CS193P - Lecture 18

iPhone Application Development

Unit Testing
Fun with Objective-C
Localization
Mailbag

Unit Testing

What Are Unit Tests?

- Test specific areas of functionality
- Minimal external dependencies
- Run frequently during development

Who Writes Unit Tests?

- **You do!**
- Ideally written along with new code
- Test-driven development
  - Write tests first
  - Fill in the implementation until tests pass
  - Rinse & repeat

Running Unit Tests

- Automate so you don't have to explicitly run tests
- Many testing frameworks can run tests **every time you build**
- Just as compiler checks **syntax**, unit tests check **semantics**

Why Unit Test?

- **Fewer bugs**
  - More confidence that you're shipping a high quality product
- Find bugs **early**
  - Bugs are easier (and cheaper) to fix early in development
- Avoid **regressions**
  - Ensure that changing one piece of code doesn't break another
- **Document** your code
  - How is a method intended to be used? Check out the tests...
- Encourage **good design**
  - Spaghetti code is hard to test! Design with **testability** in mind

Unit Testing Frameworks

- Family of similar frameworks for testing various languages
  - JUnit, NUnit, PyUnit...
- **OCUnit** for Objective-C
  - Ships with Mac OS X developer tools, integrates with Xcode
  - **Included with iPhone SDK as of 2.2**

Basics of OCUnit

- SenTestCase is abstract test case superclass
- Automatically runs methods that begin with "test"
- Macros for asserting conditions during tests
  - `STAssertNotNil(someObject, @"Some object was nil");`
  - See SenTestCase.h for more
- -setUp and -tearDown methods run before and after each test

Defining A New Test Case Class

```
#import <SenTestingKit/SenTestingKit.h>

@class Foo;

@interface FooTests : SenTestCase {
   Foo *foo;
}
@end
```

Preparing Tests

```
@implementation FooTests

- (void)setUp {
   // Every test will have its own Foo instance
   foo = [[Foo alloc] init];
}

- (void)tearDown {
   [foo release];
}

...

@end
```

Adding Tests

```
@implementation FooTests

...

- (void)testCreateFoo {
    STAssertNotNil(foo, @"Couldn't create Foo");
}

- (void)testSetBar {
    Bar *bar = ...;
    foo.bar = bar;
    STAssertEqualObjects(foo.bar, bar, @"Couldn't set foo.bar");
}

...

@end
```

Testing Error Conditions

```
@implementation FooTests

...

- (void)testOutOfBoundsAccess {
  STAssertNil([foo barAtIndex:99], @"Index 99 should be nil");
}

...

@end
```

Demo:
Unit Testing an iPhone App

When Does Unit Testing Make Sense?

- Always be conscious of the return on investment
  - Benefit of the test versus time to create and maintain?
- Some types of code are notoriously difficult to test
  - Networking
  - Databases
  - Often possible to **test a subset of behavior** and still benefit

Unit Testing Philosophy

- Keep tests short, lightweight, fast
- Test individual methods, not end-to-end behavior
- Find a new bug? Write a new test before you fix it
- Complement (rather than replace) other types of tests
  - http://www.friday.com/bbum/2005/09/24/unit-testing/

Fun with Objective-C

The Objective-C Runtime

- How does OCUnit find all the methods that begin with “test”?
- Any other cool tricks?

/usr/include/objc

- **<objc/objc.h>**
  - id, Nil, nil, BOOL, YES, NO
- **<objc/message.h>**
  - objc_msgSend() and friends
- **<objc/runtime.h>**
  - Inspect and manipulate classes, protocols, methods
  - **Add and replace methods at runtime**

Inspecting Methods

- Copy all methods for a class

```
Method *class_copyMethodList(Class cls,
                             unsigned int *outCount);
```

- Get attributes for a method

```
SEL method_getName(Method m);
IMP method_getImplementation(Method m);
char *method_copyReturnType(Method m);
...
```

Demo:
Inspecting Methods

Playing With Fire

- Adding a method to a class

```
BOOL class_addMethod(Class cls, SEL name, IMP imp,
                     const char *types);
```

- Replacing the implementation for a method

```
IMP method_setImplementation(Method method, IMP imp);
```

- Method swizzling

```
void method_exchangeImplementations(Method m1, Method m2);
```

Method Swizzling

- What if you want to **override a method in a category** while still making use of the original method?
  - Can't call super, a category isn't a subclass
- Define a new method, swizzle it into place

```
Method existingMethod = ...;
Method fancyNewMethod = ...;
method_exchangeImplementations(existingMethod, fancyNewMethod);

- (void)fancyNewMethod
{
  // This looks like it will cause an infinite loop...
  // Once swizzled, it will actually invoke -existingMethod!
  [self fancyNewMethod];

  // Perform additional work here
}
```

Demo:
Method Swizzling

Why is this dangerous?

- Other code may be dependent on the original implementation
  - Perhaps code you didn't even write?
- Can cause unexpected behavior, bizarre bugs, crashes
  - This has caused some popular apps to break on iPhone OS 3.0
- Writing "clever" code is **fun until you have to debug it**
- **Never ship an app that swizzles methods on system classes**

Objective-C 2.0 Runtime Reference

- http://developer.apple.com/DOCUMENTATION/Cocoa/Reference/ObjCRuntimeRef/Reference/reference.html

class-dump

- Inspect the classes and methods of an Objective-C binary
- Fascinating to see how a complex application is architected
  - Especially one that you didn't write!
- As usual, this can be used for evil purposes as well
  - Discover and use private methods in a framework

“Calling unpublished APIs
is like jaywalking...”

“Calling unpublished APIs
is like jaywalking across 280”

The Problem with Using Private APIs

- Framework APIs are kept private for one of a few reasons:
  - They're not done yet (and **will probably change**)
  - They're never going to be public (and **may disappear**)
- Not just because Apple wants to hide cool stuff from you
- If your app depends on a private API that goes away...
  - At best, your app won't work correctly anymore
  - More often, your app will just crash

Localization

Your International Application

- Multiple languages and locales in a **single built application**
- Keep localized resources separate from everything else
  - Strings
  - Images
  - User interfaces (in NIBs)

Where Do Localized Resources Go?

- **MyApp.app/**
  - MyApp
  - **English.lproj/**
    - Localizable.strings
    - MyView.nib
  - **Japanese.lproj/**
    - Localizable.strings
    - MyView.nib

Two Steps

- Internationalization (i18n)
  - Prepare your app to be used in different languages and locales
- Localization (l10n)
  - Add localized data for specific languages and locales

NSString to the Rescue

- Interconverts with dozens of encodings
- Saves you from having to deal with complexities of text
- Remember encoding when reading data from disk or web

```
- (id)initWithData:(NSData *)data
         encoding:(NSStringEncoding)encoding;
```

Localized Strings

- For user-visible strings in your application code
- Map from an unlocalized key to a localized string
- Stored in .strings files
  - Key-value pairs
  - Use UTF-16 for encoding

Strings File Example

- **en.lproj/Greetings.strings**

```
"Hello" = "Hello";
"Welcome to %@" = "Welcome to %@";
"Blah %@ blah %@!" = "Blah %@ blah %@";
```

- **fr.lproj/Greetings.strings**

```
"Hello" = "Bonjour";
"Welcome to %@" = "Bienvenue a %@";
"Blah %@ blah %@" = "Blah %2$@ %1$@ blah";
```

Accessing Localized Strings

```
// By default, uses Localizable.strings
NSLocalizedString(@"Hello", @"Greeting for welcome screen");

// Specify a table, uses Greetings.strings
NSLocalizedStringFromTable(@"Hello", @"Greetings",
                           @"Greeting for welcome screen");
```

genstrings

- Tool to scan your code and produce a .strings file
- Inserts comments found in code as clues to localizer
- Run the tool over your *.m files

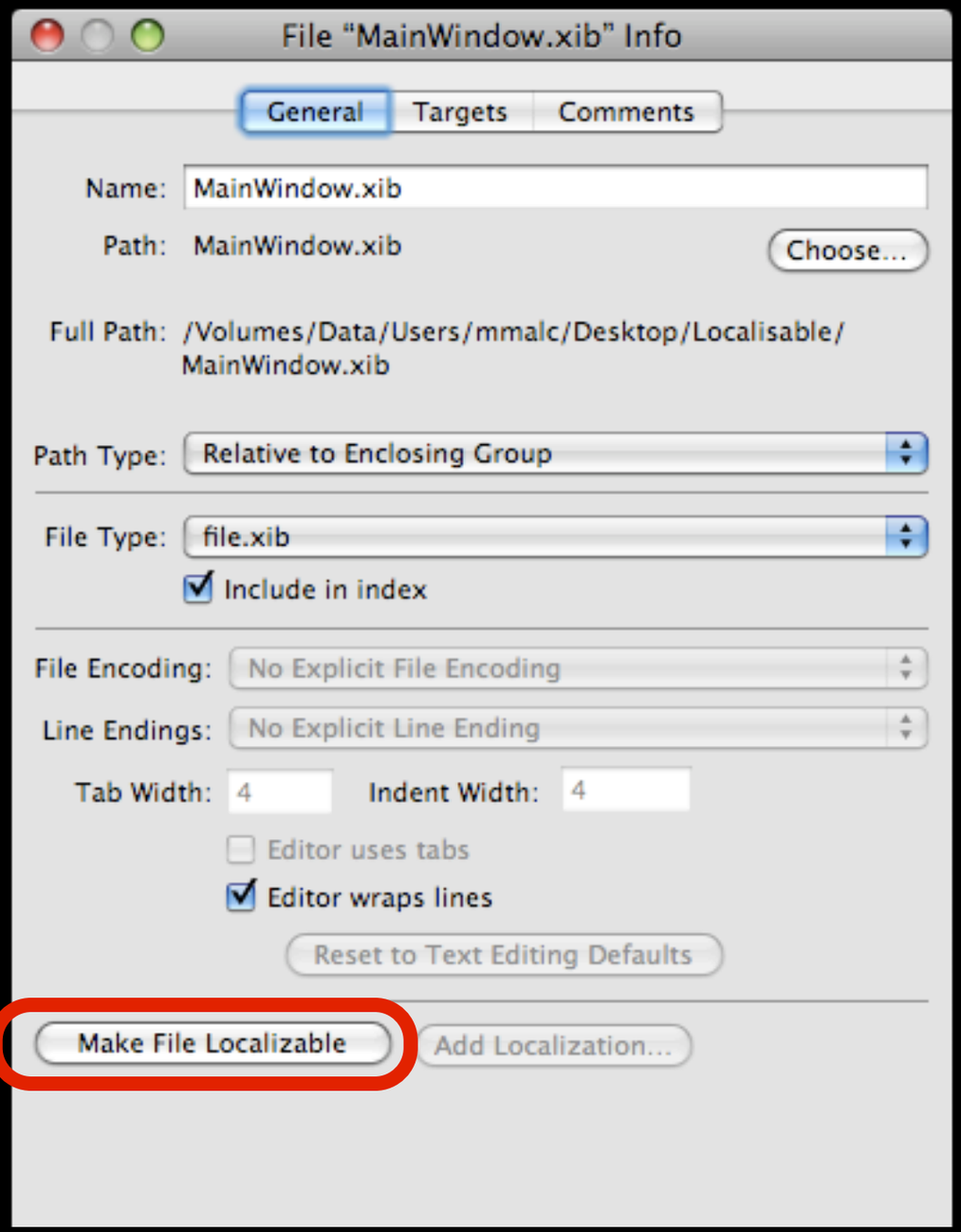
Other Resources

- NSBundle resource methods automatically use the best available localization
- Nib loading does the same

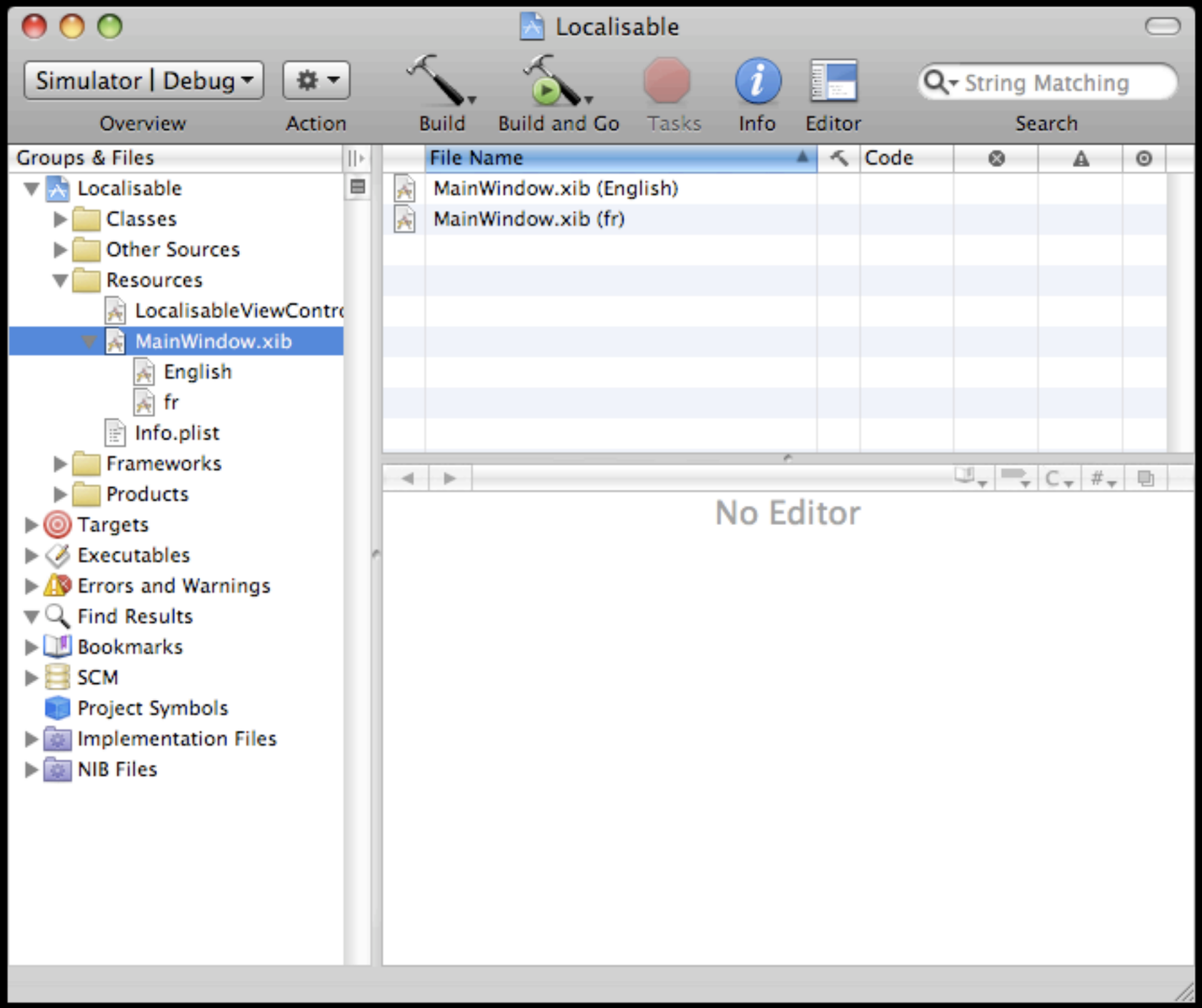
Internationalizing NIBs

- Plan for different string lengths in different languages
  - Good idea to start with German...

Localizing a Resource



Localizing a Resource



NSLocale

- Measurements
- Currency
- Number formatting
- Calendar and date format
- Country information

Opening the Mailbag…


Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Etiam id nulla. Etiam cursus tortor vel urna. Duis
lorem massa, interdum ac, sodales vel, faucibus non, justo. Vestibulum rhoncus, metus at pellentesque
laoreet, metus urna porttitor mauris, nonummy vehicula nulla leo quis diam. Proin nec lacus ac erat porta
posuere. Curabitur congue laoreet neque. Phasellus porta orci eget felis. In convallis, elit nec molestie
faucibus, magna justo tincidunt orci, ac ornare ligula erat vel est. Class aptent taciti sociosqu ad litora
torquent per conubia nostra, per inceptos hymenaeos. Praesent commodo. In hac habitasse platea dictumst.
Pellentesque scelerisque nisi in dui. Etiam tincidunt, lorem et convallis sodales, urna arcu sagittis leo, ut
dui ac quam. Fusce malesuada ultricies metus. Cras arcu. Aliquam tincidunt
tempus, tempor eu, ornare a, velit. Fusce suscipit, ante at
massa id lacus. Ut urna. Class

“How do I launch my app in landscape orientation?”

Launching Your App in Landscape

- Two steps
  - Specify **initial interface orientation** in your Info.plist

Key	Value
▼ Information Property List	(13 items)
Initial interface orientation	Landscape (right home button)
Main nib file base name	MainWindow
Localization native development re	English

  - **Support the specified orientation** in your view controller
    - Override -shouldAutorotateToInterfaceOrientation:
    - Return YES to indicate interface orientations that you support
- Works on iPhone OS 2.1 or later


AT&T
12:03 PM
ON
My Landscape iPhone App
First
Second

Demo:
Launching in Landscape

“How can I customize UIKit views and controls?”

Customizing UIKit Views

- Some classes are designed to be **totally customizable**
  - UIButton
  - UITableView
- Many classes have **limited customizability**
  - UINavigationBar
  - UISlider
- Other classes are **not customizable**
  - UISwitch
  - UITabBar

What's Safe to Customize?

- Look for methods for customizing appearance
  - UIButton: background image
  - UINavigationBar: style, tint, translucency
  - UITableView: delegate methods for appearance
- You can always create your own UIView or UIControl subclass
  - Handle touches
  - Custom drawing

Respecting the View Hierarchy

- Internal view hierarchies are always subject to change
  - Navigation bar
  - Navigation and tab bar controllers
  - Image picker controller
- Making assumptions is unsafe and **will likely break your app**
  - Don’t manipulate undocumented subviews of system views
  - Don’t add your own custom subviews
- You want your application to be **future-ready**

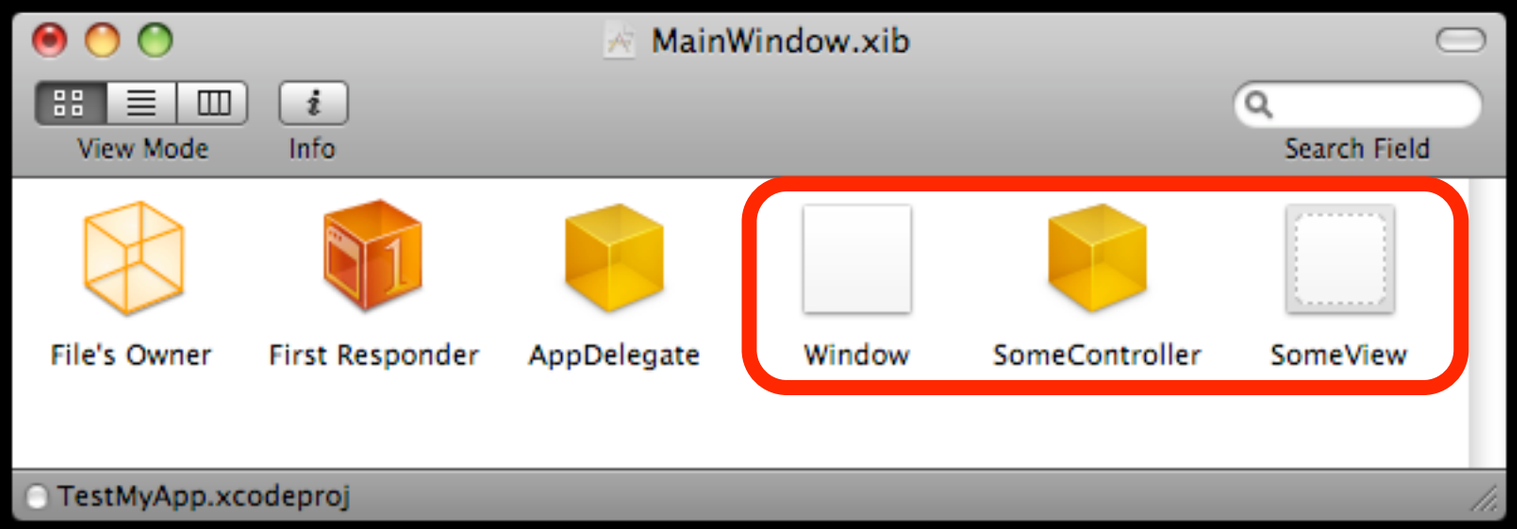
“Should I create my views using Interface Builder or in code?”

When to Use Interface Builder

- Almost always recommended
- Especially useful when creating a view with many subviews
- Not as useful when dealing with just a single view
  - Table views
- Remember: **one view controller subclass, one NIB**
  - Make connections to view controller via File's Owner

Nibs and Memory Management

- Top-level nib objects are autoreleased
  - Retain them if they should stick around after loading



- IBOutlets are **retained by default**
  - Release them in -dealloc even if you don’t have a setter!
  - Implement or synthesize a non-retained setter if desired

“Where can I get cool icons for my toolbar or tab bar items?”

Toolbar and Tab Bar Images

- Images should be about 30 x 30 pixels
- PNG with alpha channel
- Used as a mask by UIKit for drawing with system colors

Some Great Free* Icons

- Glyphish, by Joseph Wain: http://www.glyphish.com
- Creative Commons License
  - *Free to use, share, or remix with attribution

“Can I build Mac apps now that I know iPhone development?”

Building iPhone & Mac OS X Apps

- At this point, you're familiar with
  - Objective-C language
  - Cocoa Touch frameworks
  - Object-oriented design patterns
  - Interface Builder and NIBs
- Developing for the Mac desktop is within your reach!
  - First few lectures of CS193P and CS193E are identical
- Big difference is Cocoa vs. Cocoa Touch
  - Many UIKit and AppKit classes are similar
- Check out http://cs193e.stanford.edu

Wrapping up the Quarter

- Course evaluations
  - We want your feedback!
  - http://registrar.stanford.edu/students/courses/evals.htm
- **Submit final projects by Sunday at midnight**
  - Don't forget to include your slides!
- Final project demos on Monday, 12:15-3:15PM
  - Rehearse your 2-minute presentation
- WWDC next week...
  - Come to "iPhone View Controller Techniques" if you're there!

It’s been a fun quarter...

Thank you!