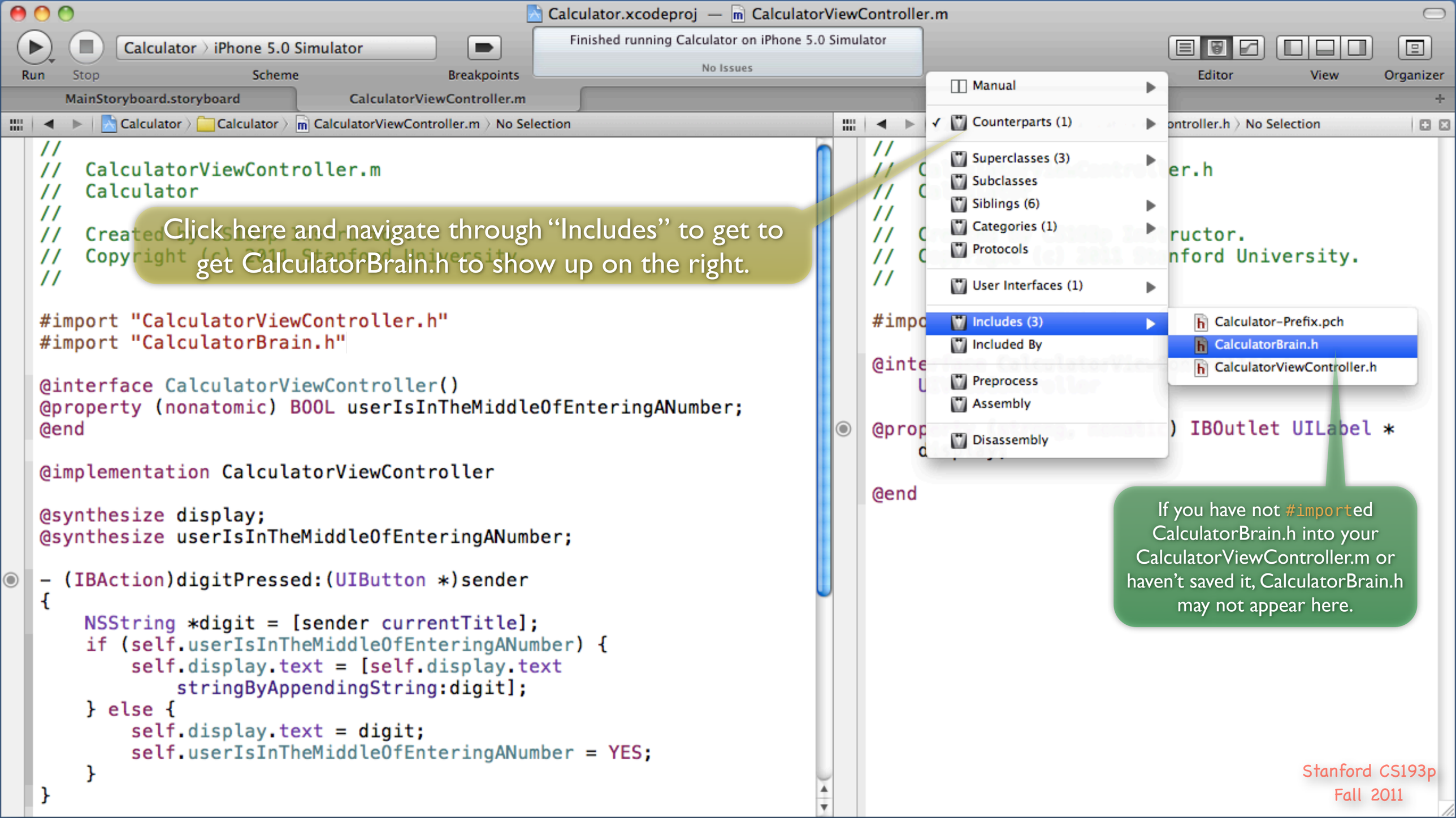
Fall 2011


Calculator.xcodeproj — CalculatorViewController.m
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Calculator 〉 Calculator 〉 CalculatorViewController.m 〉 No Selection
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
#import "CalculatorBrain.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
Click here and navigate through "Includes" to get to get CalculatorBrain.h to show up on the right.
Manual
Counterparts (1)
Superclasses (3)
Subclasses
Siblings (6)
Categories (1)
Protocols
User Interfaces (1)
Includes (3)
Included By
Preprocess
Assembly
Disassembly
Calculator-Prefix.pch
CalculatorBrain.h
CalculatorViewController.h
If you have not #imported CalculatorBrain.h into your CalculatorViewController.m or haven't saved it, CalculatorBrain.h may not appear here.
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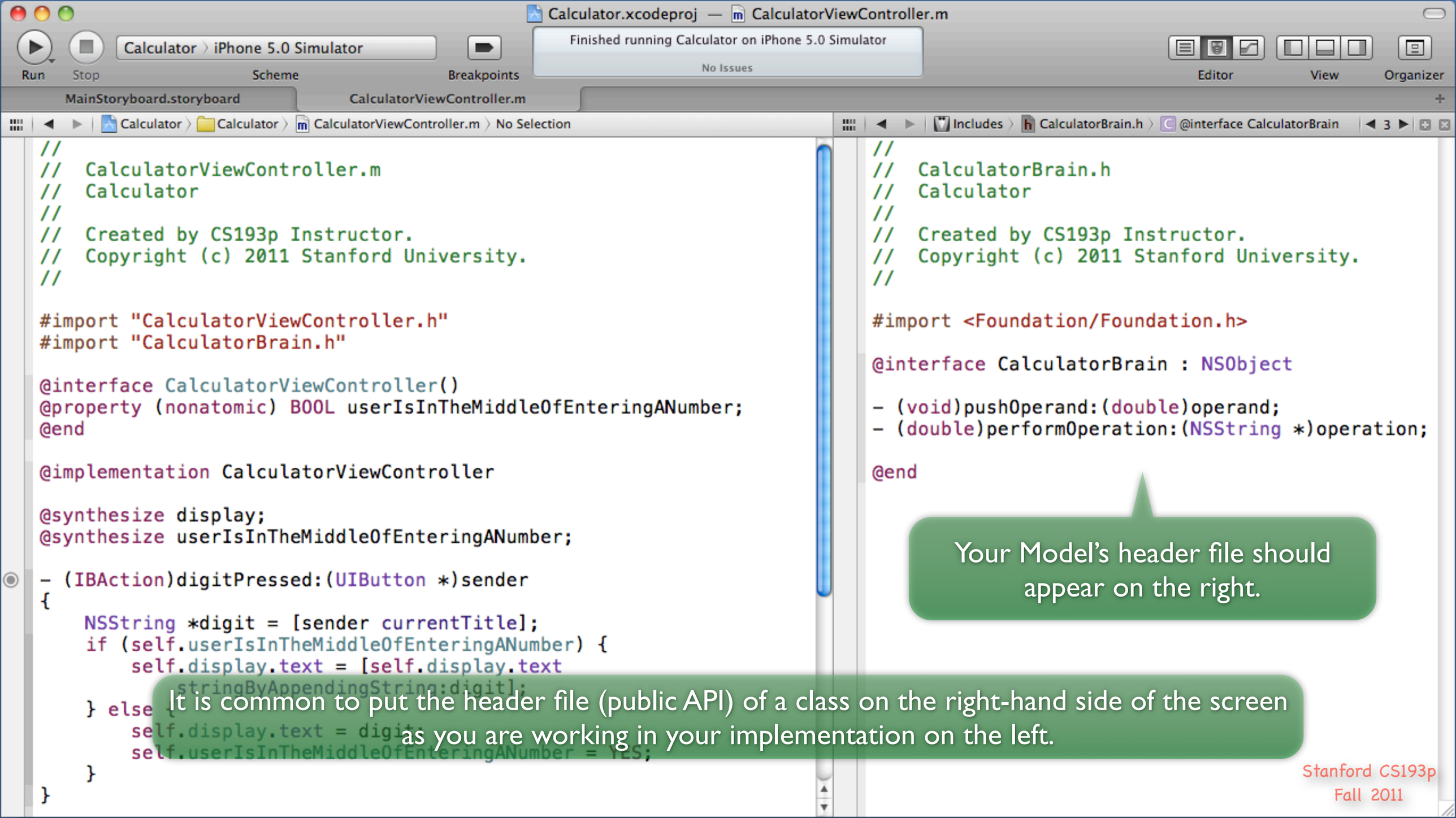
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Calculator › Calculator › CalculatorViewController.m › No Selection
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
#import "CalculatorBrain.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@end
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
Includes › CalculatorBrain.h › @interface CalculatorBrain
3
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Your Model's header file should appear on the right.
It is common to put the header file (public API) of a class on the right-hand side of the screen as you are working in your implementation on the left.
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Calculator.xcodeproj — CalculatorViewController.m

Run | Stop | Calculator › iPhone 5.0 Simulator (Scheme) | Breakpoints | Finished running Calculator on iPhone 5.0 Simulator — Project ⚠2 | Editor | View | Organizer

MainStoryboard.storyboard | CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › @interface CalculatorViewController()

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"
#import "CalculatorBrain.h"

@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@property (nonatomic, strong) CalculatorBrain *brain;
@end

@implementation CalculatorViewController

@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}
```

Includes › CalculatorBrain.h › @interface CalculatorBrain

```
//
//  CalculatorBrain.h
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import <Foundation/Foundation.h>

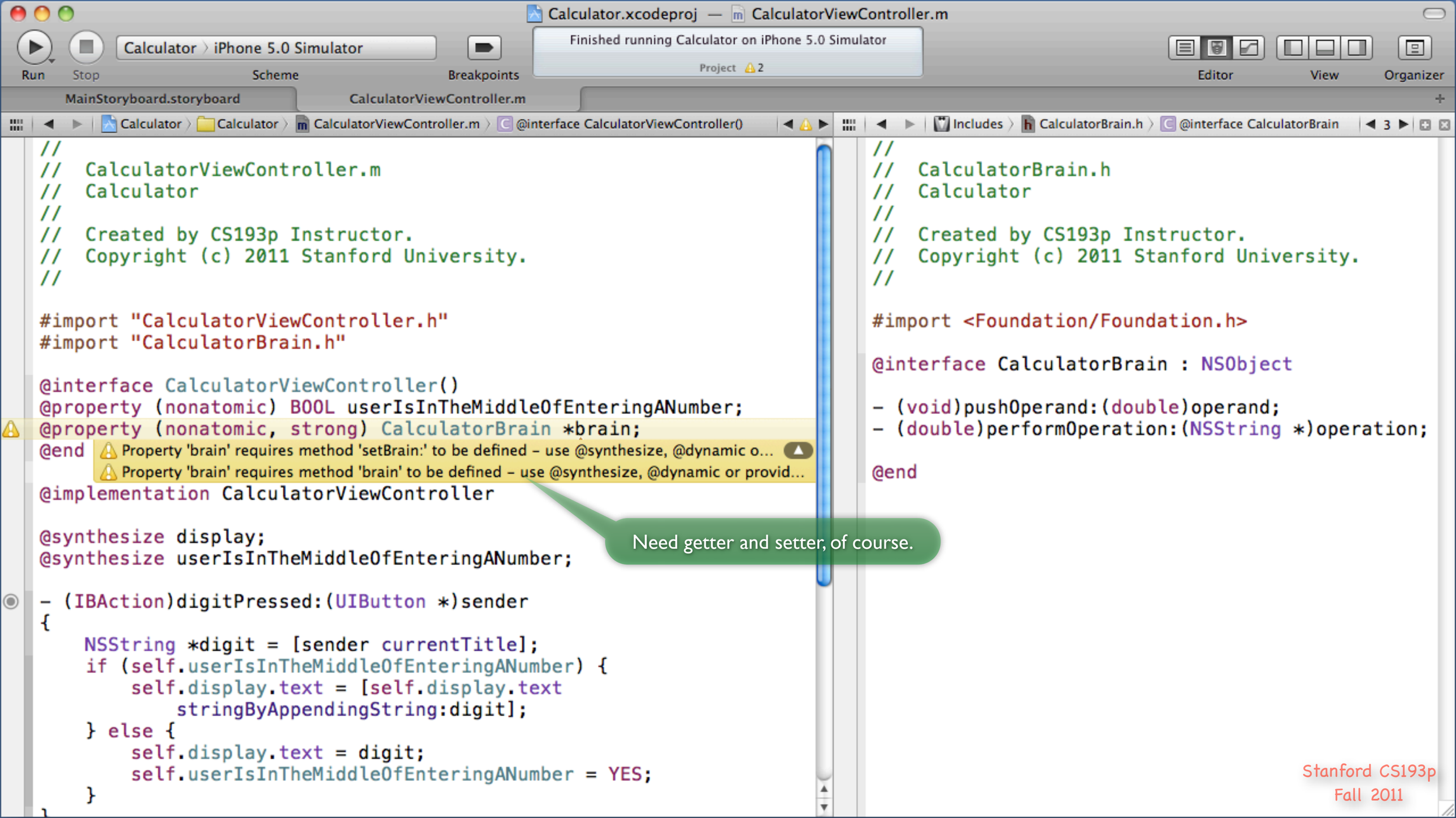
@interface CalculatorBrain : NSObject

- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;

@end
```

Okay, we are in the home stretch.
All we need to do is to add a pointer (@property) in our Controller that points to our Model.
And then use an instance of our Model to implement operationPressed: and enterPressed.

Add a @property to hold a pointer from our Controller to our Model.


Calculator.xcodeproj — CalculatorViewController.m
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Calculator 〉 Calculator 〉 CalculatorViewController.m 〉 @interface CalculatorViewController()
Includes 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
//
// CalculatorViewController.m
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import "CalculatorViewController.h"
#import "CalculatorBrain.h"
@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@property (nonatomic, strong) CalculatorBrain *brain;
@end
Property 'brain' requires method 'setBrain:' to be defined – use @synthesize, @dynamic o...
Property 'brain' requires method 'brain' to be defined – use @synthesize, @dynamic or provid...
@implementation CalculatorViewController
@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
Need getter and setter, of course.
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
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Fall 2011

Calculator.xcodeproj — CalculatorViewController.m

Run | Stop | Calculator › iPhone 5.0 Simulator (Scheme) | Breakpoints | Finished running Calculator on iPhone 5.0 Simulator — No Issues | Editor | View | Organizer

MainStoryboard.storyboard | CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › @implementation CalculatorViewController

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"
#import "CalculatorBrain.h"

@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@property (nonatomic, strong) CalculatorBrain *brain;
@end

@implementation CalculatorViewController

@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
@synthesize brain = _brain;

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
```

Add an @synthesize to create the brain setter & getter. We'll use the most common naming convention for the corresponding instance variable (underbar plus property name).

Includes › CalculatorBrain.h › @interface CalculatorBrain

```
//
//  CalculatorBrain.h
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import <Foundation/Foundation.h>

@interface CalculatorBrain : NSObject

- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;

@end
```

Calculator.xcodeproj — CalculatorViewController.m

Run | Stop | Calculator › iPhone 5.0 Simulator (Scheme) | Breakpoints | Finished running Calculator on iPhone 5.0 Simulator — No Issues | Editor | View | Organizer

MainStoryboard.storyboard | CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › -brain

```
//
//  CalculatorViewController.m
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

#import "CalculatorViewController.h"
#import "CalculatorBrain.h"

@interface CalculatorViewController()
@property (nonatomic) BOOL userIsInTheMiddleOfEnteringANumber;
@property (nonatomic, strong) CalculatorBrain *brain;
@end

@implementation CalculatorViewController

@synthesize display;
@synthesize userIsInTheMiddleOfEnteringANumber;
@synthesize brain = _brain;

- (CalculatorBrain *)brain
{
    if (!_brain) _brain = [[CalculatorBrain alloc] init];
    return _brain;
}

- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
```

Yes, we should have gone back and added = _display and = _userIsInTheMiddleOfEnteringANumber to these other @synthesizes.

Includes › CalculatorBrain.h › @interface CalculatorBrain ◀ 3 ▶

```
//
//  CalculatorBrain.h
//  Calculator
//
//  Created by CS193p Instructor.
//  Copyright (c) 2011 Stanford University.
//

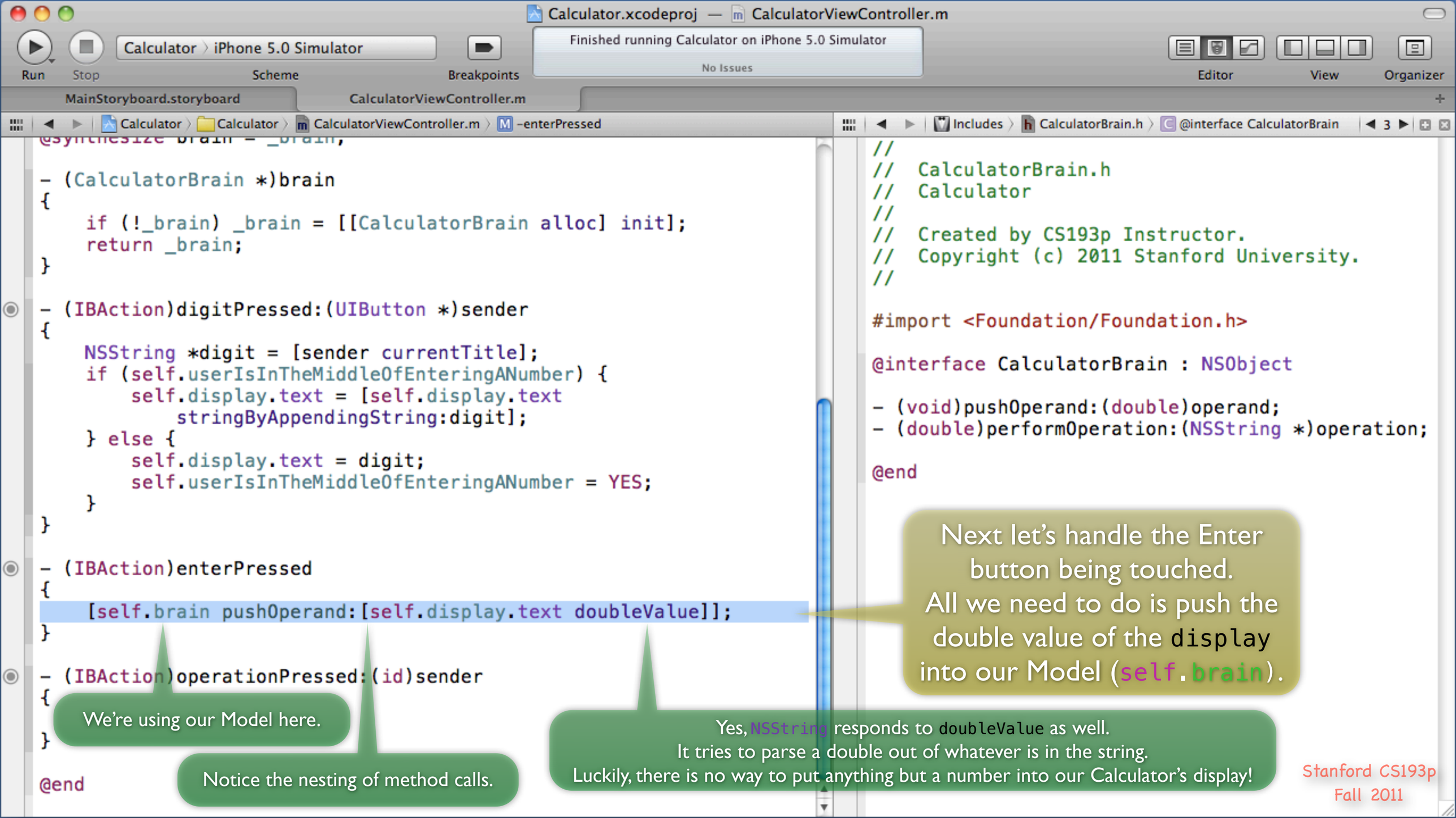
#import <Foundation/Foundation.h>

@interface CalculatorBrain : NSObject

- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;

@end
```

While we're at it, let's lazily instantiate the brain in its getter method.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Calculator 〉 Calculator 〉 CalculatorViewController.m 〉 -enterPressed
Includes 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
@synthesize brain = _brain;
- (CalculatorBrain *)brain
{
if (!_brain) _brain = [[CalculatorBrain alloc] init];
return _brain;
}
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
}
- (IBAction)operationPressed:(id)sender
{
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Next let's handle the Enter button being touched.
All we need to do is push the double value of the display into our Model (self.brain).
We're using our Model here.
Notice the nesting of method calls.
Yes, NSString responds to doubleValue as well.
It tries to parse a double out of whatever is in the string.
Luckily, there is no way to put anything but a number into our Calculator's display!
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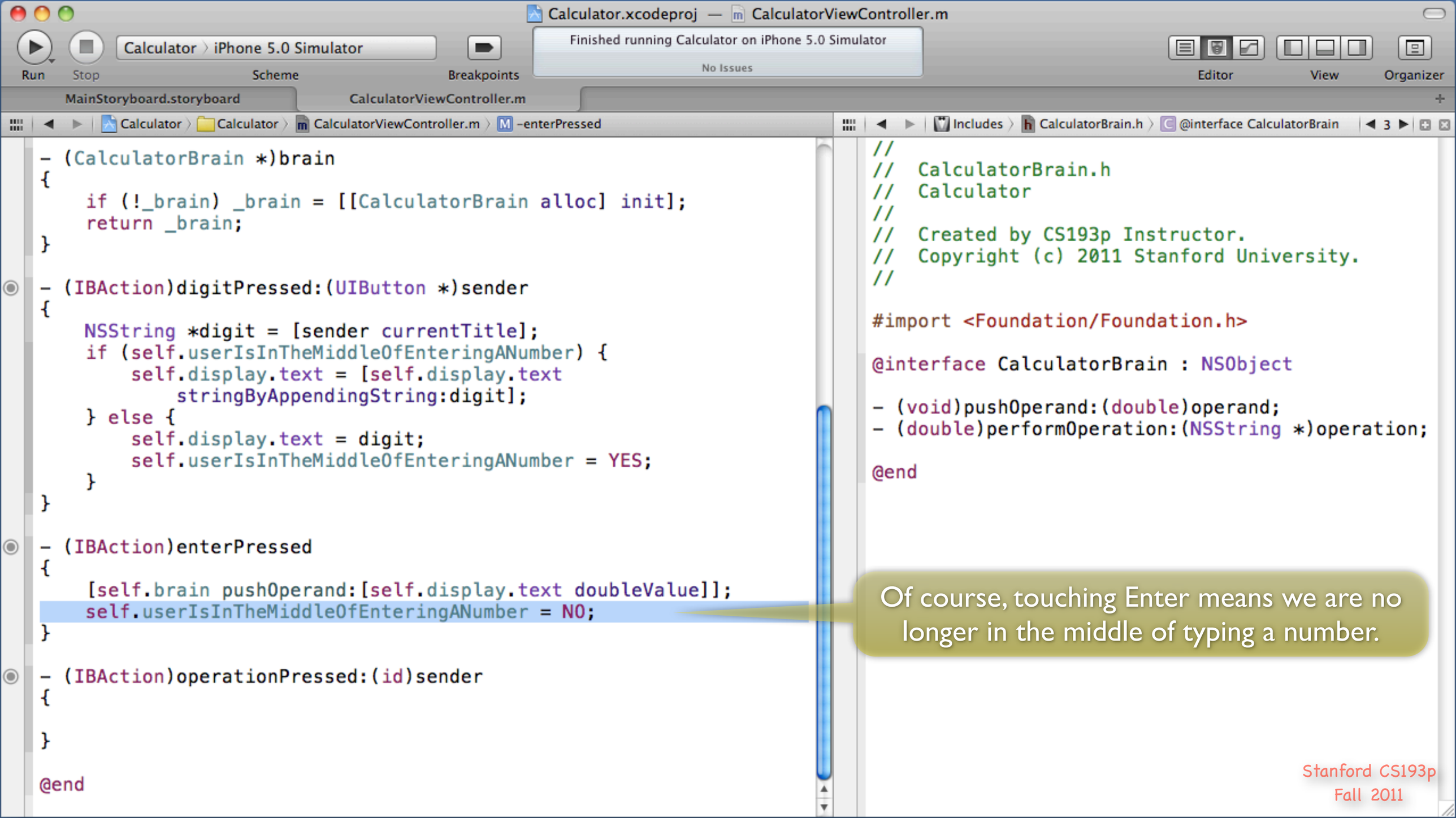
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Calculator 〉 Calculator 〉 CalculatorViewController.m 〉 -enterPressed
Includes 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
3
- (CalculatorBrain *)brain
{
if (!_brain) _brain = [[CalculatorBrain alloc] init];
return _brain;
}
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Of course, touching Enter means we are no longer in the middle of typing a number.
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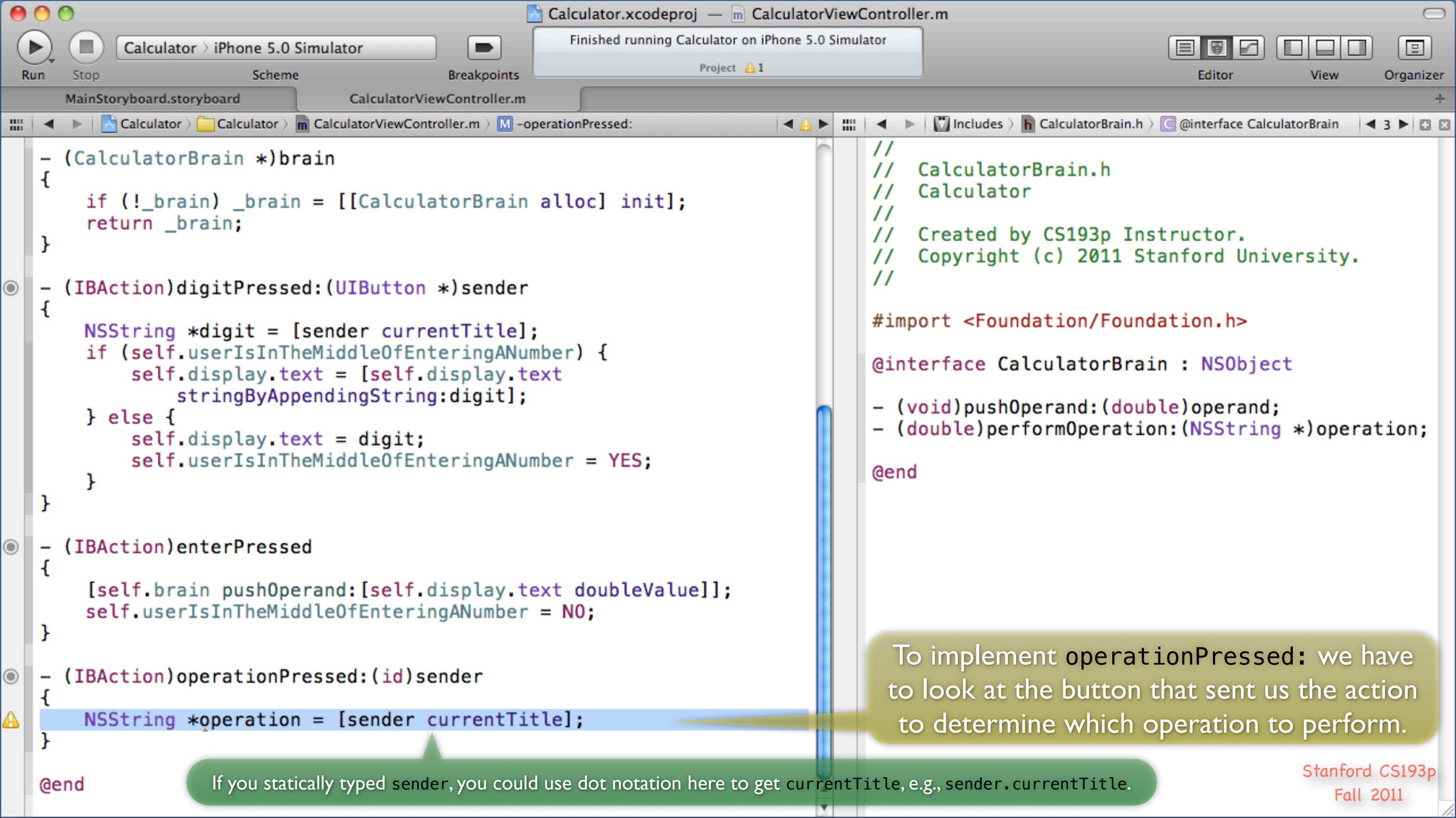
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Calculator 〉 Calculator 〉 CalculatorViewController.m 〉 -operationPressed:
Includes 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
3
- (CalculatorBrain *)brain
{
if (!_brain) _brain = [[CalculatorBrain alloc] init];
return _brain;
}
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
NSString *operation = [sender currentTitle];
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
To implement operationPressed: we have to look at the button that sent us the action to determine which operation to perform.
If you statically typed sender, you could use dot notation here to get currentTitle, e.g., sender.currentTitle.
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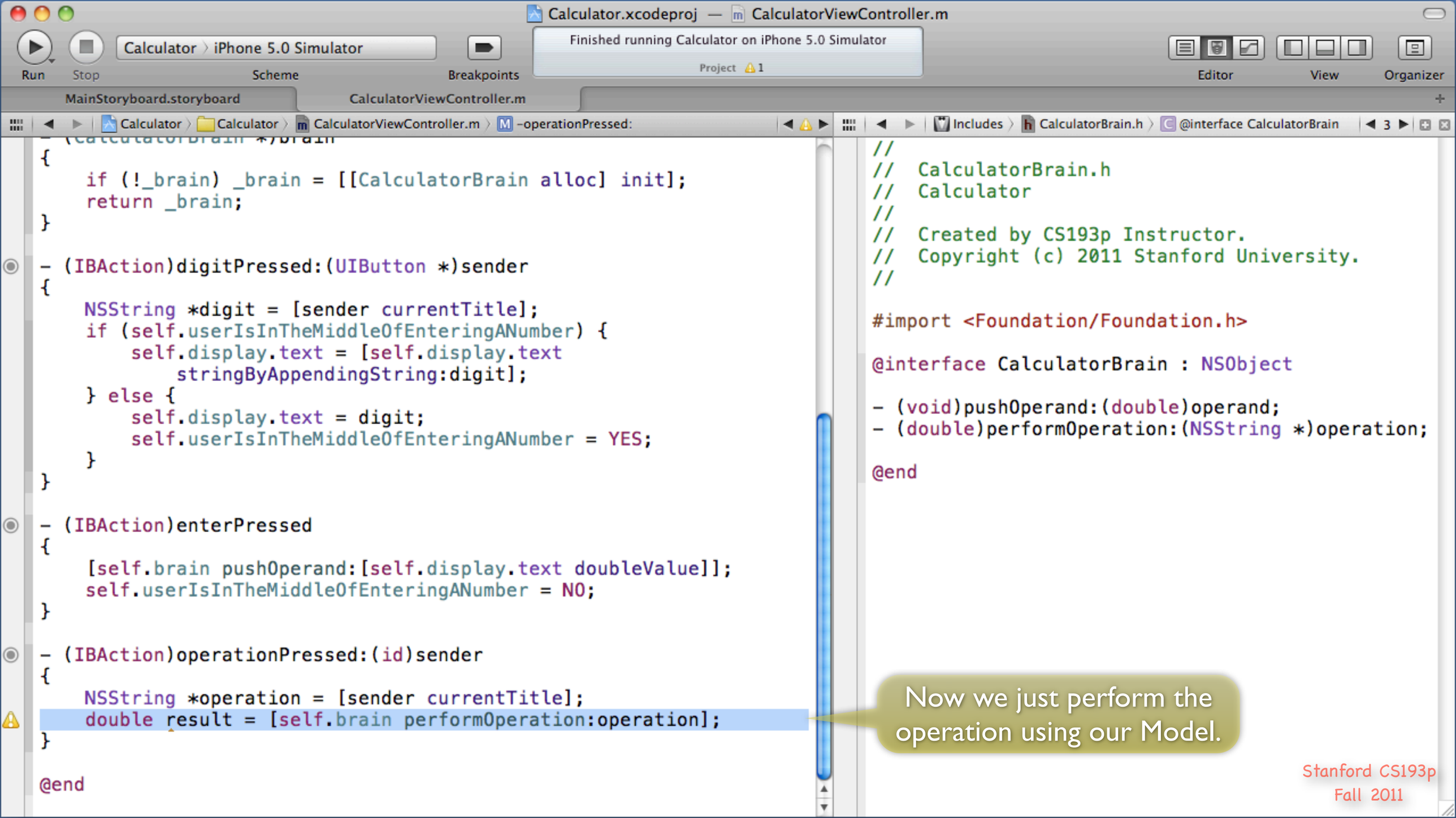
Fall 2011


Calculator.xcodeproj — CalculatorViewController.m
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
Project ⚠1
Editor
View
Organizer
MainStoryboard.storyboard
CalculatorViewController.m
Calculator › Calculator › CalculatorViewController.m › -operationPressed:
Includes › CalculatorBrain.h › @interface CalculatorBrain
{
if (!_brain) _brain = [[CalculatorBrain alloc] init];
return _brain;
}
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
NSString *operation = [sender currentTitle];
double result = [self.brain performOperation:operation];
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
Now we just perform the operation using our Model.
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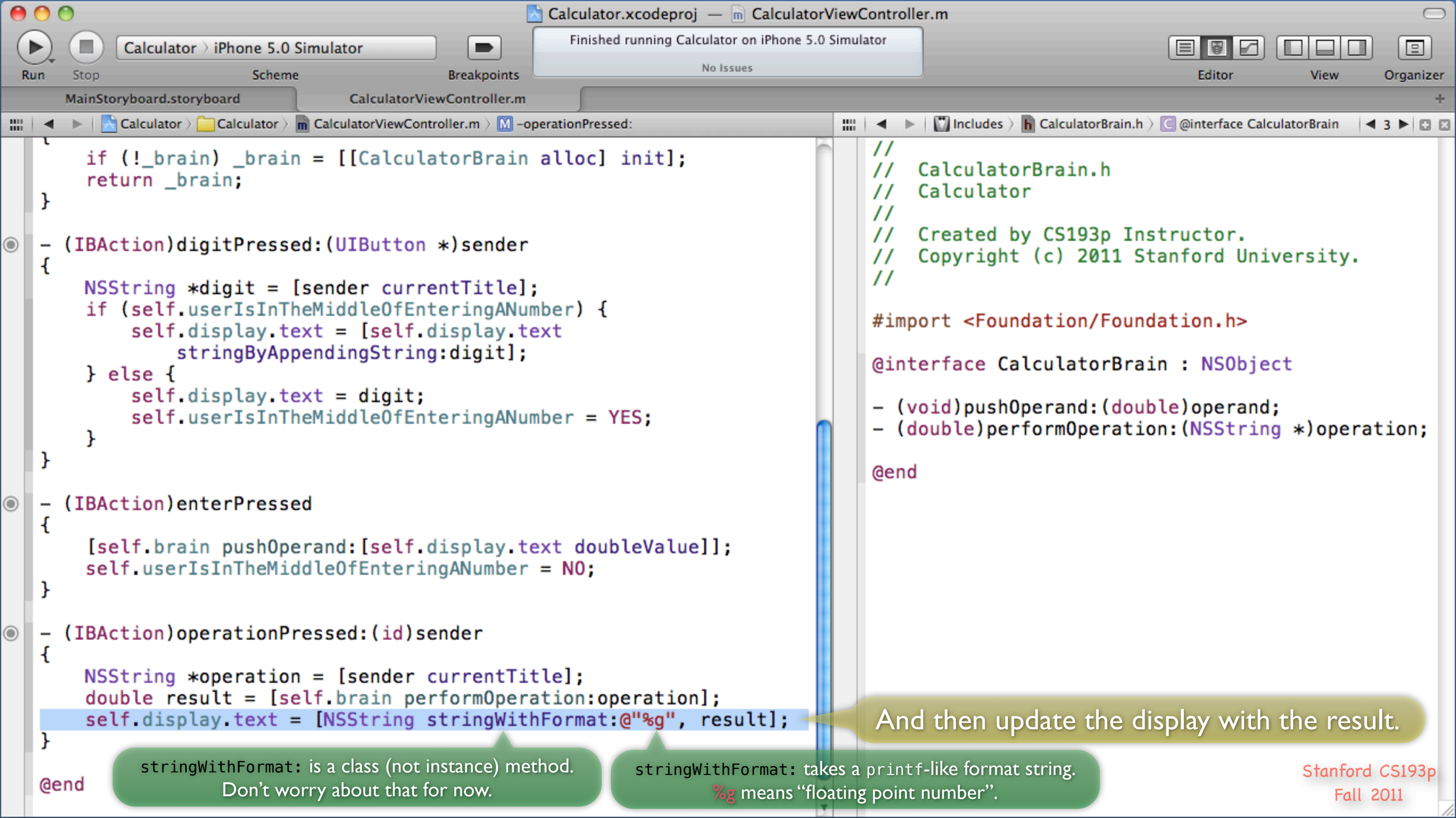
Calculator.xcodeproj — CalculatorViewController.m
Run
Stop
Calculator 〉 iPhone 5.0 Simulator
Scheme
Breakpoints
Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
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CalculatorViewController.m
Calculator 〉 Calculator 〉 CalculatorViewController.m 〉 -operationPressed:
Includes 〉 CalculatorBrain.h 〉 @interface CalculatorBrain
3
if (!_brain) _brain = [[CalculatorBrain alloc] init];
return _brain;
}
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
NSString *operation = [sender currentTitle];
double result = [self.brain performOperation:operation];
self.display.text = [NSString stringWithFormat:@"%g", result];
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
And then update the display with the result.
stringWithFormat: is a class (not instance) method.
Don't worry about that for now.
stringWithFormat: takes a printf-like format string.
%g means "floating point number".
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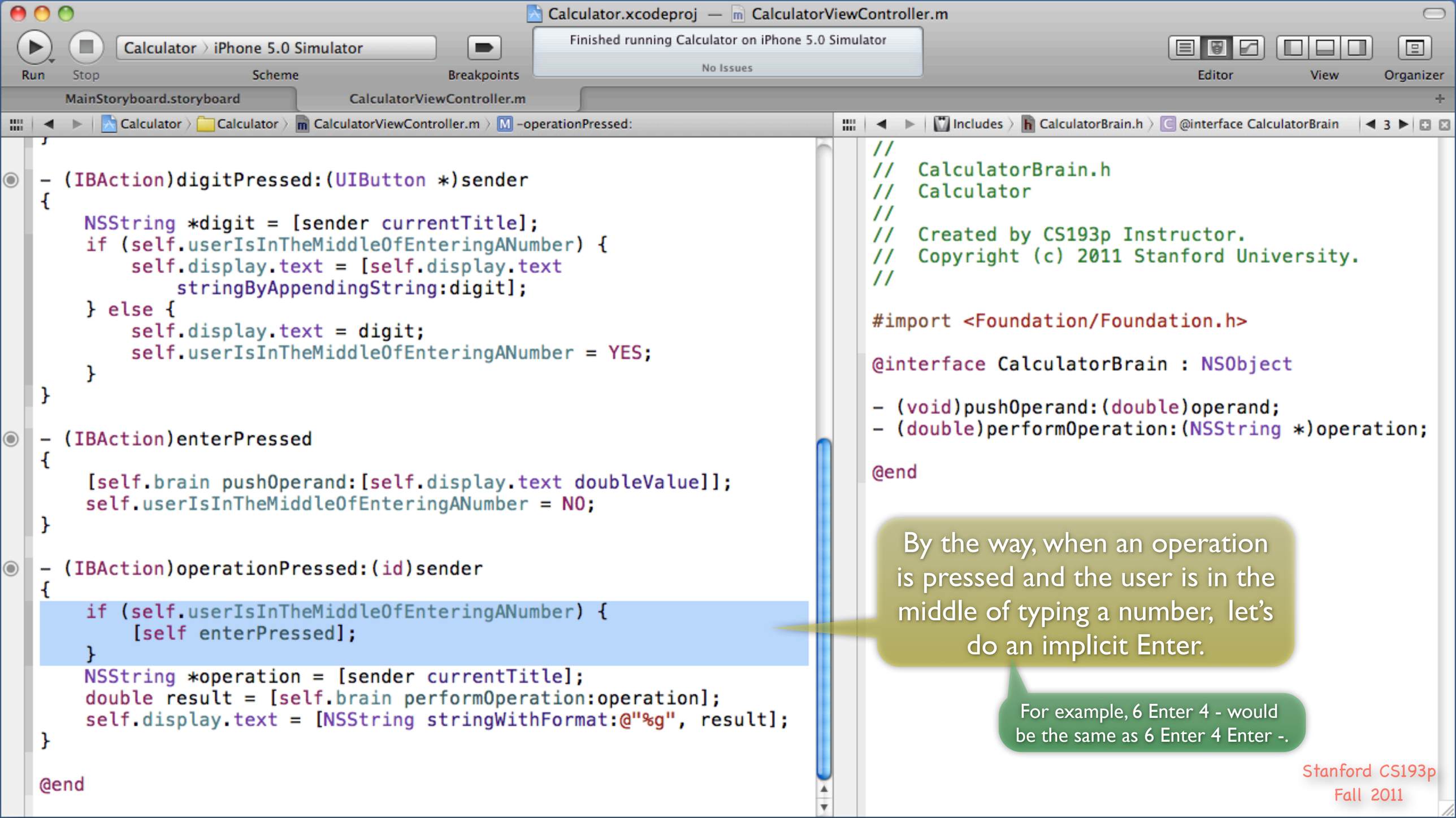
Calculator.xcodeproj — CalculatorViewController.m
Run
Stop
Calculator › iPhone 5.0 Simulator
Scheme
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Finished running Calculator on iPhone 5.0 Simulator
No Issues
Editor
View
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CalculatorViewController.m
Calculator › Calculator › CalculatorViewController.m › -operationPressed:
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- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
if (self.userIsInTheMiddleOfEnteringANumber) {
[self enterPressed];
}
NSString *operation = [sender currentTitle];
double result = [self.brain performOperation:operation];
self.display.text = [NSString stringWithFormat:@"%g", result];
}
@end
//
// CalculatorBrain.h
// Calculator
//
// Created by CS193p Instructor.
// Copyright (c) 2011 Stanford University.
//
#import <Foundation/Foundation.h>
@interface CalculatorBrain : NSObject
- (void)pushOperand:(double)operand;
- (double)performOperation:(NSString *)operation;
@end
By the way, when an operation is pressed and the user is in the middle of typing a number, let's do an implicit Enter.
For example, 6 Enter 4 - would be the same as 6 Enter 4 Enter -.
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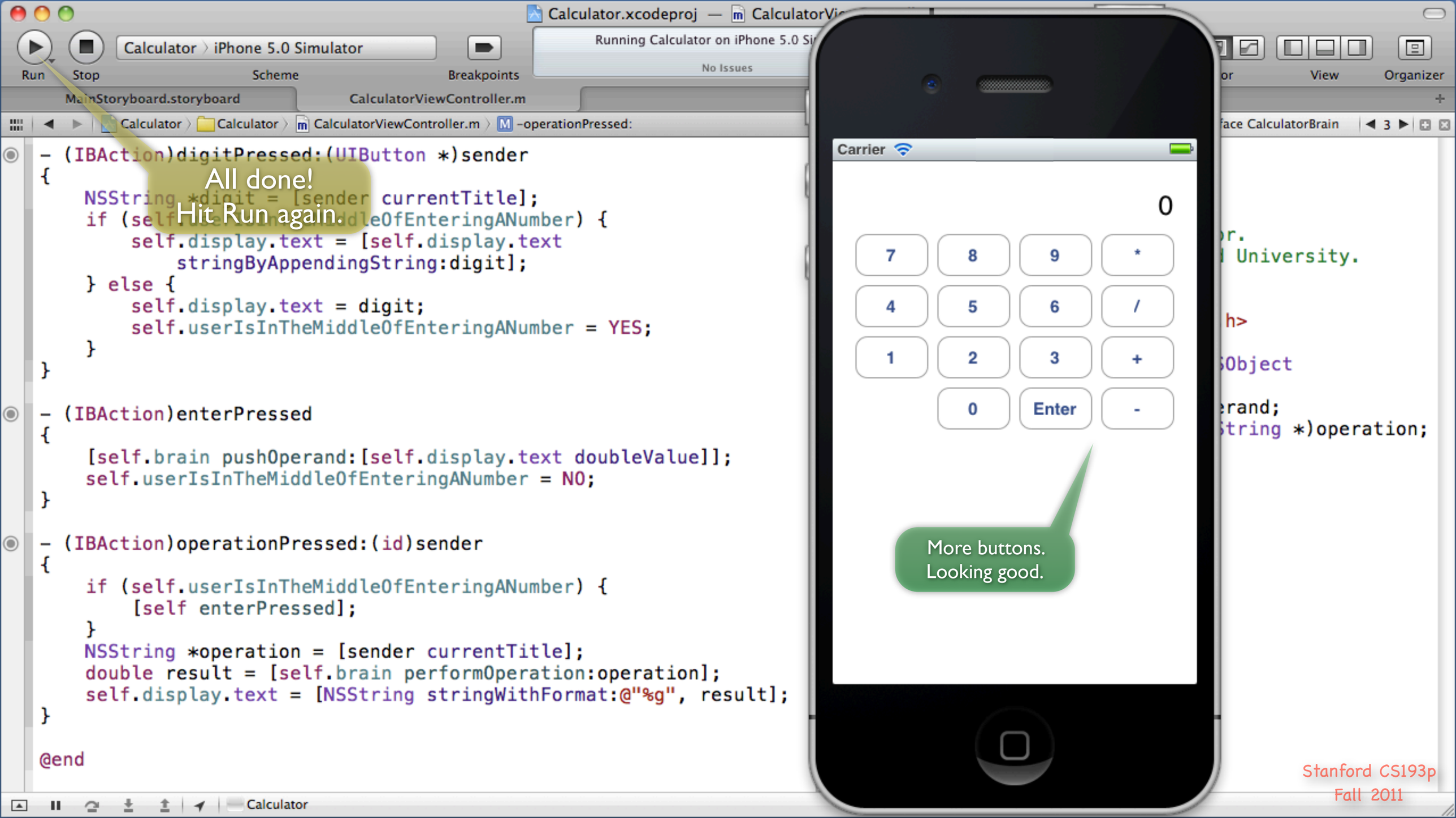
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View
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MainStoryboard.storyboard
CalculatorViewController.m
Calculator › Calculator › CalculatorViewController.m › -operationPressed:
All done!
Hit Run again.
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
if (self.userIsInTheMiddleOfEnteringANumber) {
[self enterPressed];
}
NSString *operation = [sender currentTitle];
double result = [self.brain performOperation:operation];
self.display.text = [NSString stringWithFormat:@"%g", result];
}
@end
Carrier
0
7
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4
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6
/
1
2
3
+
0
Enter
-
More buttons.
Looking good.
Calculator
Stanford CS193p
Fall 2011

Calculator.xcodeproj — CalculatorVi

Run Stop Calculator › iPhone 5.0 Simulator Scheme Breakpoints Running Calculator on iPhone 5.0 Si No Issues or View Organizer

MainStoryboard.storyboard CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › -operationPressed: face CalculatorBrain 3

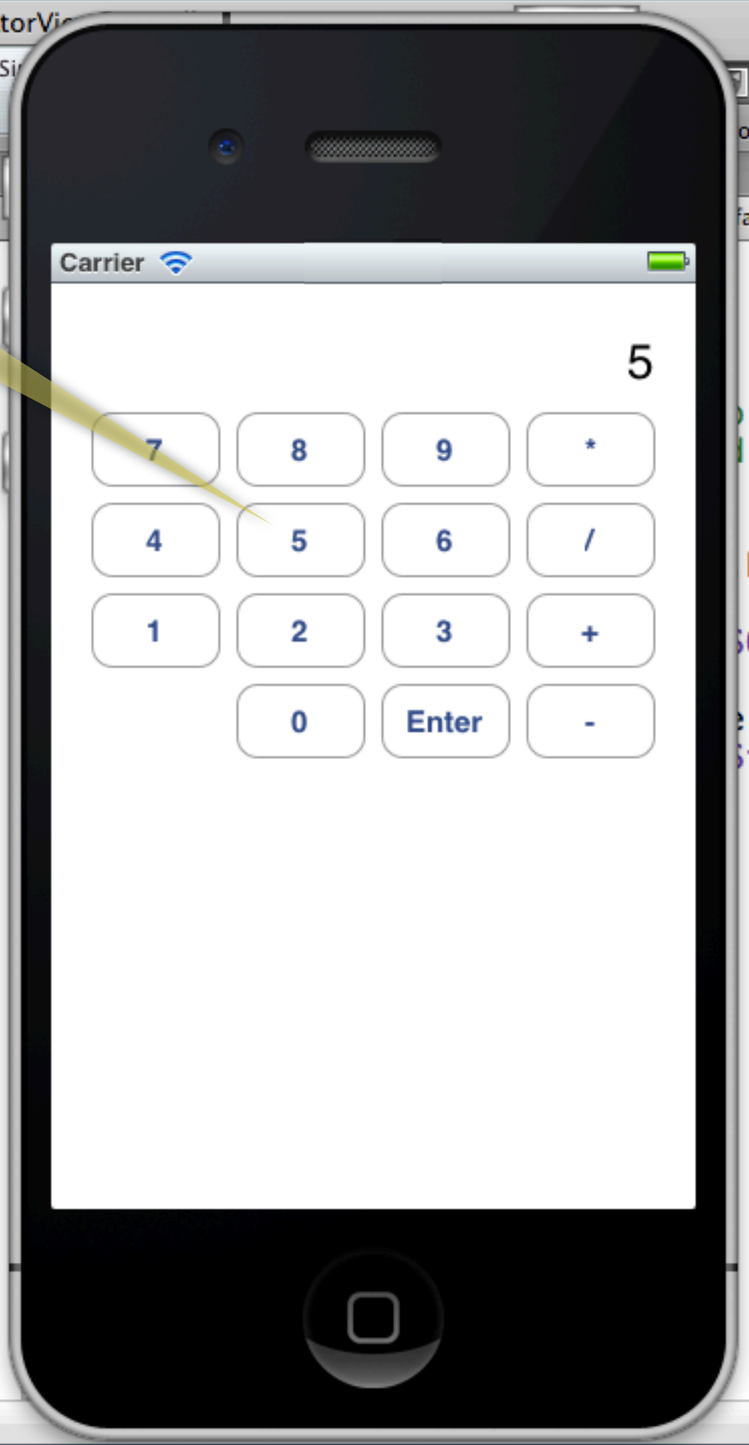
```
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

- (IBAction)enterPressed
{
    [self.brain pushOperand:[self.display.text doubleValue]];
    self.userIsInTheMiddleOfEnteringANumber = NO;
}

- (IBAction)operationPressed:(id)sender
{
    if (self.userIsInTheMiddleOfEnteringANumber) {
        [self enterPressed];
    }
    NSString *operation = [sender currentTitle];
    double result = [self.brain performOperation:operation];
    self.display.text = [NSString stringWithFormat:@"%g", result];
}

@end
```

Touch 5



Calculator

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Calculator.xcodeproj — CalculatorVi...

Run | Stop | Calculator › iPhone 5.0 Simulator (Scheme) | Breakpoints | Running Calculator on iPhone 5.0 Si... | No Issues | View | Organizer

MainStoryboard.storyboard | CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › -operationPressed:

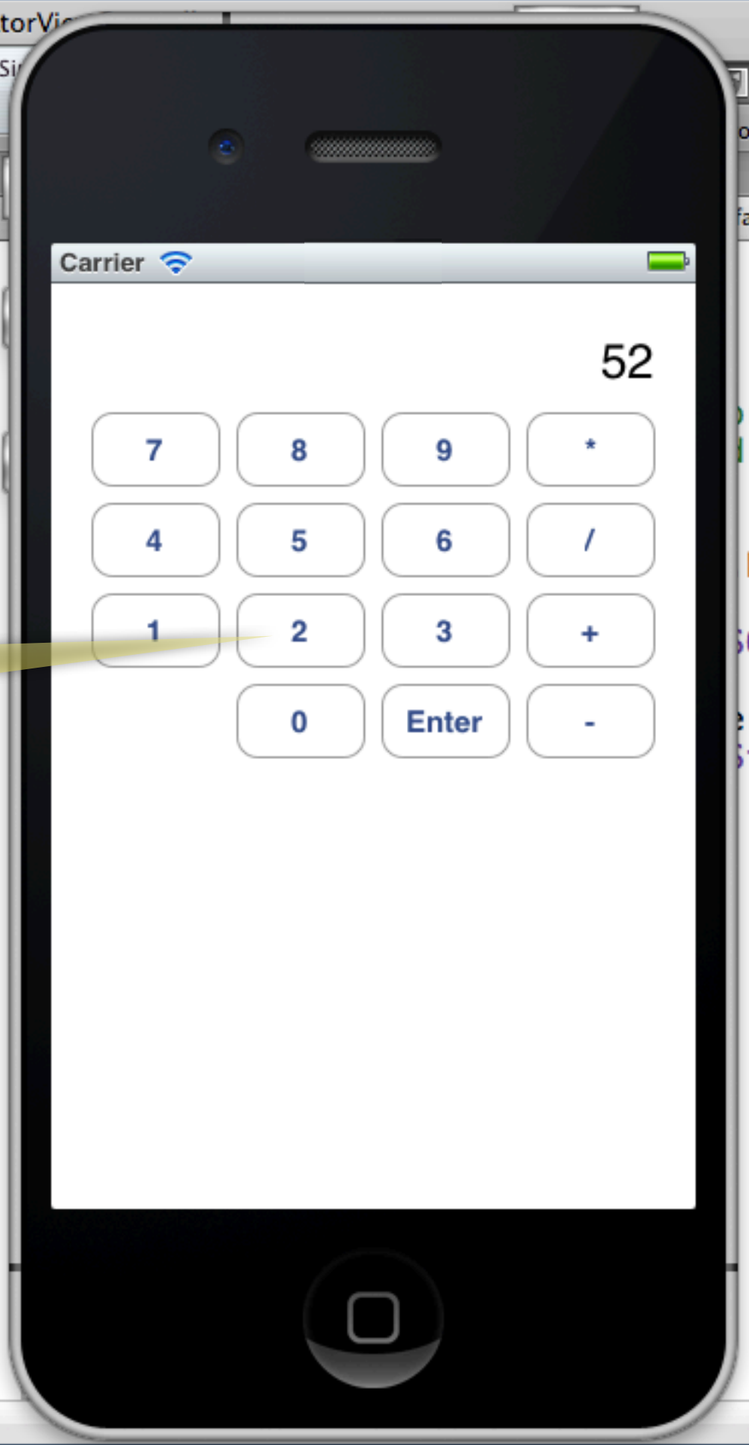
```
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

- (IBAction)enterPressed
{
    [self.brain pushOperand:[self.display.text doubleValue]];
    self.userIsInTheMiddleOfEnteringANumber = NO;
}

- (IBAction)operationPressed:(id)sender
{
    if (self.userIsInTheMiddleOfEnteringANumber) {
        [self enterPressed];
    }
    NSString *operation = [sender currentTitle];
    double result = [self.brain performOperation:operation];
    self.display.text = [NSString stringWithFormat:@"%g", result];
}

@end
```

Touch 2



Calculator

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Fall 2011

Calculator.xcodeproj — CalculatorVi...

Run | Stop | Calculator › iPhone 5.0 Simulator | Scheme | Breakpoints | Running Calculator on iPhone 5.0 Si... | No Issues | or | View | Organizer

MainStoryboard.storyboard | CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › -operationPressed: | face CalculatorBrain | 3

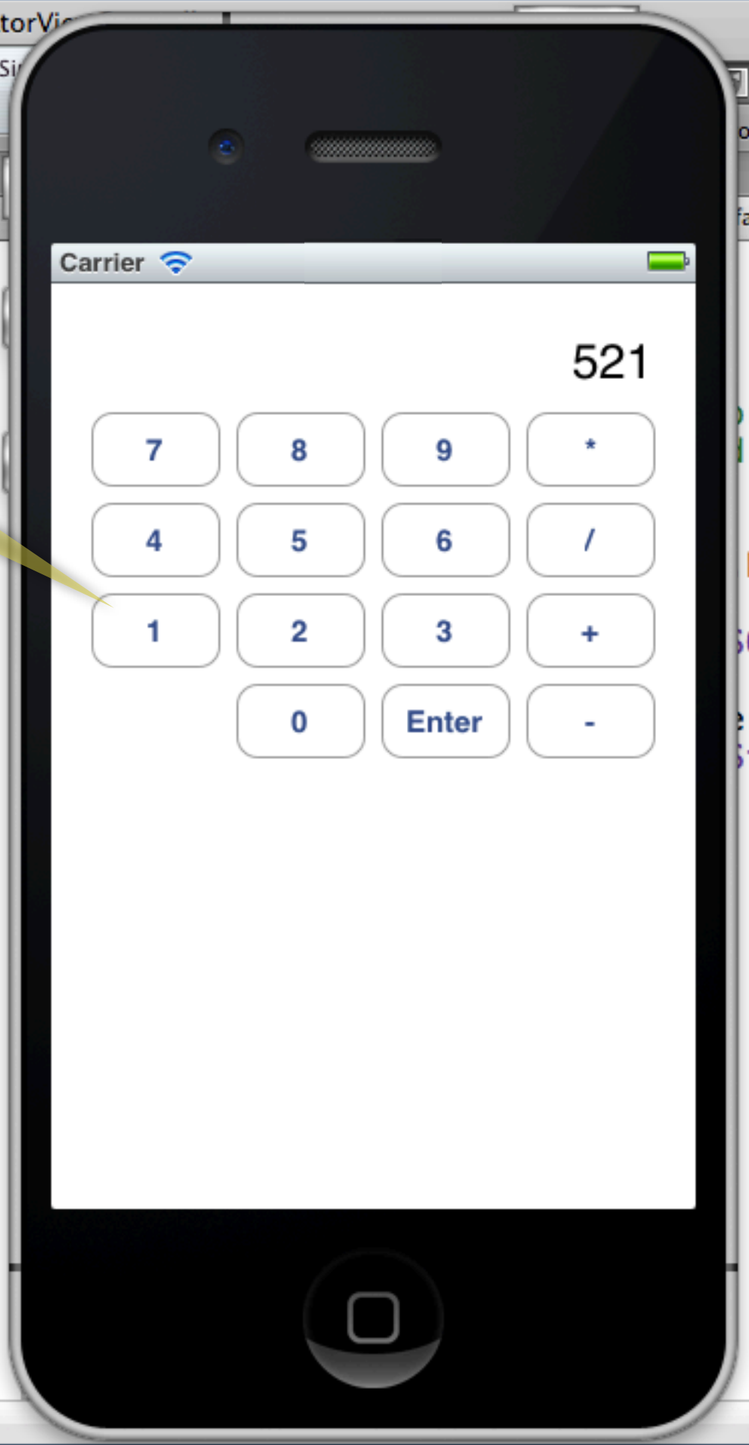
```
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

- (IBAction)enterPressed
{
    [self.brain pushOperand:[self.display.text doubleValue]];
    self.userIsInTheMiddleOfEnteringANumber = NO;
}

- (IBAction)operationPressed:(id)sender
{
    if (self.userIsInTheMiddleOfEnteringANumber) {
        [self enterPressed];
    }
    NSString *operation = [sender currentTitle];
    double result = [self.brain performOperation:operation];
    self.display.text = [NSString stringWithFormat:@"%g", result];
}

@end
```

Touch 1

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Object

rand;
tring *)operation;
```

Calculator

Stanford CS193p
Fall 2011

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Run | Stop | Calculator › iPhone 5.0 Simulator | Scheme | Breakpoints | Running Calculator on iPhone 5.0 Si... | No Issues | or | View | Organizer

MainStoryboard.storyboard | CalculatorViewController.m

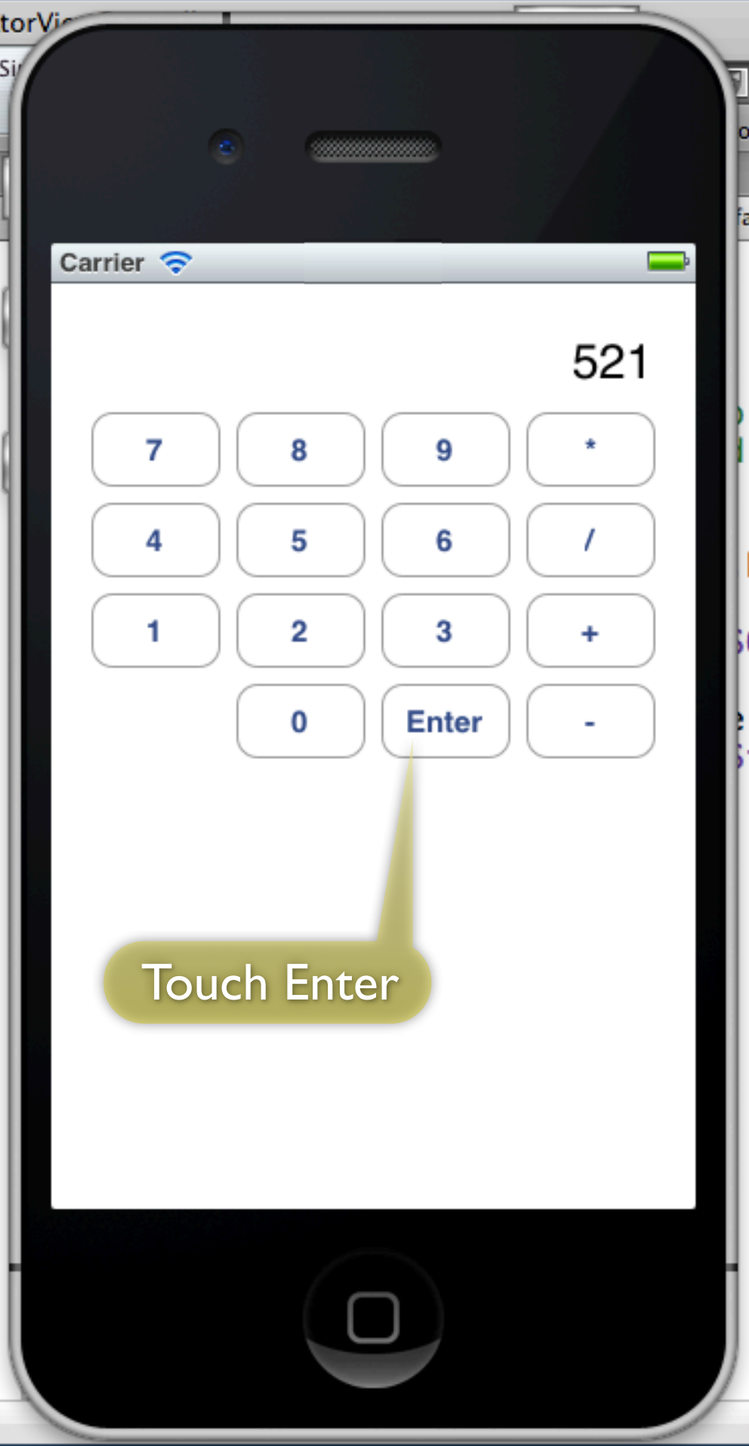
Calculator › Calculator › CalculatorViewController.m › -operationPressed: | face CalculatorBrain | 3

```
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

- (IBAction)enterPressed
{
    [self.brain pushOperand:[self.display.text doubleValue]];
    self.userIsInTheMiddleOfEnteringANumber = NO;
}

- (IBAction)operationPressed:(id)sender
{
    if (self.userIsInTheMiddleOfEnteringANumber) {
        [self enterPressed];
    }
    NSString *operation = [sender currentTitle];
    double result = [self.brain performOperation:operation];
    self.display.text = [NSString stringWithFormat:@"%g", result];
}

@end
```



Calculator

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CalculatorViewController.m
Calculator › Calculator › CalculatorViewController.m › -operationPressed:
face CalculatorBrain
3
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
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stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
if (self.userIsInTheMiddleOfEnteringANumber) {
[self enterPressed];
}
NSString *operation = [sender currentTitle];
double result = [self.brain performOperation:operation];
self.display.text = [NSString stringWithFormat:@"%g", result];
}
@end
Touch 6
Carrier
6
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h>
Object
rand;
tring *)operation;
Calculator
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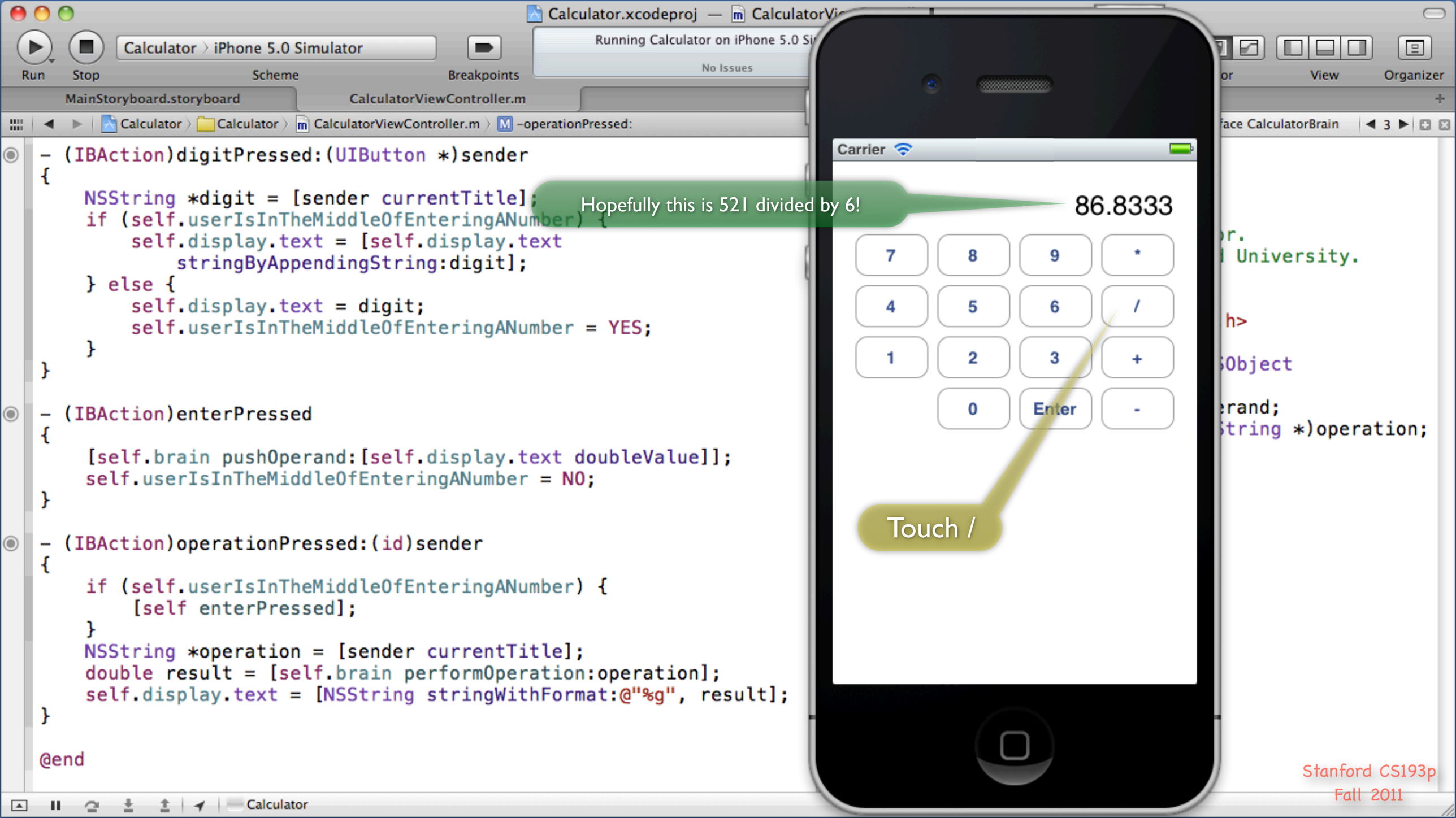
Fall 2011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3
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
if (self.userIsInTheMiddleOfEnteringANumber) {
[self enterPressed];
}
NSString *operation = [sender currentTitle];
double result = [self.brain performOperation:operation];
self.display.text = [NSString stringWithFormat:@"%g", result];
}
@end
r.
University.
h>
Object
rand;
tring *)operation;
Carrier
Hopefully this is 521 divided by 6!
86.8333
7
8
9
*
4
5
6
/
1
2
3
+
0
Enter
-
Touch /
Calculator
Stanford CS193p
Fall 2011

Calculator.xcodeproj — CalculatorVi

Run Stop Calculator › iPhone 5.0 Simulator Scheme Breakpoints

Running Calculator on iPhone 5.0 Si

No Issues

View Organizer

MainStoryboard.storyboard CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › -operationPressed:

face CalculatorBrain 3

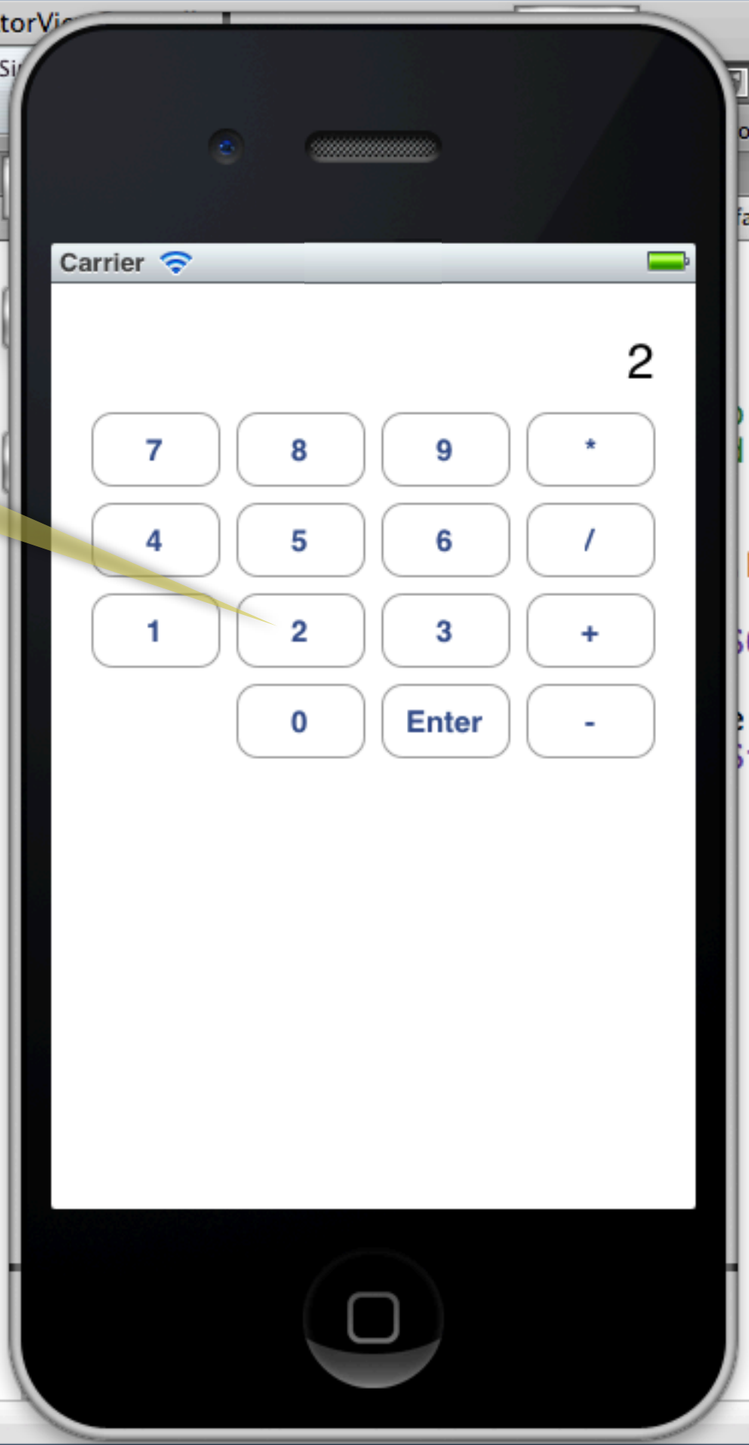
```
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

- (IBAction)enterPressed
{
    [self.brain pushOperand:[self.display.text doubleValue]];
    self.userIsInTheMiddleOfEnteringANumber = NO;
}

- (IBAction)operationPressed:(id)sender
{
    if (self.userIsInTheMiddleOfEnteringANumber) {
        [self enterPressed];
    }
    NSString *operation = [sender currentTitle];
    double result = [self.brain performOperation:operation];
    self.display.text = [NSString stringWithFormat:@"%g", result];
}

@end
```

Touch 2



Calculator

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CalculatorViewController.m
Calculator › Calculator › CalculatorViewController.m › -operationPressed:
face CalculatorBrain
3
- (IBAction)digitPressed:(UIButton *)sender
{
NSString *digit = [sender currentTitle];
if (self.userIsInTheMiddleOfEnteringANumber) {
self.display.text = [self.display.text
stringByAppendingString:digit];
} else {
self.display.text = digit;
self.userIsInTheMiddleOfEnteringANumber = YES;
}
}
- (IBAction)enterPressed
{
[self.brain pushOperand:[self.display.text doubleValue]];
self.userIsInTheMiddleOfEnteringANumber = NO;
}
- (IBAction)operationPressed:(id)sender
{
if (self.userIsInTheMiddleOfEnteringANumber) {
[self enterPressed];
}
NSString *operation = [sender currentTitle];
double result = [self.brain performOperation:operation];
self.display.text = [NSString stringWithFormat:@"%g", result];
}
@end
r.
University.
h>
Object
rand;
tring *)operation;
Carrier
23
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Enter
-
Touch 3
Calculator
Stanford CS193p
Fall 2011

Calculator.xcodeproj — CalculatorVi

Run Stop Calculator › iPhone 5.0 Simulator Scheme Breakpoints Running Calculator on iPhone 5.0 Si No Issues or View Organizer

MainStoryboard.storyboard CalculatorViewController.m

Calculator › Calculator › CalculatorViewController.m › -operationPressed: face CalculatorBrain 3

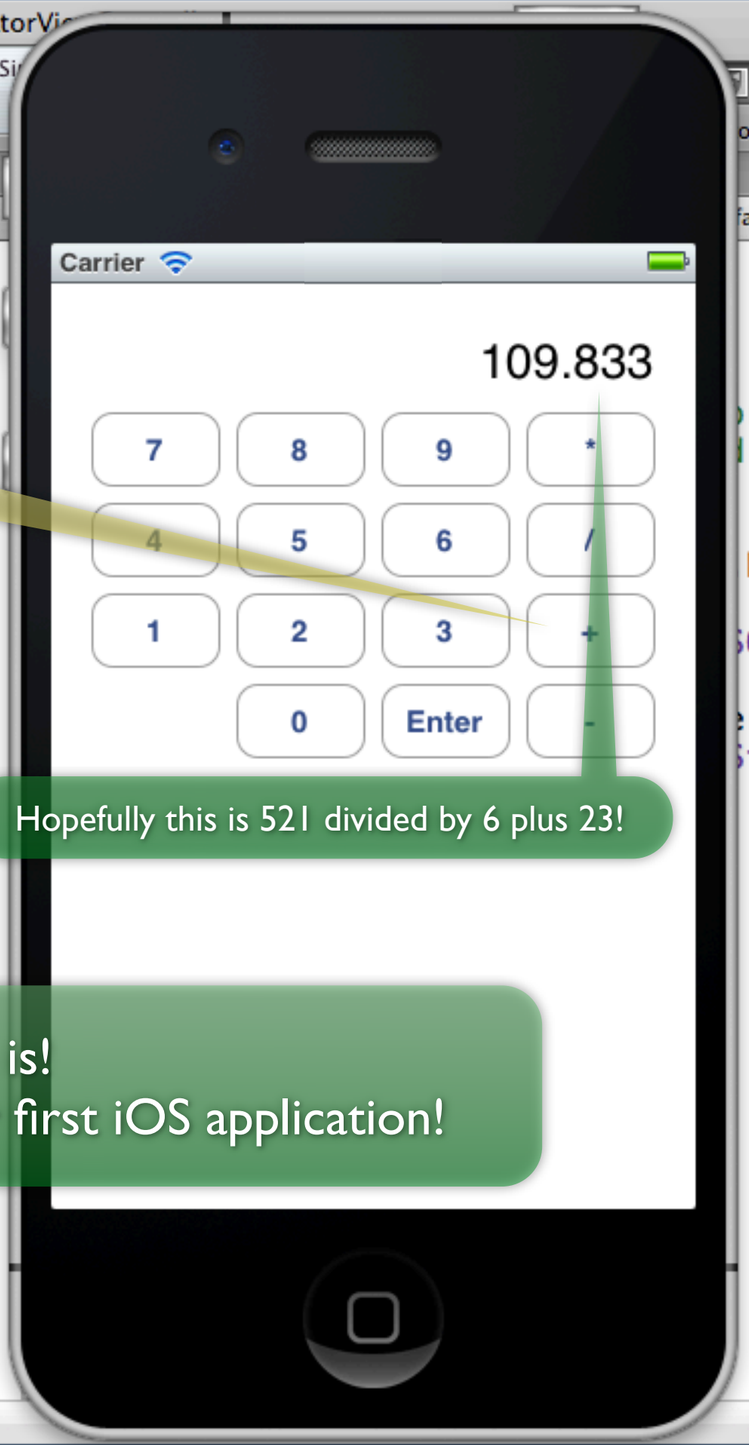
```
- (IBAction)digitPressed:(UIButton *)sender
{
    NSString *digit = [sender currentTitle];
    if (self.userIsInTheMiddleOfEnteringANumber) {
        self.display.text = [self.display.text
            stringByAppendingString:digit];
    } else {
        self.display.text = digit;
        self.userIsInTheMiddleOfEnteringANumber = YES;
    }
}

- (IBAction)enterPressed
{
    [self.brain pushOperand:[self.display.text doubleValue]];
    self.userIsInTheMiddleOfEnteringANumber = NO;
}

- (IBAction)operationPressed:(id)sender
{
    if (self.userIsInTheMiddleOfEnteringANumber) {
        [self enterPressed];
    }
    NSString *operation = [sender currentTitle];
    double result = [self.brain performOperation:operation];
    self.display.text = [NSString stringWithFormat:@"%g", result];
}

@end
```

Touch +



Hopefully this is 521 divided by 6 plus 23!

That's all there is!
Congratulations, you've built your first iOS application!

Calculator

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