10. a) Write unit tests for UI components.

Unit tests are handy for verifying the behavior of a single function, method, or class. The test package provides the core framework for writing unit tests, and the flutter_test package provides additional utilities for testing widgets.

This recipe demonstrates the core features provided by the test package using the following steps:

Add the test or flutter_test dependency.

Create a test file.

Create a class to test.

Write a test for our class.

Combine multiple tests in a group.

Run the tests.

For more information about the test package, see the test package documentation.

1. Add the test dependency

The test package provides the core functionality for writing tests in Dart. This is the best approach when writing packages consumed by web, server, and Flutter apps.

To add the test package as a dev dependency, run flutter pub add:

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flutter pub add dev:test

2. Create a test file

In this example, create two files: counter.dart and counter_test.dart.

The counter.dart file contains a class that you want to test and resides in the lib folder.

The counter_test.dart file contains the tests themselves and lives inside the test folder.

In general, test files should reside inside a test folder located at the root of your Flutter application or package. Test files should always end with _test.dart, this is the convention used by the test runner when searching for tests.

When you're finished, the folder structure should look like this:

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counter_app/

lib/

counter.dart

```
test/
  counter_test.dart
```

3. Create a class to test

Next, you need a “unit” to test. Remember: “unit” is another name for a function, method, or class. For this example, create a Counter class inside the lib/counter.dart file. It is responsible for incrementing and decrementing a value starting at 0.

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```
class Counter {
 int value = 0;
 void increment() => value++;
 void decrement() => value--;
}
```

Note: For simplicity, this tutorial does not follow the “Test Driven Development” approach. If you’re more comfortable with that style of development, you can always go that route.

4. Write a test for our class

Inside the counter_test.dart file, write the first unit test. Tests are defined using the top-level test function, and you can check if the results are correct by using the top level expect function. Both of these functions come from the test package.

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```
// Import the test package and Counter class
import 'package:counter_app/counter.dart';
import 'package:test/test.dart';
void main() {
 test('Counter value should be incremented', () {
   final counter = Counter();
   counter.increment();
   expect(counter.value, 1);
 });
}
```

5. Combine multiple tests in a group

If you want to run a series of related tests, use the flutter_test package group function to categorize the tests. Once put into a group, you can call flutter test on all tests in that group with one command.

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```
import 'package:counter_app/counter.dart';
import 'package:test/test.dart';
void main() {
 group('Test start, increment, decrement', () {
   test('value should start at 0', () {
     expect(Counter().value, 0);
   });
   test('value should be incremented', () {
     final counter = Counter();
     counter.increment();
     expect(counter.value, 1);
   });
   test('value should be decremented', () {
     final counter = Counter();
     counter.decrement();
     expect(counter.value, -1);
   });
 });
}
```

6. Run the tests

Now that you have a Counter class with tests in place, you can run the tests.

Run tests using IntelliJ or VSCode

The Flutter plugins for IntelliJ and VSCode support running tests. This is often the best option while writing tests because it provides the fastest feedback loop as well as the ability to set breakpoints.

IntelliJ

Open the counter_test.dart file

Go to Run > Run ‘tests in counter_test.dart’. You can also press the appropriate keyboard shortcut for your platform.

VSCode

Open the counter_test.dart file

Go to Run > Start Debugging. You can also press the appropriate keyboard shortcut for your platform.

Run tests in a terminal

To run the all tests from the terminal, run the following command from the root of the project:

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flutter test test/counter_test.dart

To run all tests you put into one group, run the following command from the root of the project:

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flutter test --plain-name "Test start, increment, decrement"

This example uses the group created in section 5.

To learn more about unit tests, you can execute this command:

10.b) Use Flutter's debugging tools to identify and fix issues.

Ans) Flutter provides a set of debugging tools that can help you identify and fix issues in your app. Here's a step-by-step guide on how to use these tools:

1. Flutter DevTools:

Run your app with the flutter run command.

Open DevTools by running the following command in your terminal:

bash

flutter pub global activate devtools

flutter pub global run devtools

Open your app in a Chrome browser and connect it to DevTools by clicking on the "Open DevTools" button in the terminal or by navigating to http://127.0.0.1:9100/.

DevTools provides tabs like Inspector, Timeline, Memory, and more.

2. Flutter Inspector:

Use the Flutter Inspector in your integrated development environment (IDE) like Android Studio or Visual Studio Code.

Toggle the Inspector in Android Studio with the shortcut Alt + Shift + D (Windows/Linux) or Option + Shift + D (Mac).

Inspect the widget tree, modify widget properties, and observe widget relationships.

3. Hot Reload:

Leverage Hot Reload to see the immediate effect of code changes without restarting the entire app.

Press R in the terminal or use the "Hot Reload" button in your IDE.

4. Debugging with Breakpoints:

Set breakpoints in your code to pause execution and inspect variables.

Use the debugger in your IDE to step through code and identify issues.

5. Logging:

Utilize the print function to log messages to the console.

```
print('Debugging message');
```

View logs in the terminal or the "Logs" tab in DevTools.

6. Debug Paint:

Enable debug paint to visualize the layout and rendering of widgets.

Use the debugPaintSizeEnabled and debugPaintBaselinesEnabled flags.

```
void main() {
 debugPaintSizeEnabled = true; // Shows bounding boxes of widgets
 runApp(MyApp());
}
```

7. Memory Profiling:

Use the "Memory" tab in DevTools to analyze memory usage and identify potential memory leaks.

Monitor object allocations and deallocations.

8. Performance Profiling (Timeline):

Analyze app performance using the "Timeline" tab in DevTools.

Identify UI jank, slow frames, and performance bottlenecks.

9. Flutter Driver Tests:

Write automated UI tests using Flutter Driver.

Simulate user interactions and validate the correctness of your UI.