iOS Debugging + Instruments

FIX ALL THE BUGS!

Overview

- Alternatives to Debugging
    - Print statements
    - Asserts
- Important Xcode Settings
- Debugger Tour
- Instruments: Allocations/Time Profiler
- Debugging Advice
- Practice Debugging
- Essential Tools

What I don’t cover

- This is just an intro.
- I don’t cover LLDB commands.
- The debugger has a whole CL interface that is very powerful.
- 🎗 Instead of learning LLDB commands become a unit test master!

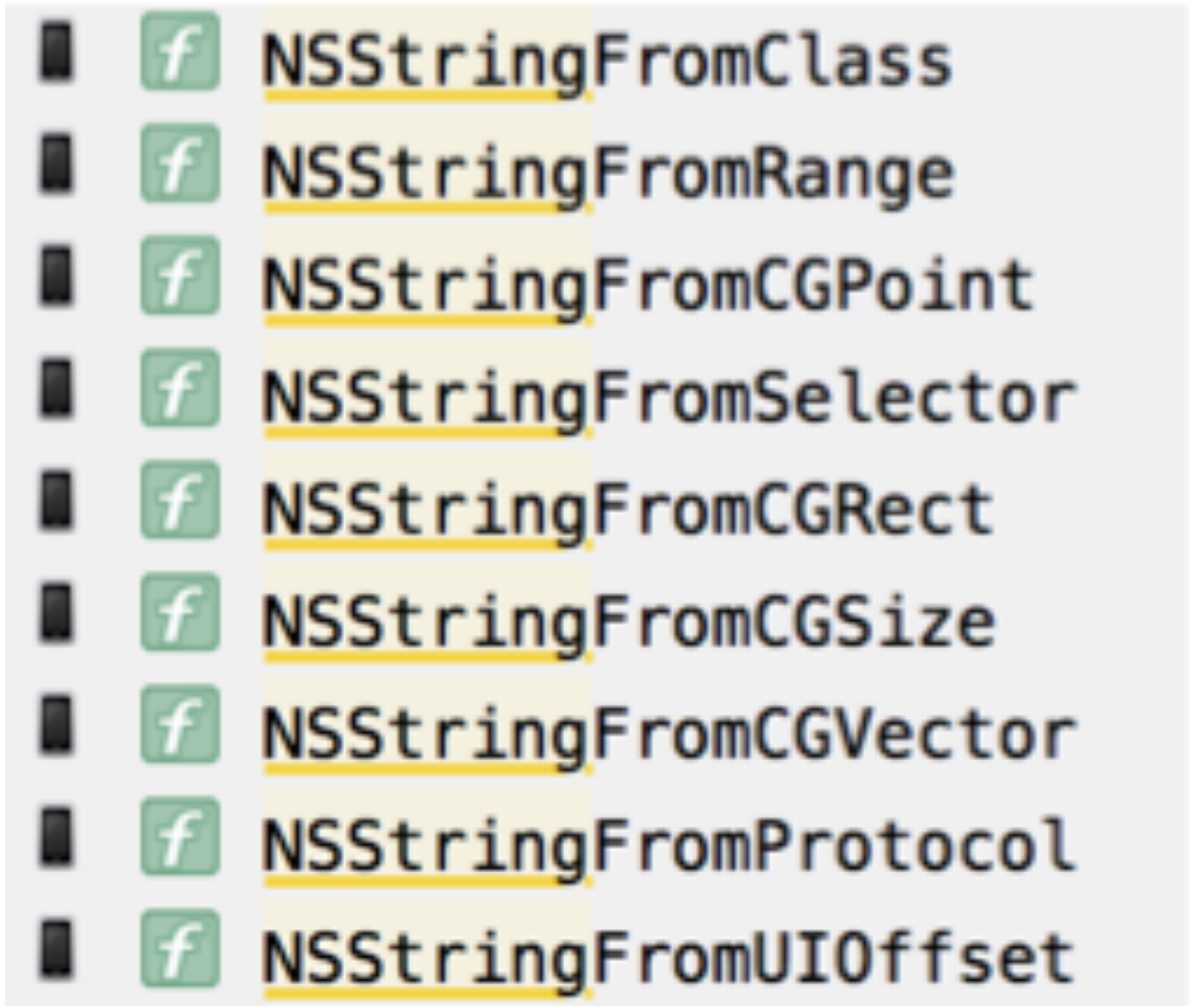
Print Tricks 🧘🏼‍♂️

```
// Objc

NSLog(@"%d: %s", __LINE__, __PRETTY_FUNCTION__);
```

```swift
// Swift

/*
#file
#function
#line
#column
*/

// print is a variadic function

print(#file, #function, #line, #column)
```

Convenience methods in Objc for converting C primitives to NSString

```
CGRect rect = CGRectMake(0, 0, 100, 100);
NSLog(@"%@", NSStringFromCGRect(rect));

NSLog(@"%@", @(10).stringValue);

// Swift treats CGRect as a Swift Struct! 🙃
print(rect)
```



```
NSStringFromClass
NSStringFromRange
NSStringFromCGPoint
NSStringFromSelector
NSStringFromCGRect
NSStringFromCGSize
NSStringFromCGVector
NSStringFromProtocol
NSStringFromUIOffset
```

The Good & 💩 of Print

Good
- Easy, immediate, essential

Bad
- Called “cowboy debugging” for reason
- Can introduce bugs. (You're adding testing to production code. Don't.)
- Need to be removed before shipping.
- DLog/ALog & other alternatives automatically removed from release builds.
- Swift automatically removes Assert from release builds.
- Makes code harder to read.
- "Busy console" problem. (Solution: print the line/function in the console).

```
// Eg.
print("======>>>>>>!!!!!! HEY !!!!!!!<<<<<<=========")
```

NSAssert/Assert

- We’ve seen Asserts in the tests exercise (eg. XCTestAssertNil()), and unit testing lecture.
- Plain Asserts are functions that take 2 parameters.
  - The first parameter is some statement that is being asserted to be *true*.
  - The second, optional parameter, is a message that is logged only if the assertion fails. (This can be a format string).
- Assertions assert something to be true, and if that statement is not true the app crashes and dumps the message to the console.

```
// Objc
NSAssert(self.data, @"data should not be nil");

NSAssert(self.data.count == 20,
@"%@ was expected to be equal to 20",
@(self.data.count).stringValue);

// Swift
let num = 10
assert(num == 10,
"This message will not run because num is 10")
assert(num == 11,
"\(num) is not equal to 11")
```

Question

- Why would you ever want to force your app to crash?

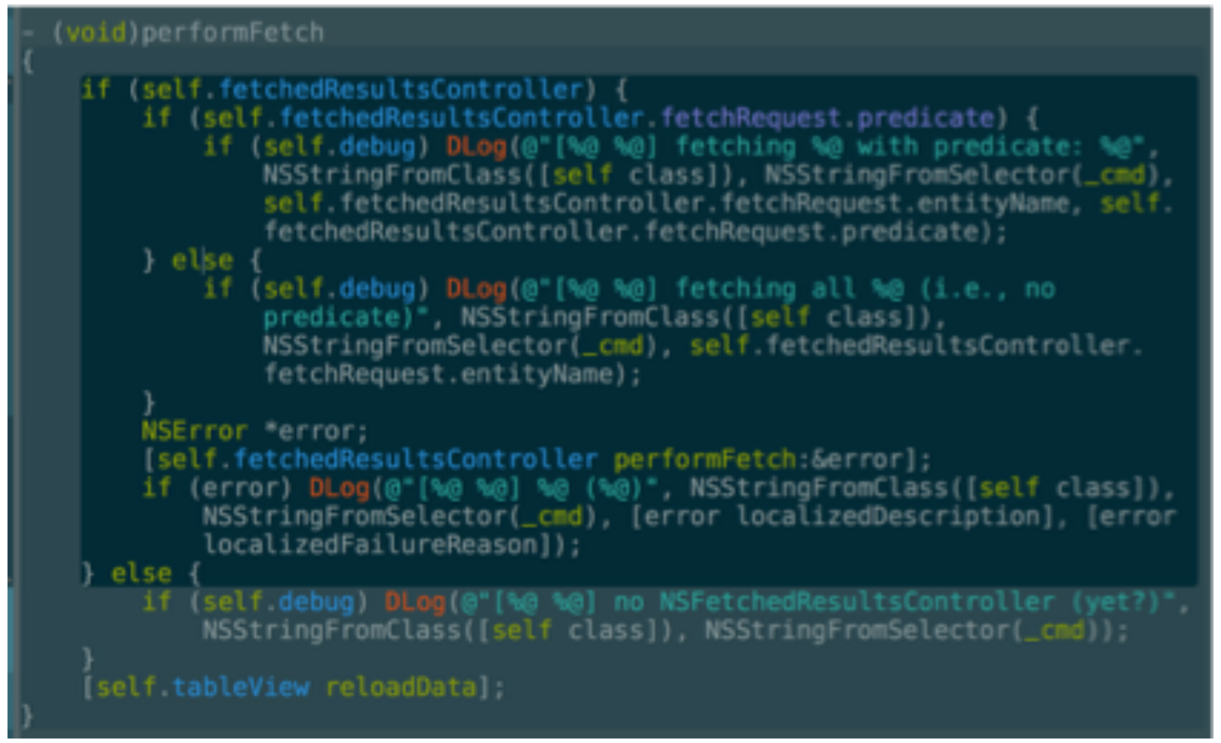
Problem with Asserts

- They should be removed from production code (automatic in Swift).
- But you can use macros that automatically remove them from production code in Objc (eg. ZAssert).
- You’re adding code to your *app* target to do testing. Don't.
- Might as well write unit tests instead! Unit tests are asserts. But they live in a separate target from your production code. Much smarter. **UNIT TESTS == BETTER**.
- But for quick tests in an app that isn’t using unit tests, it’s a reasonable choice.

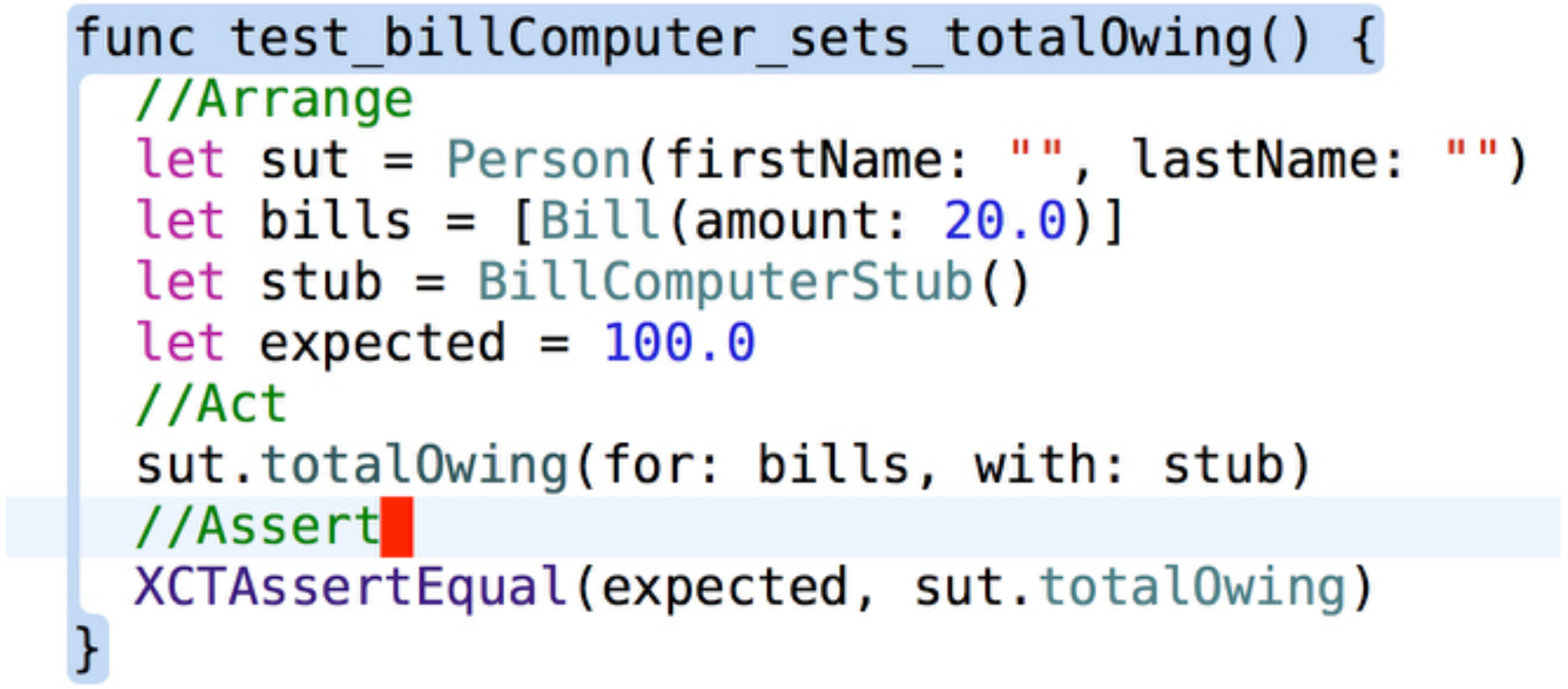
Helpful Xcode Pro Settings

Folding Ribbon

- Ribbon folding was removed from Xcode 9.
- Xcode 9 supports a version of the Ribbon Folding by holding down ⌘ + bring the mouse pointer over the first word in a function or class.
- Great for solving scope issues.
- But it’s likely a "code smell" if you have to use the ribbon to figure out your scopes.
- Repeated conditional statements or switches ARE almost always a code smell.



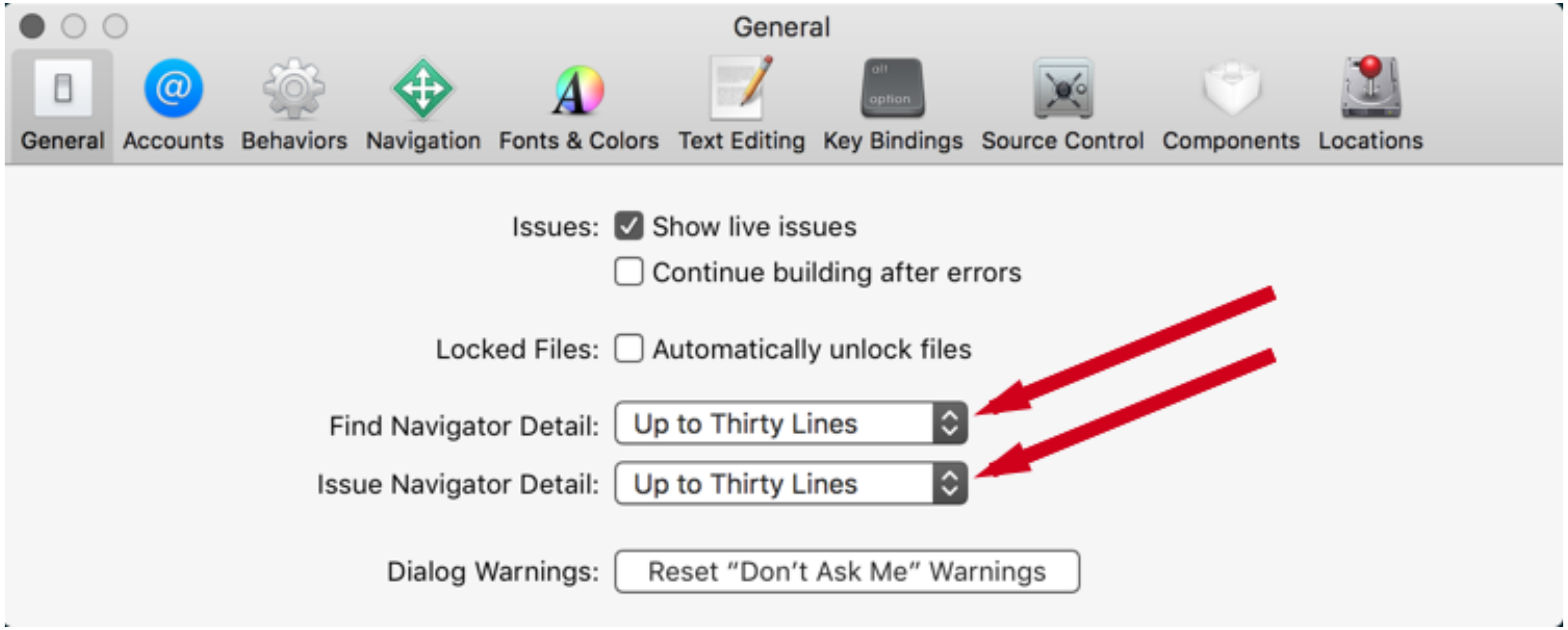
```
- (void)performFetch
{
    if (self.fetchedResultsController) {
        if (self.fetchedResultsController.fetchRequest.predicate) {
            if (self.debug) DLog(@"[%@ %@] fetching %@ with predicate: %@",
                NSStringFromClass([self class]), NSStringFromSelector(_cmd),
                self.fetchedResultsController.fetchRequest.entityName, self.
                fetchedResultsController.fetchRequest.predicate);
        } else {
            if (self.debug) DLog(@"[%@ %@] fetching all %@ (i.e., no
                predicate)", NSStringFromClass([self class]),
                NSStringFromSelector(_cmd), self.fetchedResultsController.
                fetchRequest.entityName);
        }
        NSError *error;
        [self.fetchedResultsController performFetch:&error];
        if (error) DLog(@"[%@ %@] %@ (%@)", NSStringFromClass([self class]),
            NSStringFromSelector(_cmd), [error localizedDescription], [error
            localizedFailureReason]);
    } else {
        if (self.debug) DLog(@"[%@ %@] no NSFetchedResultsController (yet?)",
            NSStringFromClass([self class]), NSStringFromSelector(_cmd));
    }
    [self.tableView reloadData];
}
```



```
func test_billComputer_sets_totalOwing() {
    //Arrange
    let sut = Person(firstName: "", lastName: "")
    let bills = [Bill(amount: 20.0)]
    let stub = BillComputerStub()
    let expected = 100.0
    //Act
    sut.totalOwing(for: bills, with: stub)
    //Assert
    XCTAssertEqual(expected, sut.totalOwing)
}
```

Show Full Error Messages in Sidebar

- Settings > General in Xcode, increase number of lines for errors!



Issues: [✓] Show live issues
[ ] Continue building after errors

Locked Files: [ ] Automatically unlock files

Find Navigator Detail: Up to Thirty Lines

Issue Navigator Detail: Up to Thirty Lines

Dialog Warnings: Reset "Don't Ask Me" Warnings

Debugger Demo

Open BreakPointsTourSwift

Instruments

- Xcode has a massive instruments feature used for debugging and performance tuning.
- We'll just look very briefly at two of the most useful instruments.
    - Allocations: takes a snapshot of all of the objects your app allocates, retains and releases.
    - Time Profiler: gives you data on how long your app is spending running various methods.

Instruments Demo
Open AllocationsTest & TimeProfiler

Debugging Strategies

- Avoid stabbing in the dark. THINK before changing anything.
- My Technique:
  - Describe problem thoroughly.
  - Try to describe the precise conditions that trigger **unexpected** behaviour.
  - If you need more info, gather it. THINK, don’t just start stabbing into the dark (i.e. commenting out lines **superstitiously**).
  - Form a hypothesis.
  - Start with most obvious and easy to test.

More…

- Test your hypothesis.
- If that isn’t it, go to the next most obvious cause.
- Repeat until you find the problem and solve it.
- Document your results in a Solutions Log (Agile Best Practice).
- Always take any compiler errors seriously. Decrypt them first.
- Get in the habit of solving problems yourself before looking them up on SO.

More…

- Consider that a problem might have more than a single cause.
- Avoid complex problems by a practice of continuous testing. Better yet use TDD.
- When building always try to get your code to a testable state, test and then move to building the next element.
- Learn to write unit tests.

Open DebuggingExerciseSwift

Important Tools

Viewing Diff Files

- SourceTree
- P4Merge
- Git Tower
- Fork
- Kaleidoscope

Networking Tools

- Paw
- Postman Chrome Extension
- Charles Proxy

References

- Apple Debugging
- Apple Debugging With Xcode
- Instruments User Guide
- LLVM
- Using Breakpoints