สยามชำนาญกิจ
SIAM CHAMNAN KIT

Effective Android Testing

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Somkiat Puisungnoen

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Somkiat Puisungnoen

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When did you work at Opendream?

... 22 Pending Items

Intro

Software Craftsmanship

Software Practitioner at สยามชำนาญกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

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What's on your mind?

Public | Post

Somkiat Puisungnoen

15 mins · Bangkok ·

Java and Bigdata

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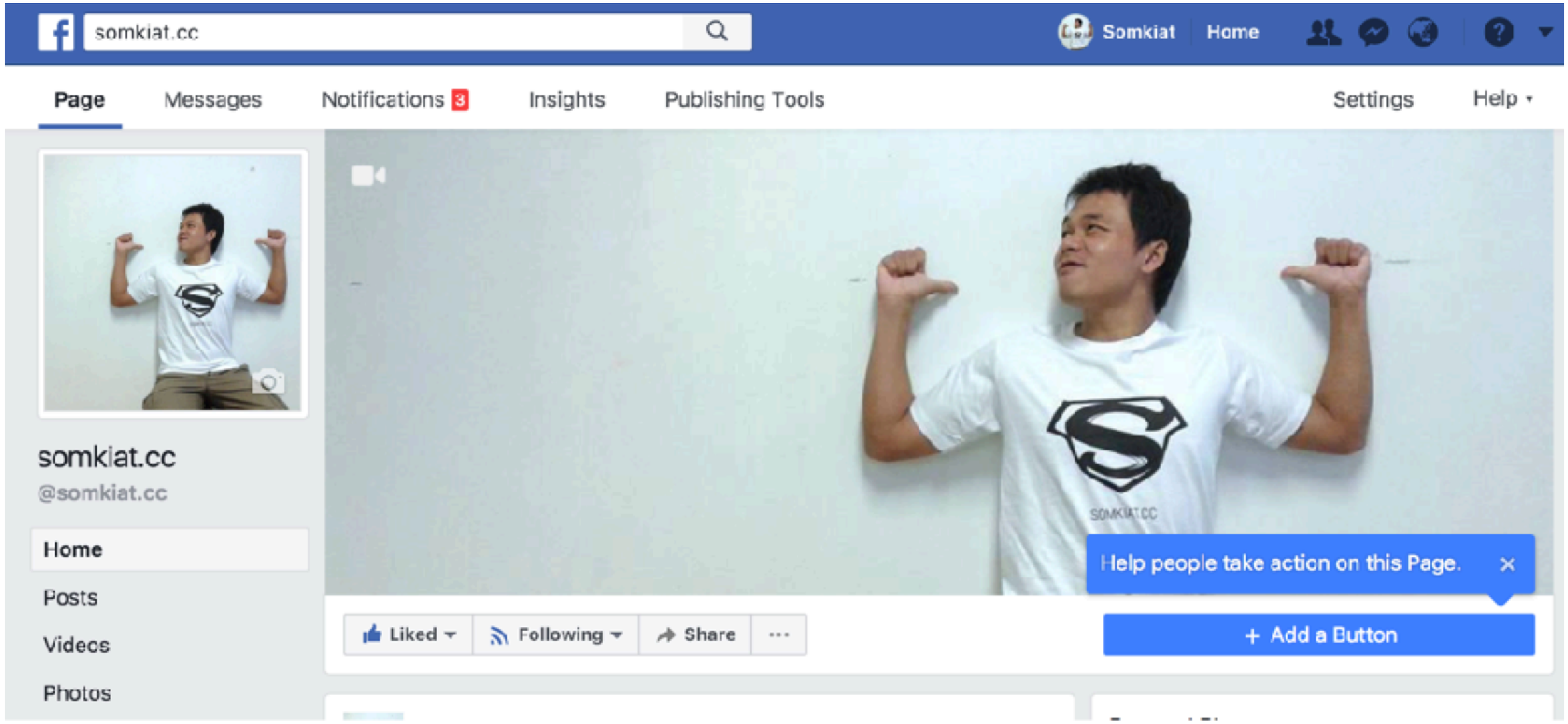

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https://github.com/up1/course-effective-android-testing

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Agenda

- Introduction of testing
- Why we need to test ?
- Types of tests
- Testing pyramid concept
- Android testing
- Workshop (step-by-step)

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Agenda

- UI testing with Espresso and Kakao
- Expresso workshop
- Testable application
- Code coverage

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Testing for Android app

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"Program testing can be used to show the presence of bugs, but never their absence."

Edsger Dykstra, 1970, Notes on Structured Programming

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Why we need to test ?

Help you to **catch bugs**
Develop features **faster**
Enforce **modularity** of your project

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But,
It’s <u>take time</u> to learning and practice !!

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Goals

How to **THINK** when and where you should test ?

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What you need to know ?

Java/Android/Kotlin
Android Studio
JUnit 4
Espresso/Kakao

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All about Testing

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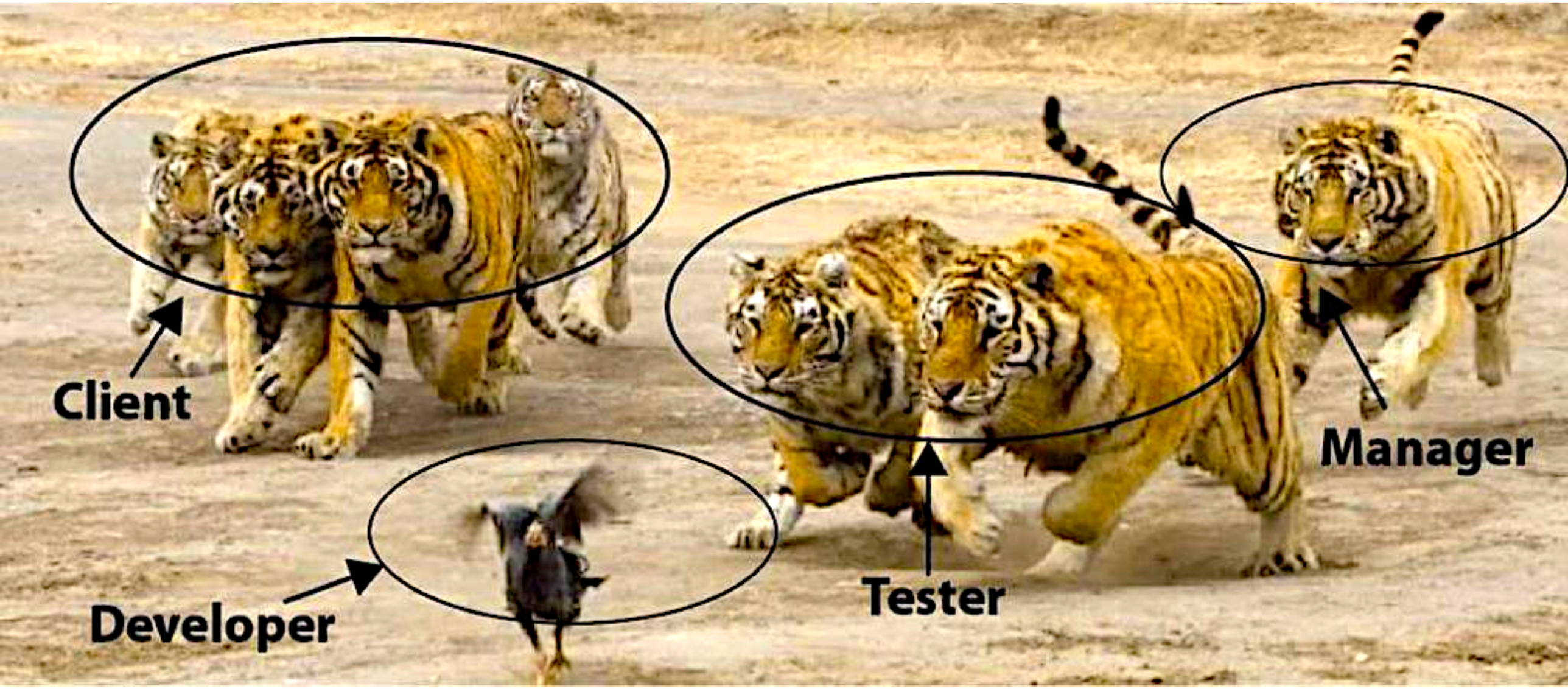

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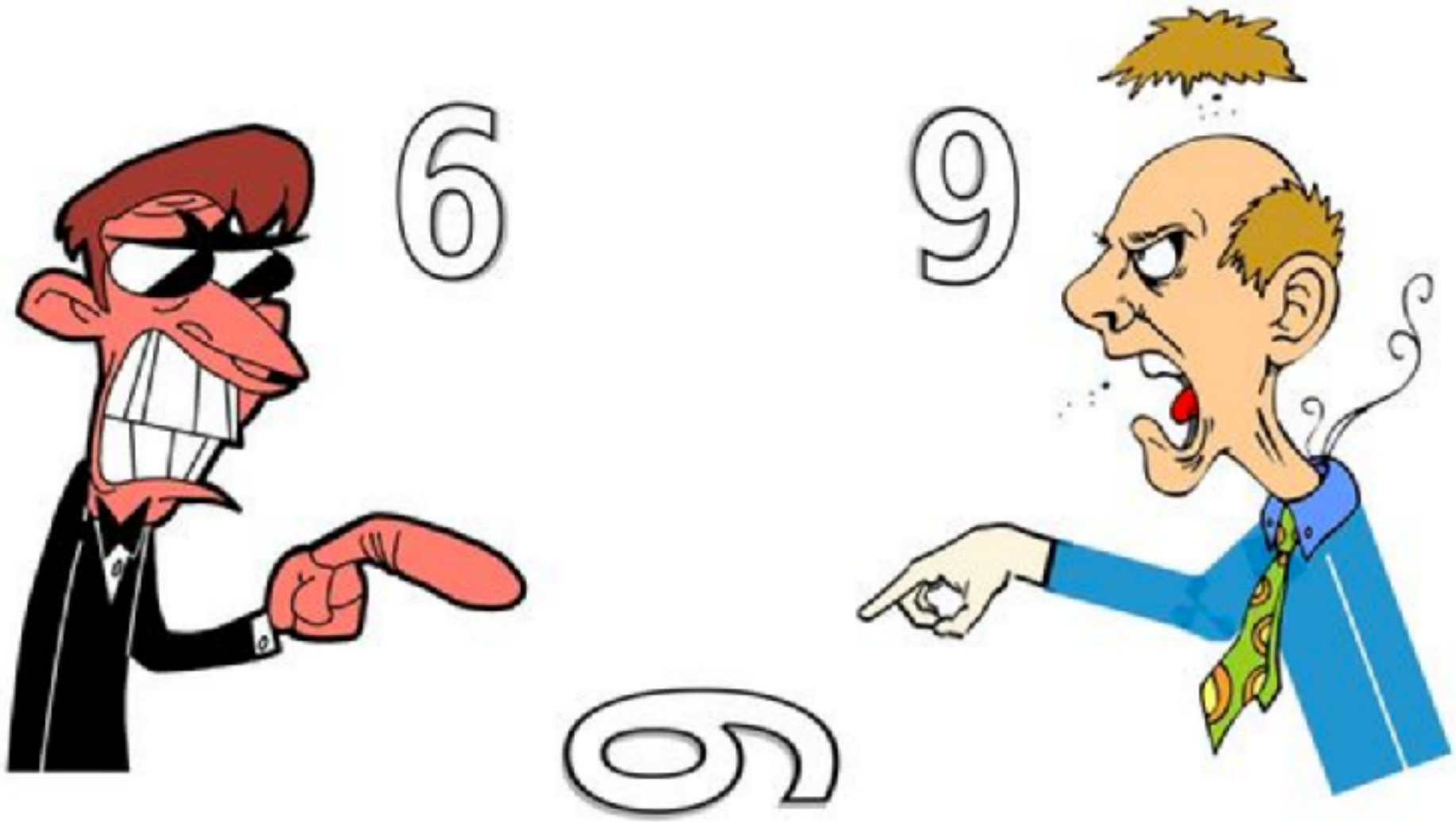
Developer vs Tester



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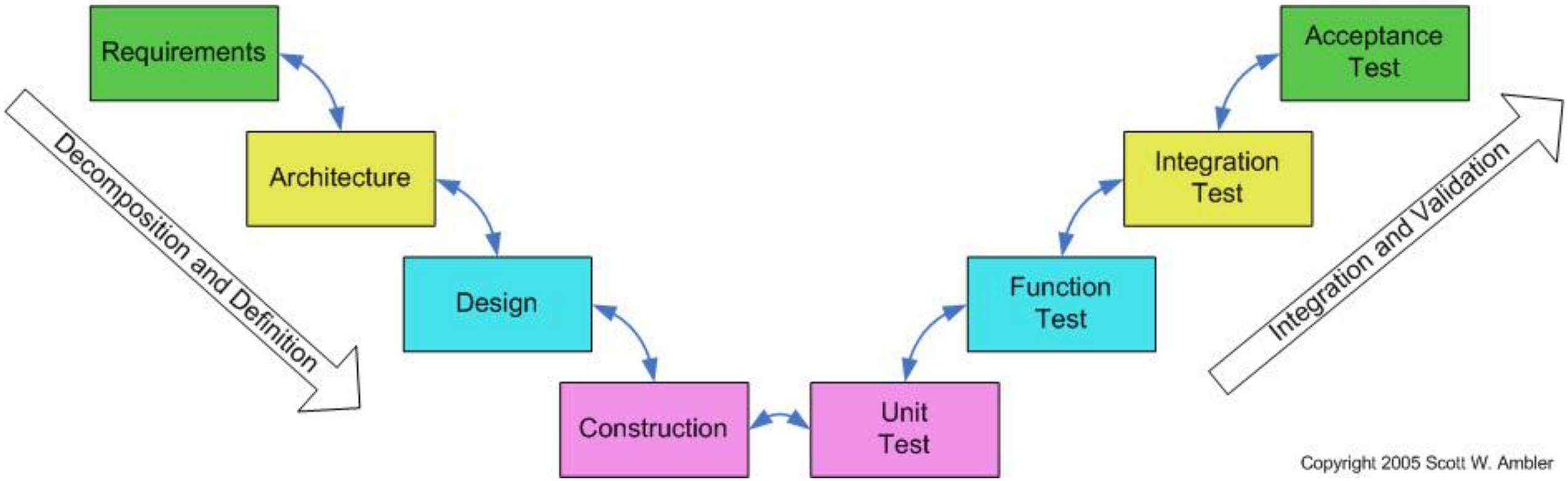

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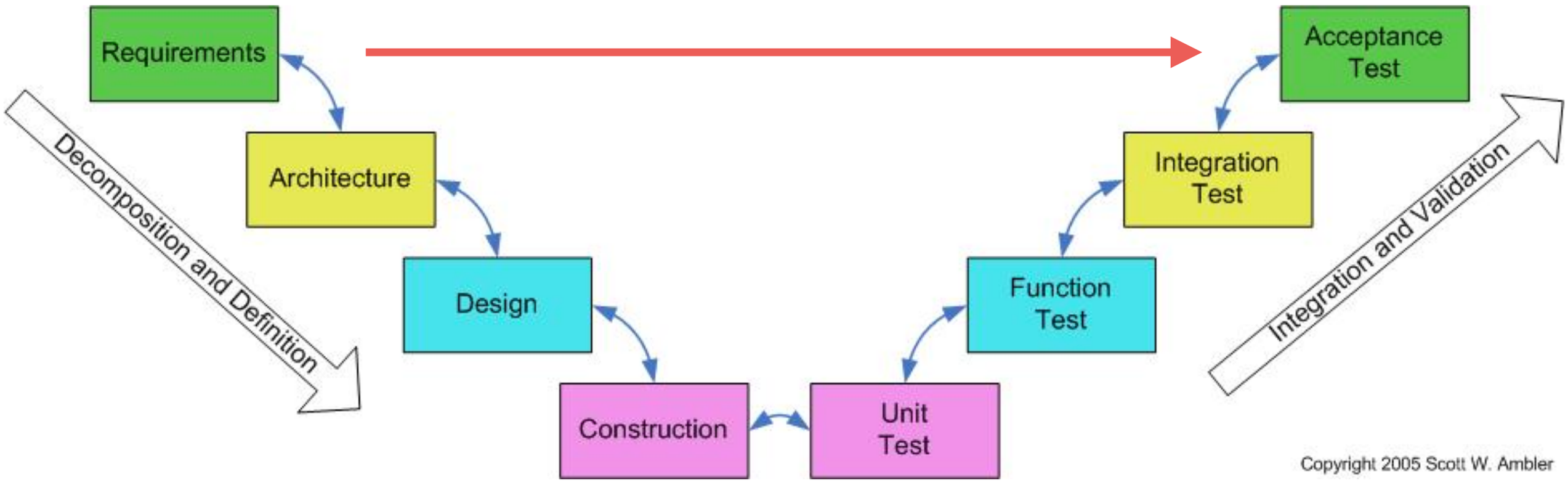

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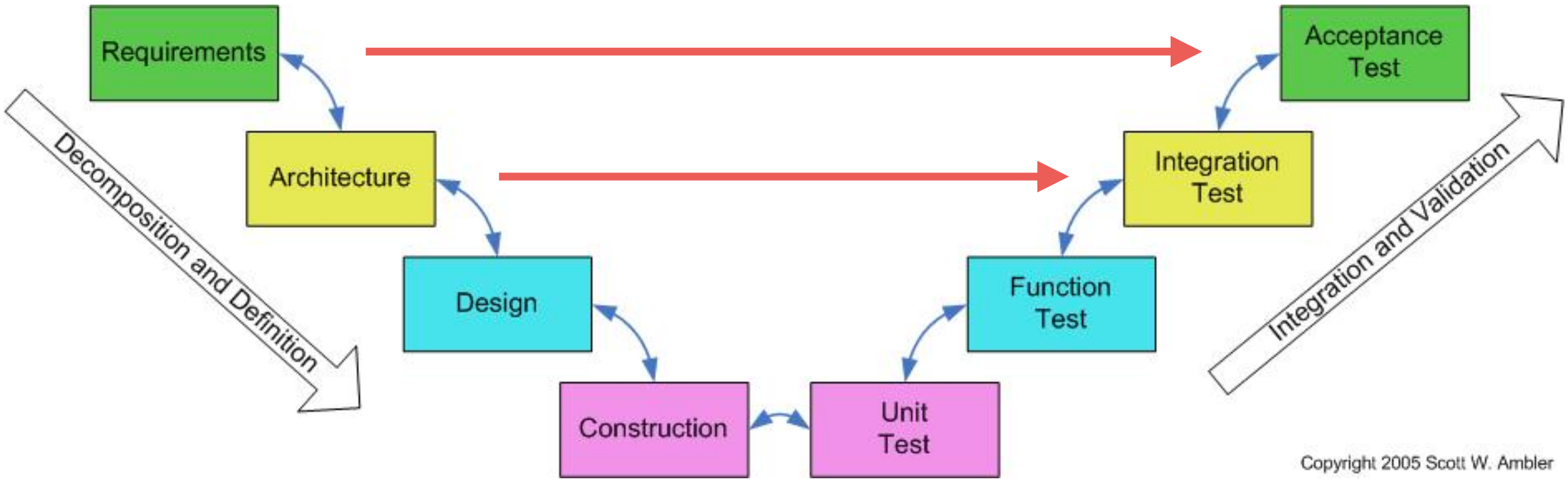

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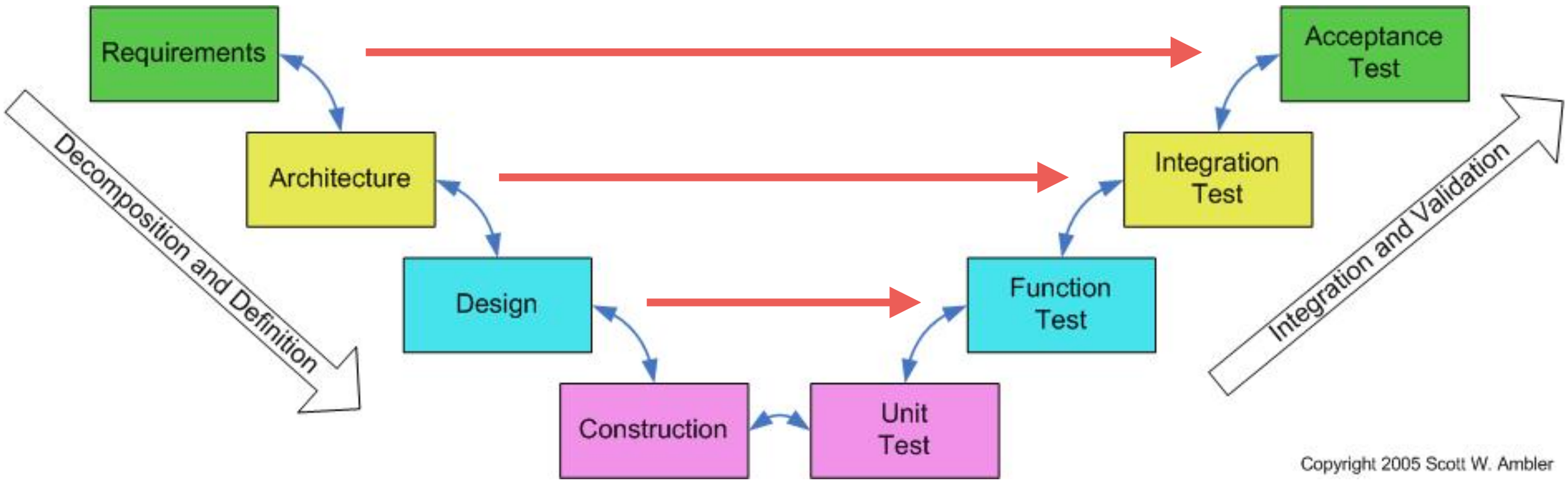

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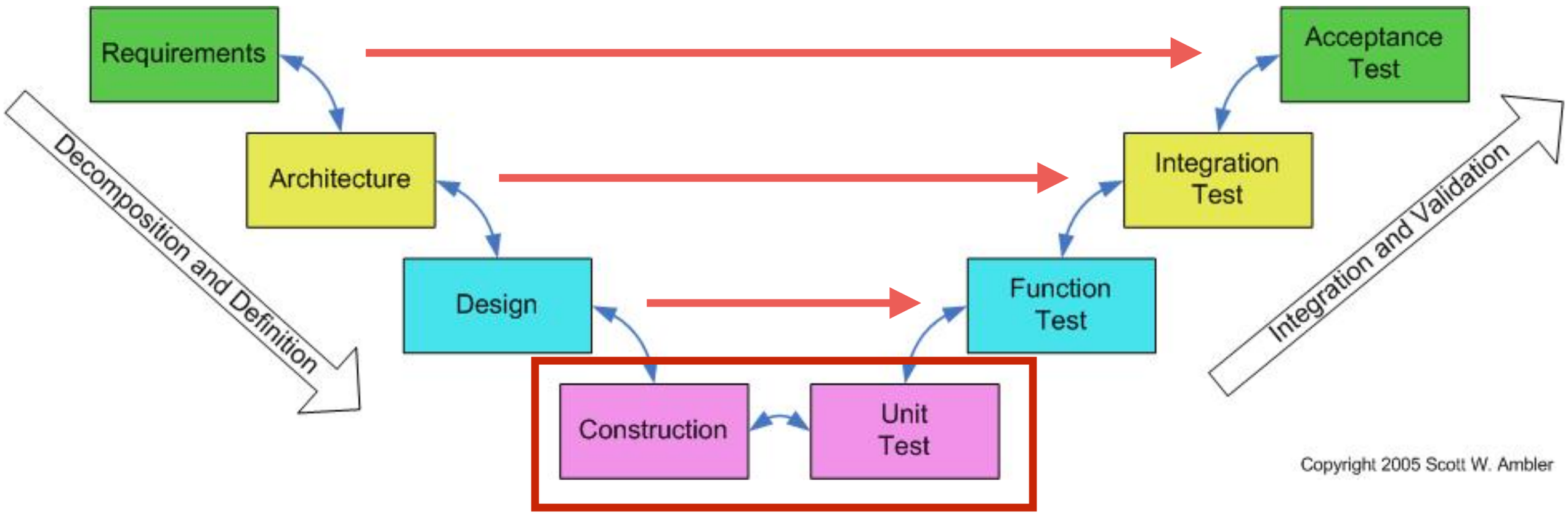

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Type of testing

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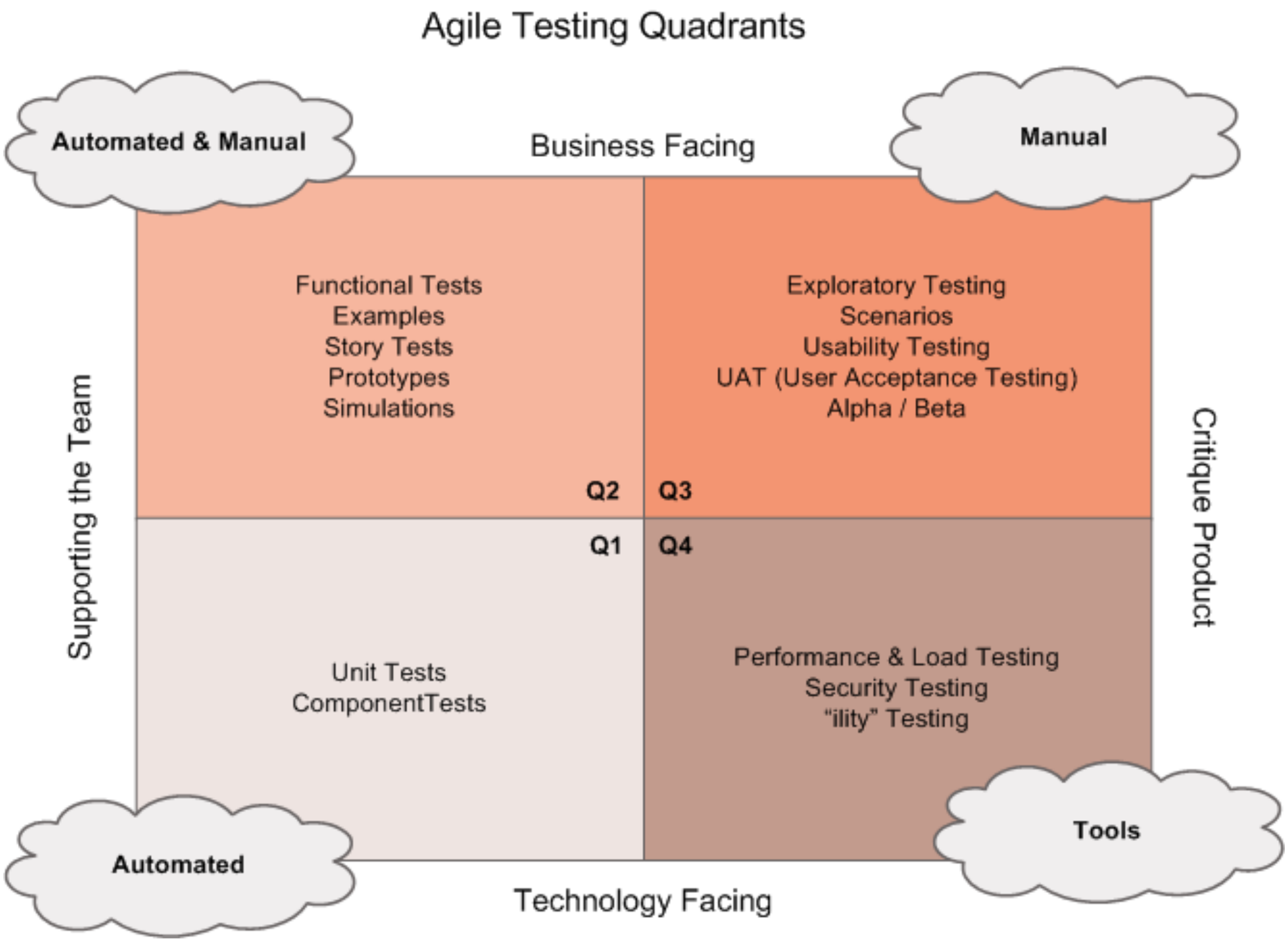

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Testing pyramid

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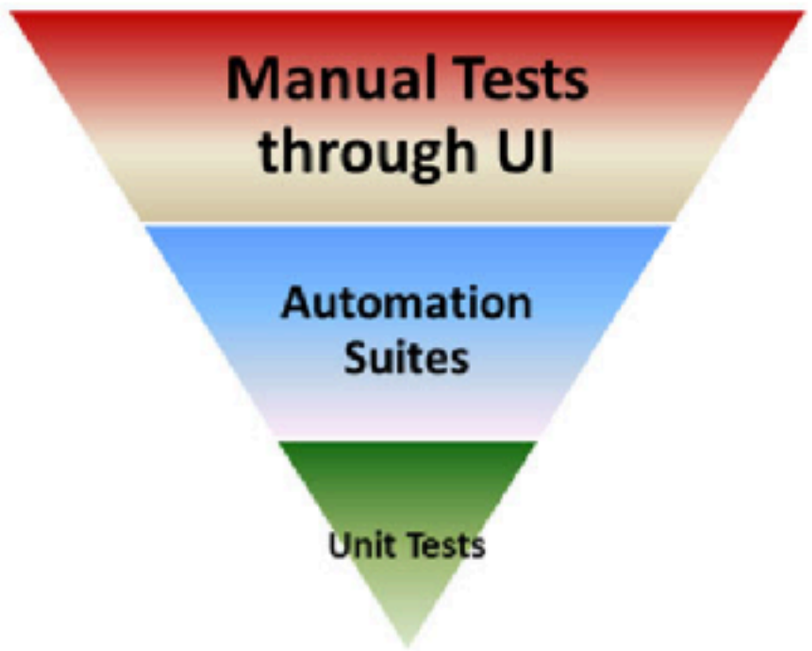
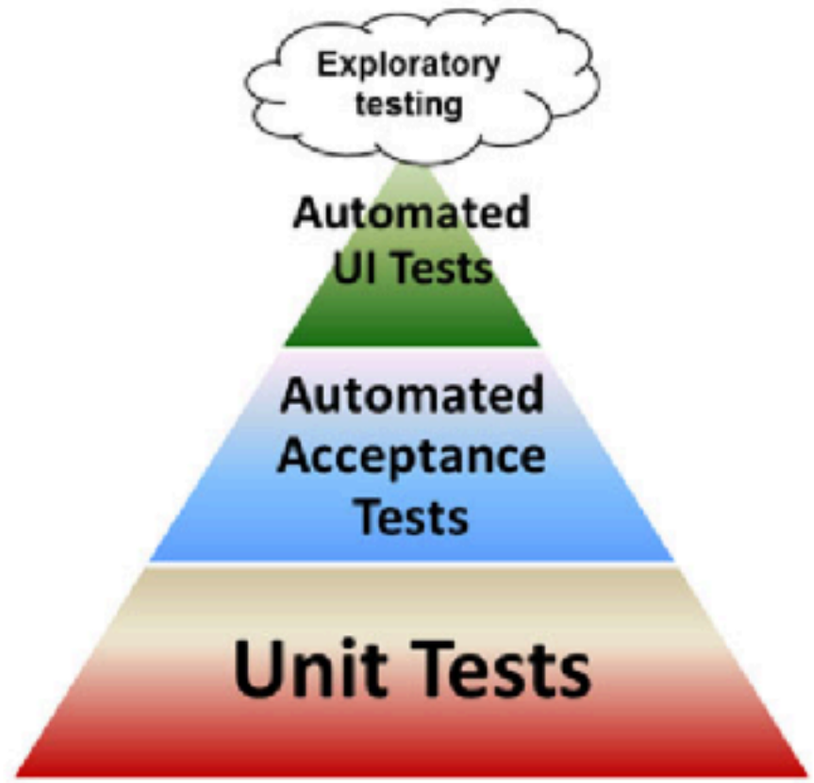
Testing Pyramid



Traditional
(find bugs)



Agile
(prevent bugs)

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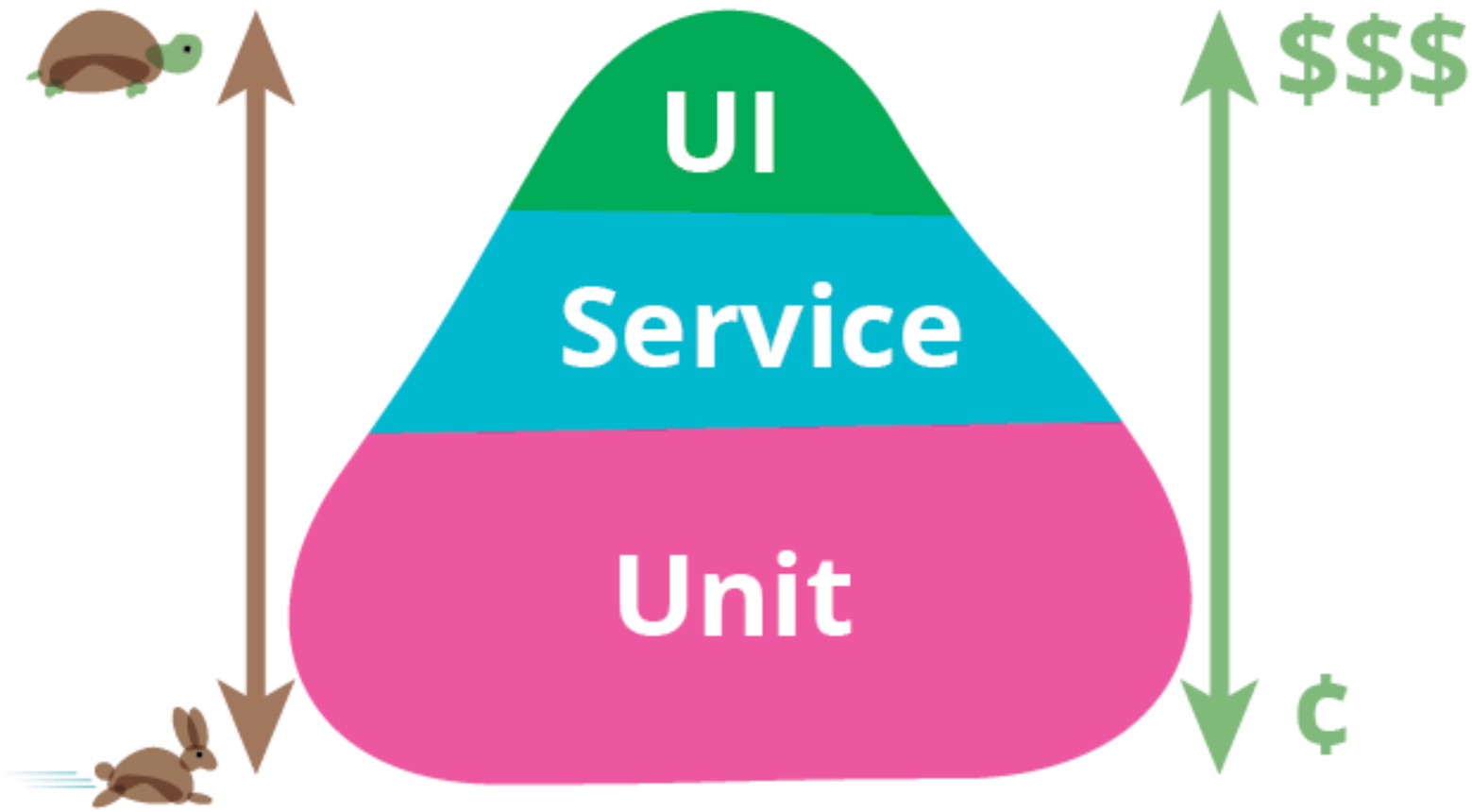
Testing Pyramid



https://martinfowler.com/bliki/TestPyramid.html

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Testing not a phase
Testing is activity

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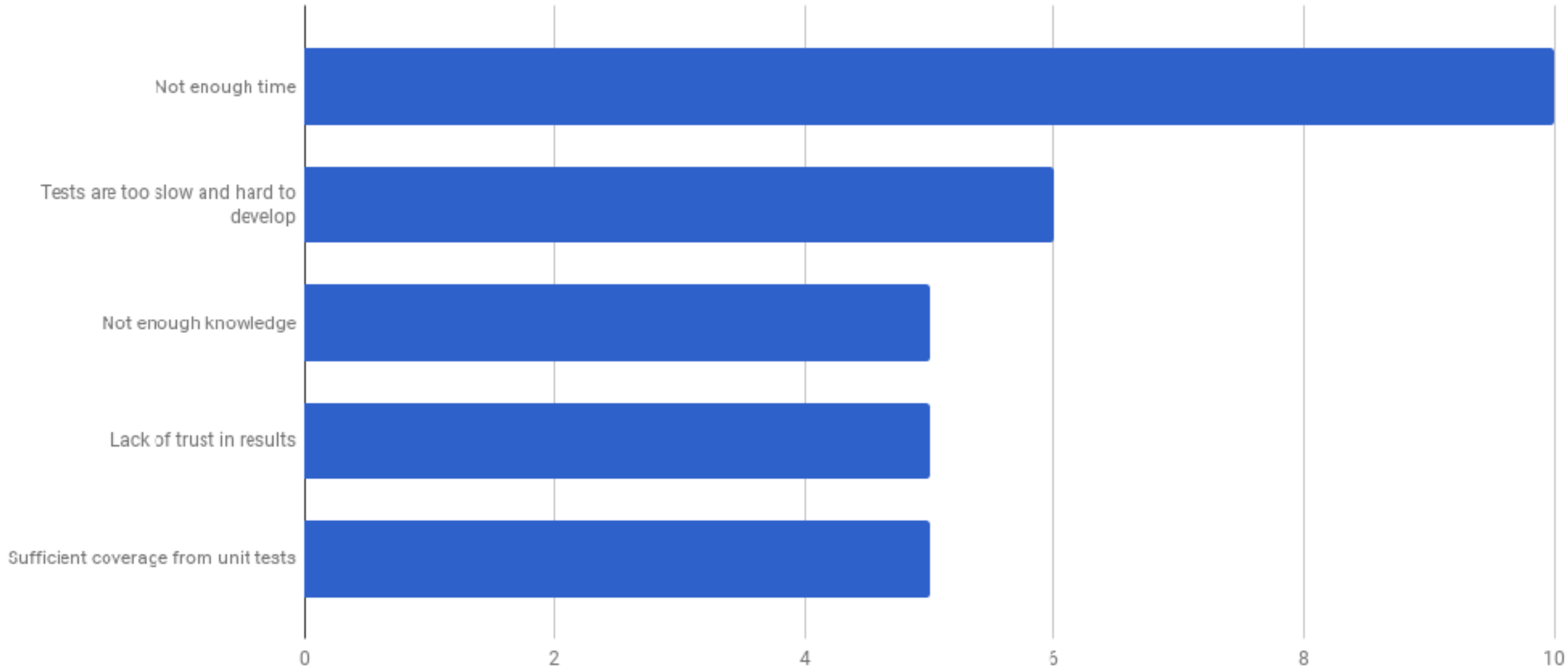
Why not write automated tests ?



https://slack.engineering/android-ui-automation-part-1-building-trust-de3deb1c5995

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Android Testing

Android

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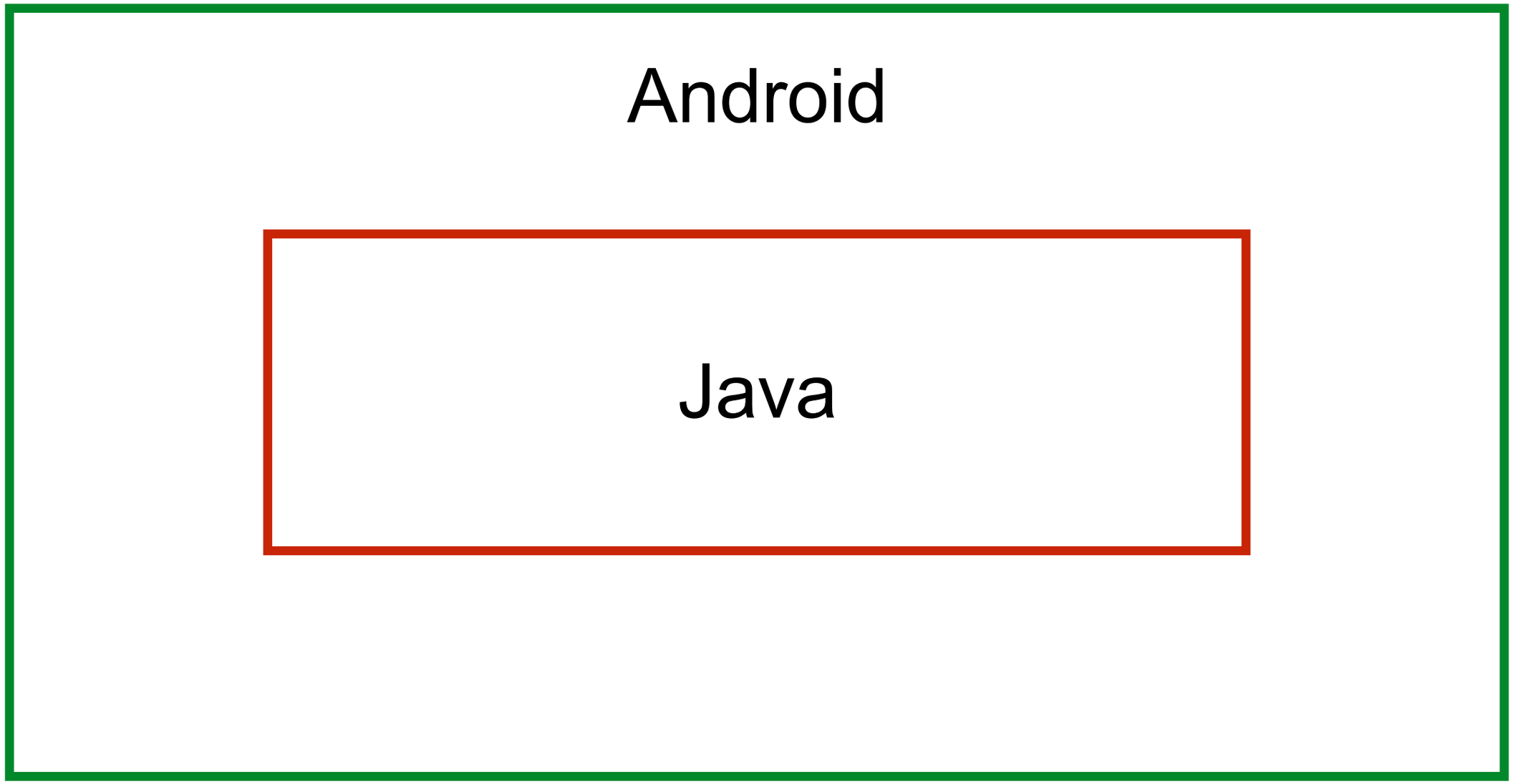
Android Testing



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Java run on JVM

JVM (Java Virtual Machine)

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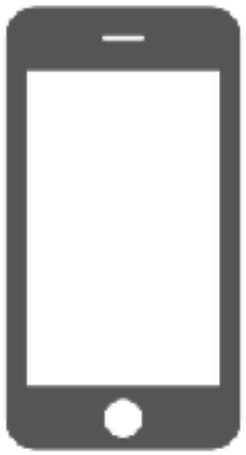
Run android need device



Build app -> Install to device -> Test

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Android Testing

JVM	Device
/src/test	/src/androidTest

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JVM unit test

JVM

Device

JVM unit test

/src/test

Business logic with pure java code

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Instrumentation unit test

JVM	Device
JVM unit test	Instrumentation unit test
/src/test	/src/androidTest

Working with Android specific code, you need run on device such as AssetManager, SharedPreference

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UI vs Non-UI

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Android Testing

	JVM	Device
Non-UI	JVM unit test	Instrumentation unit test
UI		

/src/test /src/androidTest

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Instrumentation UI test

	JVM	Device
Non-UI	JVM unit test	Instrumentation unit test
UI		Instrumentation UI test

/src/test /src/androidTest

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Android Testing

	JVM	Device
Non-UI	JVM unit test	Instrumentation unit test
UI		Instrumentation UI test

UI TESTING FOR ANDROID
espresso

/src/test /src/androidTest

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UI test on JVM ?

	JVM	Device
Non-UI	JVM unit test	Instrumentation unit test
UI	? ? ?	Instrumentation UI test

/src/test /src/androidTest

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Android Testing

	JVM	Device
Non-UI	JVM unit test	Instrumentation unit test
UI	Robolectric	Instrumentation UI test
	/src/test	/src/androidTest

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Resources

https://developer.android.com/studio/test/index.html

https://developer.android.com/topic/libraries/testing-support-library/index.html#Espresso

http://robolectric.org/

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Rule of thumb

Instrumentation tests are slower than JVM tests.

Try to separate the standard Java code from Android-dependent code.

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Workshop with Testing

Hello Android Testing

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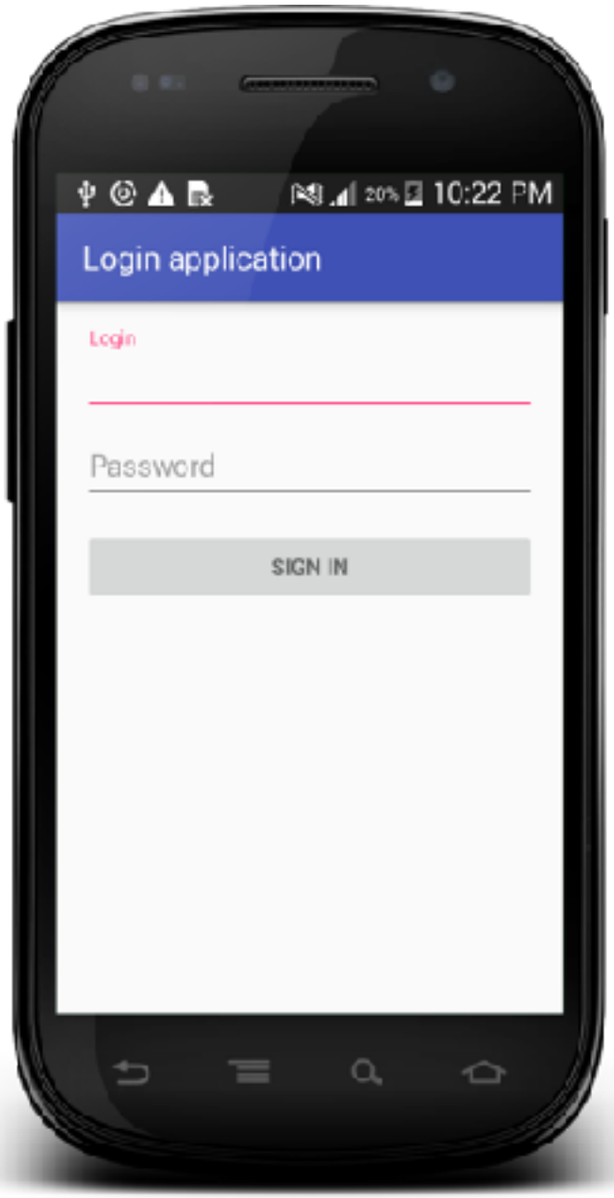
Login application

Login Page



Result

Success

Failure

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Write test case ?

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Test cases

Test Case Name	Email	Password	Expected Result
Login success	somkiat@xxx.com		Show **success** message
Login fail			Show **fail** message

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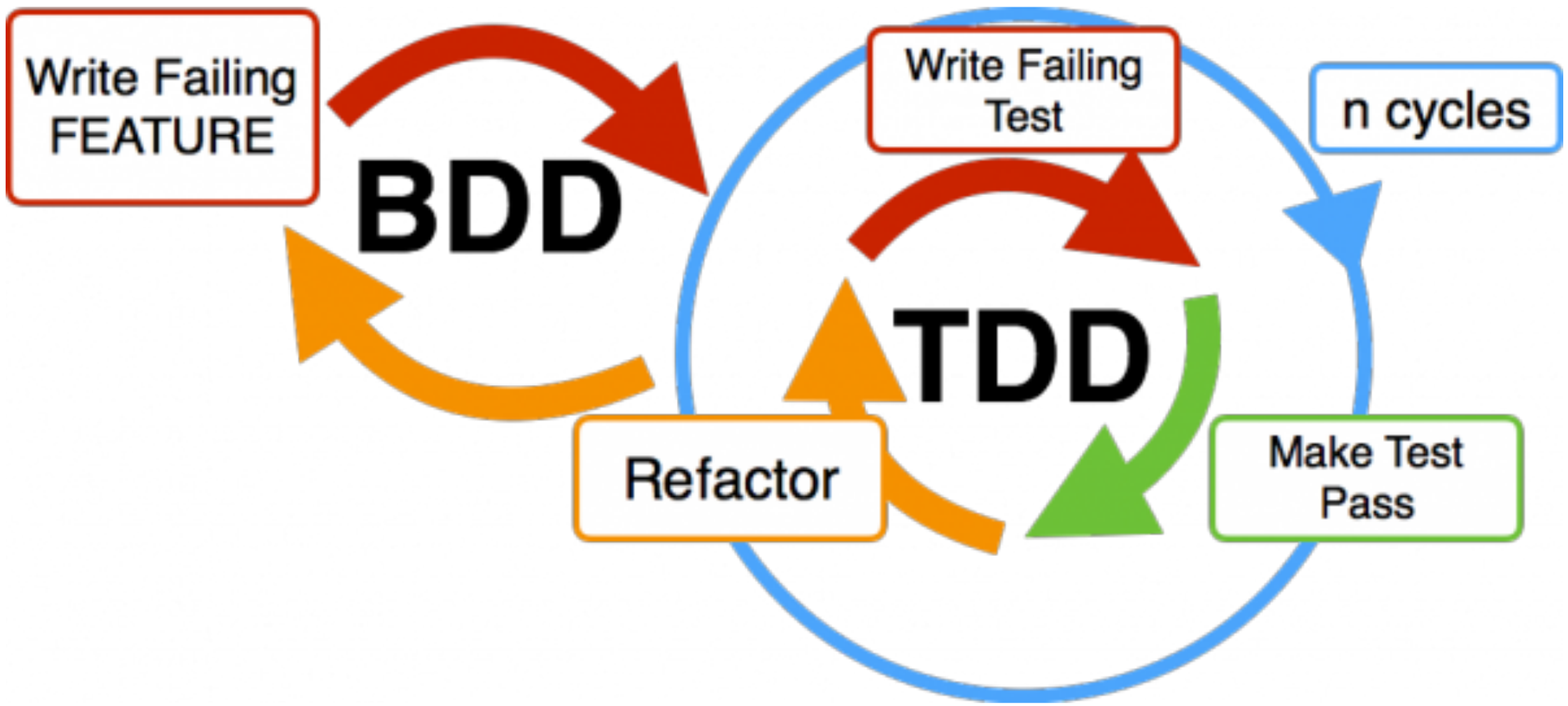
Start to write UI testing

Using espresso



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Let’ start to write UI tests

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What is Espresso ?

A simple API for writing reliable UI tests
Develop by Google team
Compatibility with API 8 (Froyo) or higher
Add to Android Testing Support Library in 2015

https://developer.android.com/training/testing/espresso/

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Why use Espresso ?

Small API and predictable
Easy to learn and understand
Extensible
Fast - UI thread synchronization
No wait, No Sleep
Support JUnit4

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Android Studio support by default

Try to create a new project
Open file /app/build.gradle

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Cheat sheet

CHEAT SHEET espresso 2.1

```
onView(ViewMatcher)
    .perform(ViewAction)
    .check(ViewAssertion);
```

```
onData(ObjectMatcher)
    .DataOptions
    .perform(ViewAction)
    .check(ViewAssertion);
```

View Matchers

USER PROPERTIES

```
withId(...)
withText(...)
withTagKey(...)
withTagValue(...)
hasContentDescription(...)
withContentDescription(...)
withHint(...)
withSpinnerText(...)
hasLinks()
hasEllipsizedText()
hasMultilineTest()
```

HIERARCHY

```
withParent(Matcher)
withChild(Matcher)
hasDescendant(Matcher)
isDescendantOfA(Matcher)
hasSibling(Matcher)
isRoot()
```

INPUT

```
supportsInputMethods(...)
hasIMEAction(...)
```

UI PROPERTIES

```
isDisplayed()
```

CLASS

```
isAssignableFrom(...)
```

Data Options

```
inAdapterView(Matcher)
atPosition(Integer)
onChildView(Matcher)
```

View Actions

CLICK/PRESS

```
click()
doubleClick()
longClick()
pressBack()
pressIMEActionButton()
```

GESTURES

```
scrollTo()
swipeLeft()
swipeRight()
swipeUp()
swipeDown()
```

https://developer.android.com/training/testing/espresso/cheat-sheet

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Let’ start to write tests

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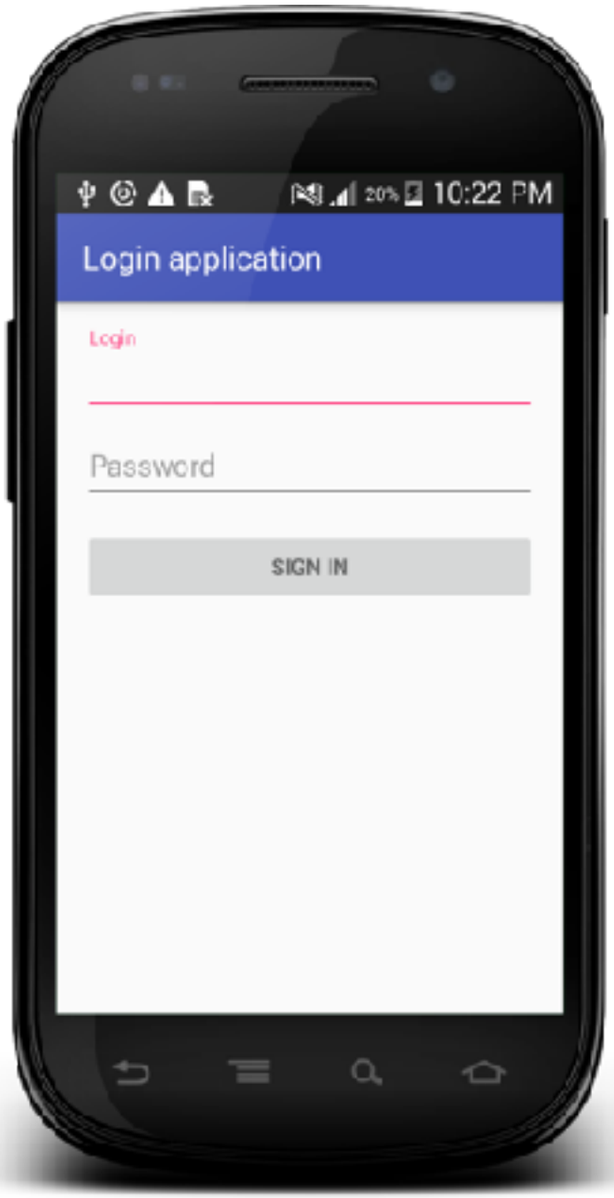
Flow 1 :: Login Success

Login Page

Result Page



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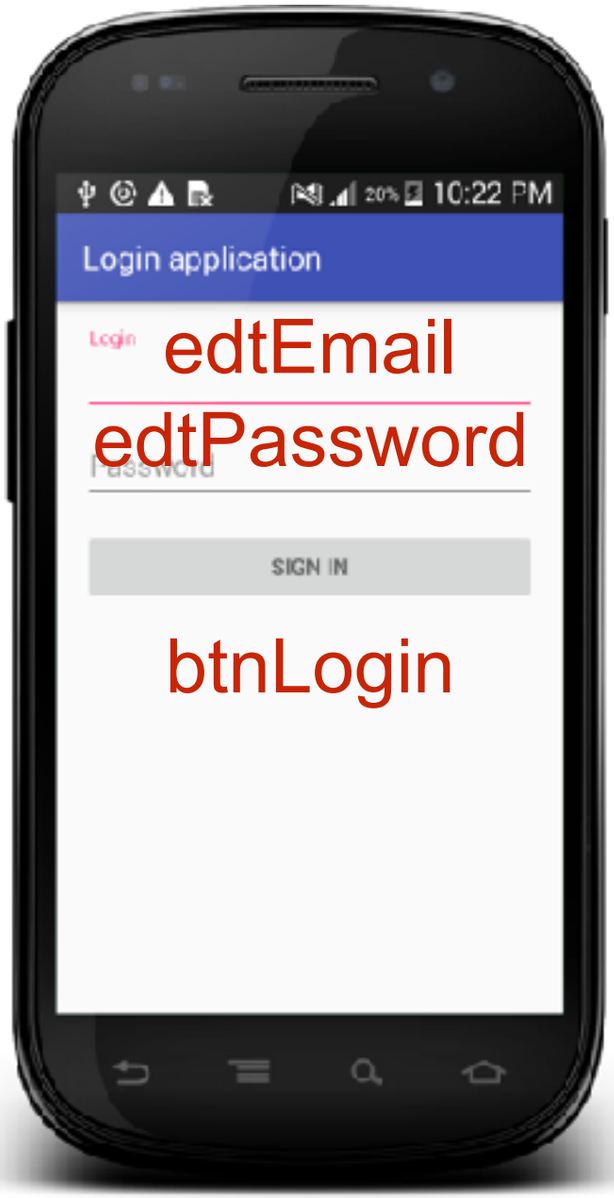
Define ID in each element

Login Page



Result Page

txtResult

Success

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Create test case of Android Test

/app/src/androidTest/java
Filename = MainActivityTest.java

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How to start/open MainActivity ?

Using ActivityTestRule class from Espresso

```
public class MainActivityTest {

    @Rule
    public ActivityTestRule<MainActivity> mainPage =
        new ActivityTestRule<>(MainActivity.class);
```


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Issue

ActivityTestRule class not found

Solution :: Add new dependency in file /app/build.gradle

```
dependencies {
    implementation fileTree(dir: 'libs', include: ['*.jar'])
    implementation 'com.android.support:appcompat-v7:28.0.0-rc01'
    implementation 'com.android.support.constraint:constraint-layout:1.1.2'
    testImplementation 'junit:junit:4.12'
    androidTestImplementation 'com.android.support.test:runner:1.0.2'
    androidTestImplementation 'com.android.support.test:rules:1.0.2'
    androidTestImplementation 'com.android.support.test.espresso:espresso-core:3.0.2'
```


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Issue

Conflict version of support-annotation

Solution :: Exclude in /app/build.gradle

```
dependencies {
    androidTestImplementation('com.android.support.test.espresso:espresso-core:3.0.2') {
        exclude group: 'com.android.support', module: 'support-annotations'
    }
    androidTestImplementation('com.android.support.test:runner:1.0.2') {
        exclude group: 'com.android.support', module: 'support-annotations'
    }
```


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Write first test case

Login success with correct data

```
@Test
public void login_สำเร็จ() {
    onView(withId(R.id.edtEmail))
            .perform(
                    typeText("somkiat@gmail.com"),
                    closeSoftKeyboard());
    onView(withId(R.id.edtPassword))
            .perform(
                    typeText("12345"),
                    closeSoftKeyboard()
            );
    onView(withId(R.id.btnLogin))
            .perform(click());

    onView(withId(R.id.txtResult))
            .check(matches(withText("Success")));
}
```


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Run test in Android Studio

```
public class MainActivityTest {
    Run 'MainActivityTest'        ^⇧R
    Debug 'MainActivityTest'      ^⇧D
    Profile 'MainActivityTest'
    @Rule
    public ActivityTestRule<Mai
        new ActivityTestRule<>(M
```


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Run test in command line

$gradlew connectedAndroidTest
$gradlew cAT

```
> Task :app:connectedDebugAndroidTest
Starting 5 tests on Nexus_5X_API_28(AVD) - 9


BUILD SUCCESSFUL in 1m 6s
53 actionable tasks: 8 executed, 45 up-to-date
```


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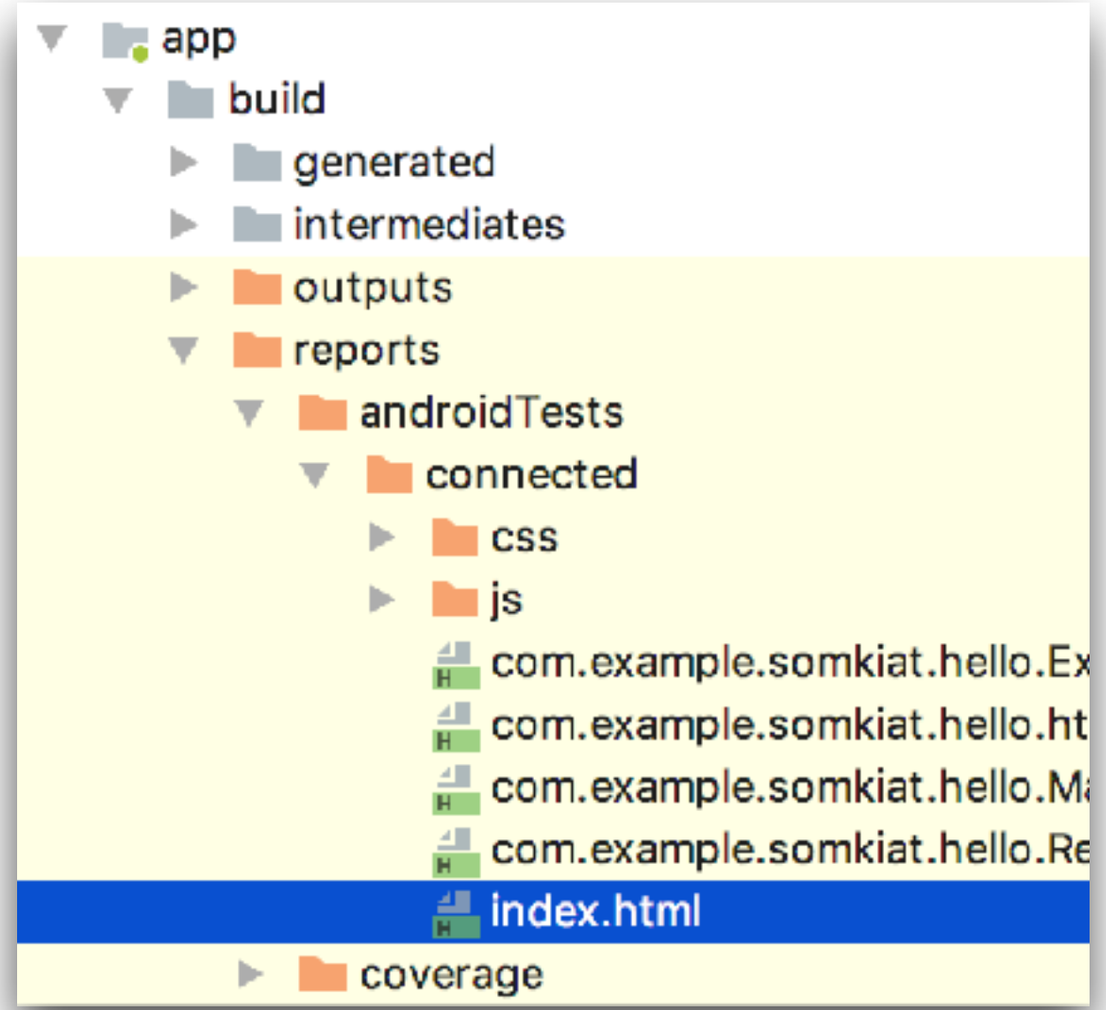
Test result of Android Testing

/app/build/reports/androidTests/connected



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Test result of Android Testing

/app/build/reports/androidTests/connected

Test Summary

5	0	22.055s
tests	failures	duration

100%
successful

Packages Classes

Package	Tests	Failures	Duration	Success rate
com.example.somkiat.hello	5	0	22.055s	100%

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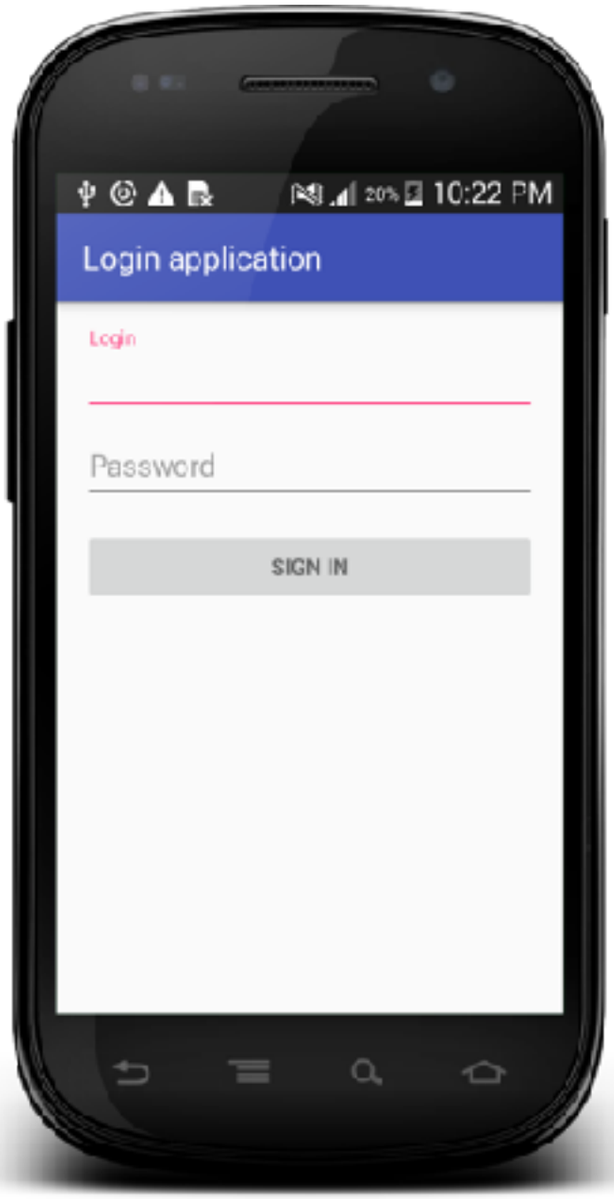
Flow 2 :: Login Fail

Login Page

Result Page



Failure

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Write second test case

Login file with wrong email

```
@Test
public void login_ไม่สำเร็จในกรณี_email_ไม่พบในระบบ() {
    onView(withId(R.id.edtEmail))
            .perform(
                    typeText("somkiat1@gmail.com"),
                    closeSoftKeyboard());
    onView(withId(R.id.edtPassword))
            .perform(
                    typeText("12345"),
                    closeSoftKeyboard()
            );
    onView(withId(R.id.btnLogin))
            .perform(click());

    onView(withId(R.id.txtResult))
            .check(matches(withText("BAD")));
}
```


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Write third test case

Login file with wrong password

```
@Test
public void login_ไม่สำเร็จในกรณี_password_ไม่พบในระบบ() {
    onView(withId(R.id.edtEmail))
            .perform(
                    typeText("somkiat@gmail.com"),
                    closeSoftKeyboard());
    onView(withId(R.id.edtPassword))
            .perform(
                    typeText("123456"),
                    closeSoftKeyboard()
            );
    onView(withId(R.id.btnLogin))
            .perform(click());

    onView(withId(R.id.txtResult))
            .check(matches(withText("BAD")));
}
```


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Write test cases of ResultActivity

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ResultActivity

Pass data via Intent

Show data from intent

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How to start ResultActivity ?

Start activity without open !!

```
public class ResultActivityTest {

    @Rule
    public ActivityTestRule<ResultActivity> resultPage =
            new ActivityTestRule<>(
                    ResultActivity.class, true, false);
```

flag to launch activity

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Setup data for intent

```
@Test
public void แสดงค่า_Success() {
    Intent intent = new Intent();
    intent.putExtra("result", "Success");

    resultPage.launchActivity(intent);

    onView(withId(R.id.txtResult))
            .check(matches(withText("Success")));
}
```


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Launch activity with intent

```
@Test
public void แสดงค่า_Success() {
    Intent intent = new Intent();
    intent.putExtra("result", "Success");

    resultPage.launchActivity(intent);

    onView(withId(R.id.txtResult))
            .check(matches(withText("Success")));
}
```


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Check result in current page

```
@Test
public void แสดงค่า_Success() {
    Intent intent = new Intent();
    intent.putExtra("result", "Success");

    resultPage.launchActivity(intent);

    onView(withId(R.id.txtResult))
            .check(matches(withText("Success")));
}
```


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Code coverage

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"Code coverage can show the high risk areas in a program, but never the risk-free."

Paul Reilly, 2018, Kotlin TDD with Code Coverage

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Code coverage

A tool to measure how much of your code is covered by tests that break down into classes, methods and lines.

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Code coverage

But 100% of code coverage **does not mean** that your code is 100% correct

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Code coverage

Powerful tool to improve the quality of your code

Code coverage != quality of tests

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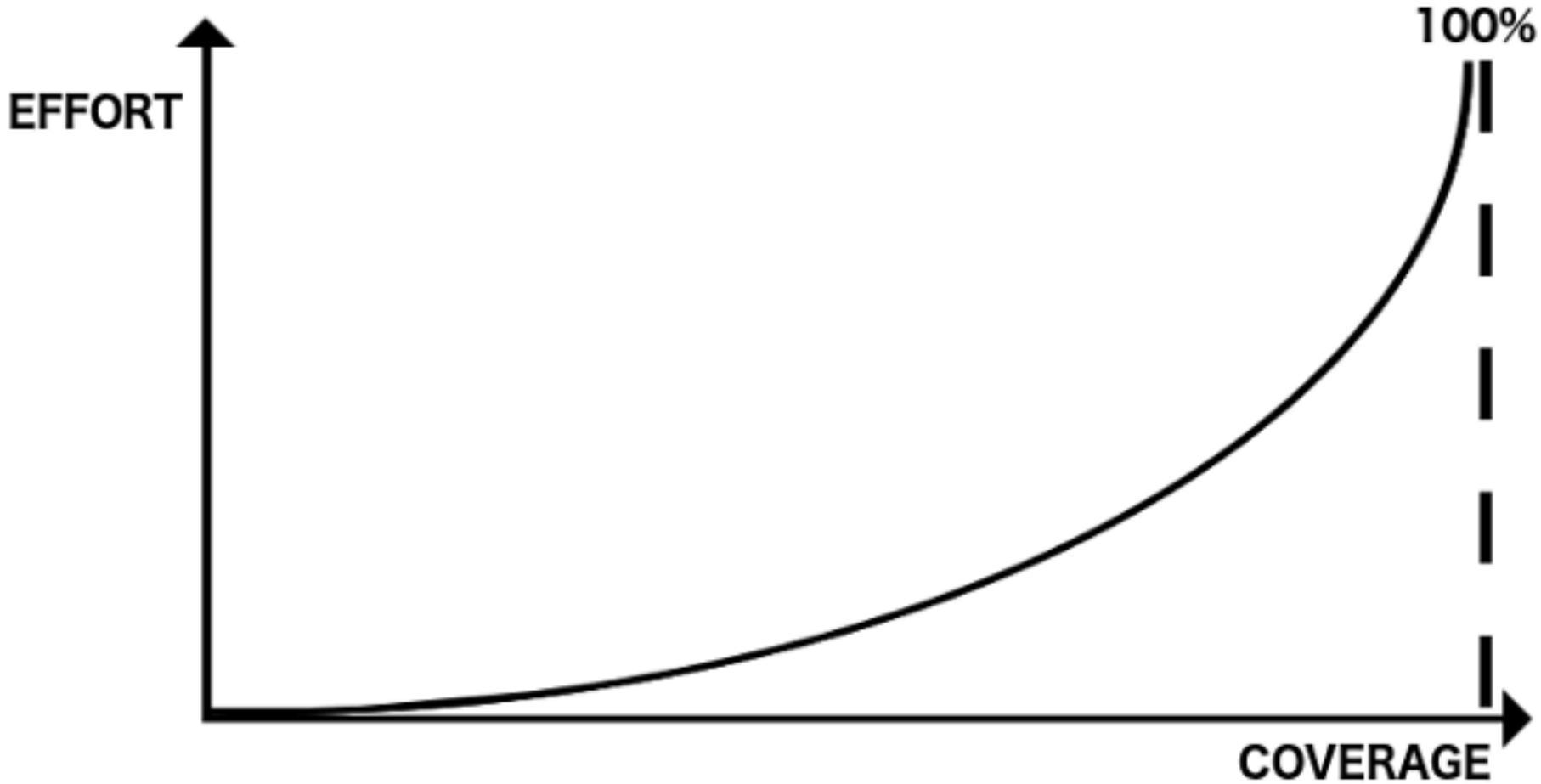
Code coverage 100% ?



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Code coverage for android

Disabled by default !!

Unit test

```
class HelloTest {

    @Test
    fun `login success with
    // Arrange or Given
    lo = Hello()
```

Run 'HelloTest' ^⇧R
Debug 'HelloTest' ^⇧D
Run 'HelloTest' with Coverage

androidTest

```
@Test
fun success() {
    onView(withId(R.id.e
        replaceText(
        closeSoftKey
```

Run 'success()' ^⇧R
Debug 'success()' ^⇧D
Profile 'success()'

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Enable code coverage

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1. Enable coverage in debug

In file /app/build.gradle

```
buildTypes {
    debug {
        testCoverageEnabled true
    }

    release {
        minifyEnabled false
        proguardFiles getDefaultProg
    }
}
```


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2. Use jacobo library

In file /app/build.gradle

```
apply plugin: 'jacoco'

jacoco {
    toolVersion = "0.8.1"
}
```


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3. Run code coverage of Android Test

$gradlew createDebugCoverageReport

Result in /app/build/reports/coverage/debug/index.html

debugAndroidTest

debugAndroidTest

Element	Missed Instructions	Cov.	Missed Branches	Cov.	Missed	Cxty	Missed	Lin
com.example.somkiat.hello		100%		100%	0	7	0	
Total	0 of 80	100%	0 of 4	100%	0	7	0	

Generated by the Android Gradle plugin 3.1.4

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Tips and Tricks

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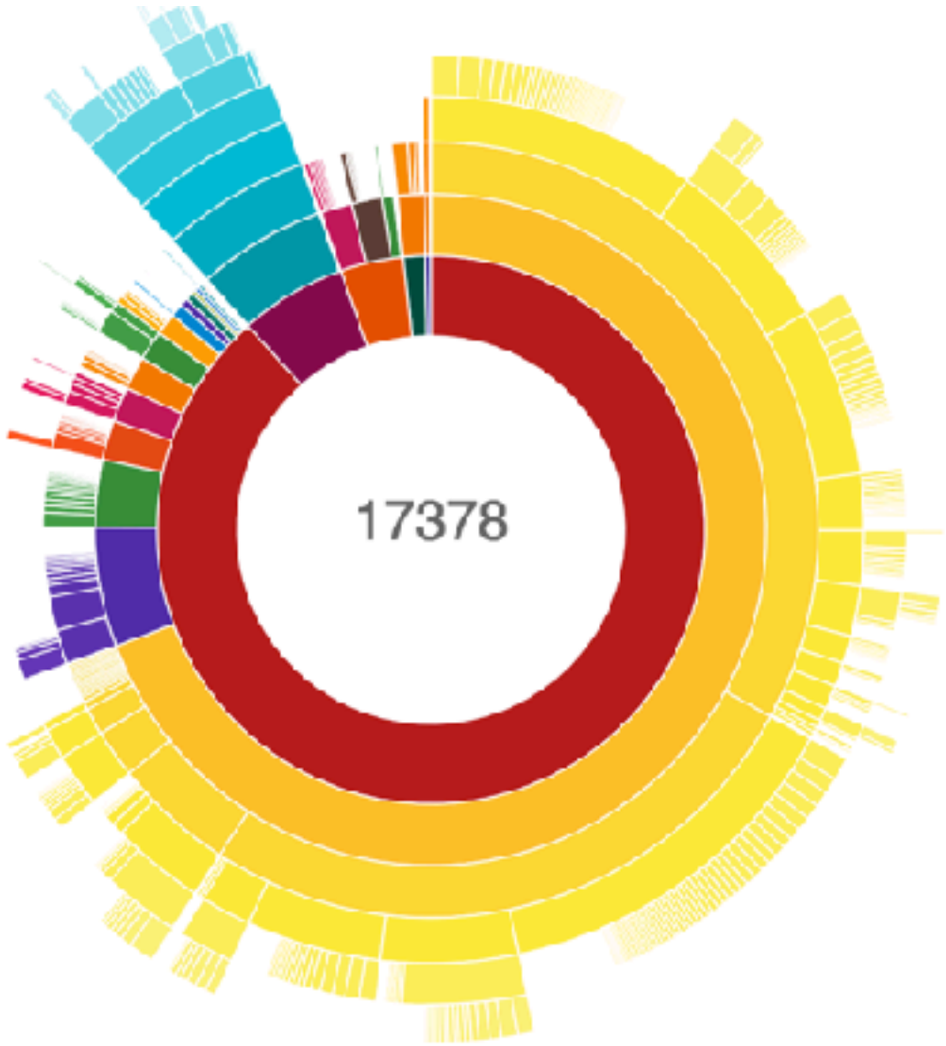
Count number of methods (65K)

Using dexcount plugin



https://github.com/KeepSafe/dexcount-gradle-plugin

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Using monkey test (Stress testing)

$**adb** shell monkey -p your.package.name -v 500

Number of events for testing

https://developer.android.com/studio/test/monkey

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Run unit testing in command line

```
$gradlew testDebugUnitTest
$gradlew tDUT
```

https://developer.android.com/studio/test/command-line

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Run unit testing in command line

See result in /app/build/reports/tests/testDebugUnitTest

Test Summary

1	0	0	0.001s
tests	failures	ignored	duration

100%
successful

Packages Classes

Package	Tests	Failures	Ignored	Duration	Success rate
com.example.somkiat.hello	1	0	0	0.001s	100%

https://developer.android.com/studio/test/command-line

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Validation input

https://github.com/up1/course-effective-android-testing/wiki/Validation

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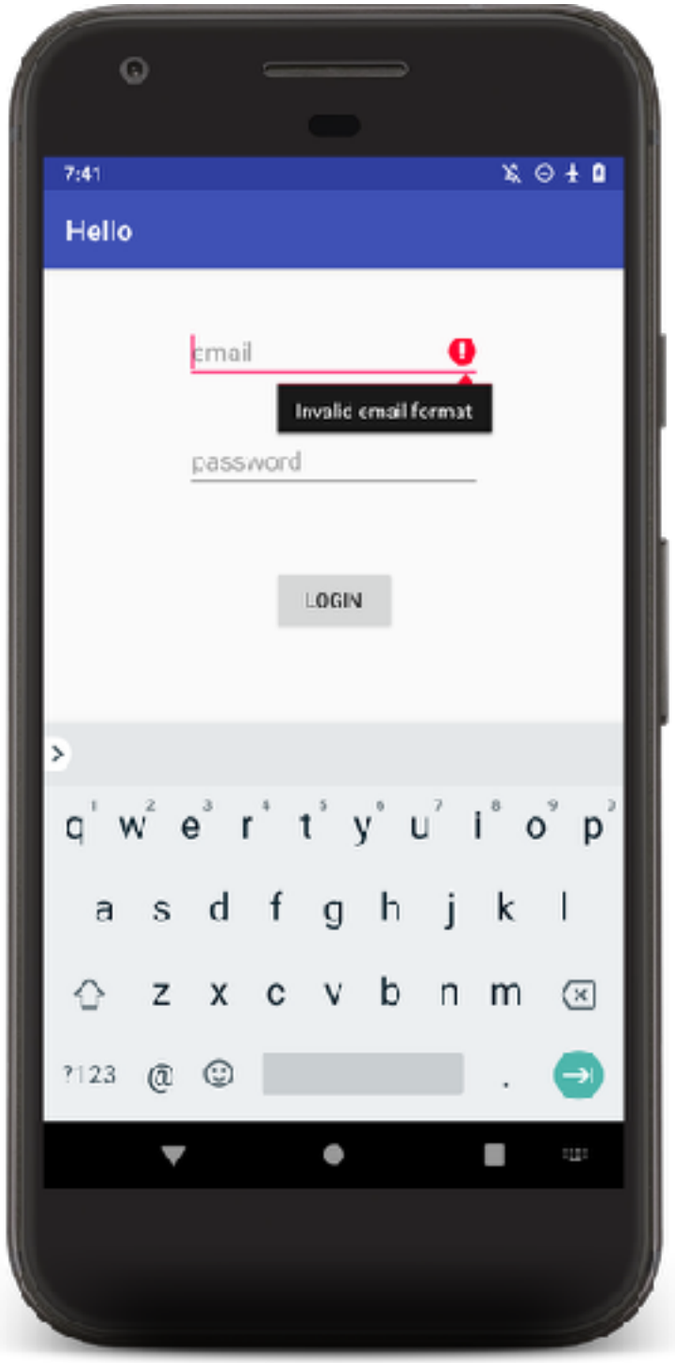
How to write test cases ?



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Sample code to validate inputs

```
// Validation
if(TextUtils.isEmpty(email)) {
    edtEmail.setError("Invalid email");
    return;
}

if(TextUtils.isEmpty(password)) {
    edtPassword.setError("Invalid password");
    return;
}
```


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Test cases

Test Case Name	Email	Password	Expected Result
Empty email			Invalid email
Empty password			Invalid password

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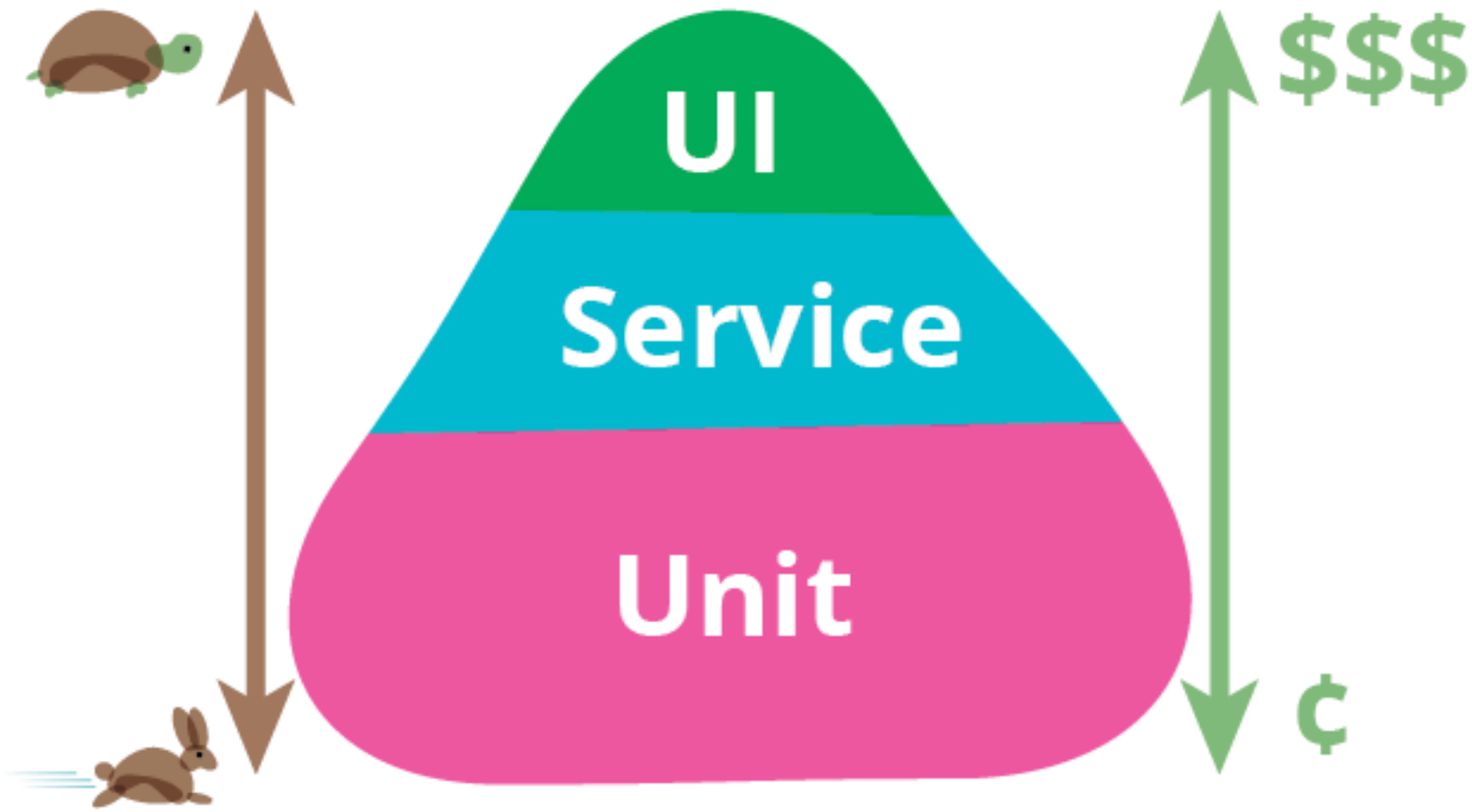
Write test cases ?



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UI testing

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UI testing with validation input

Create class **MainActivityValidateInputTest**
in /app/src/androidTest/java

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Case 1 :: Empty email

```
@Test
public void invalid_email_with_empty_email() {
    onView(withId(R.id.edtEmail))
            .perform(
                    typeText(""),
                    closeSoftKeyboard());
    onView(withId(R.id.edtPassword))
            .perform(
                    typeText("12345"),
                    closeSoftKeyboard()
            );
    onView(withId(R.id.btnLogin))
            .perform(click());

    onView(withId(R.id.edtEmail))
            .check(matches(hasErrorText("Invalid email")));
}
```


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Case 2 :: Empty password

```
@Test
public void invalid_password_with_empty_password() {
    onView(withId(R.id.edtEmail))
            .perform(
                    typeText("somkiat@gmail.com"),
                    closeSoftKeyboard());
    onView(withId(R.id.edtPassword))
            .perform(
                    typeText(""),
                    closeSoftKeyboard()
            );
    onView(withId(R.id.btnLogin))
            .perform(click());

    onView(withId(R.id.edtPassword))
            .check(matches(hasErrorText("Invalid password")));
}
```


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Add more tests …

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Working with data-driven testing

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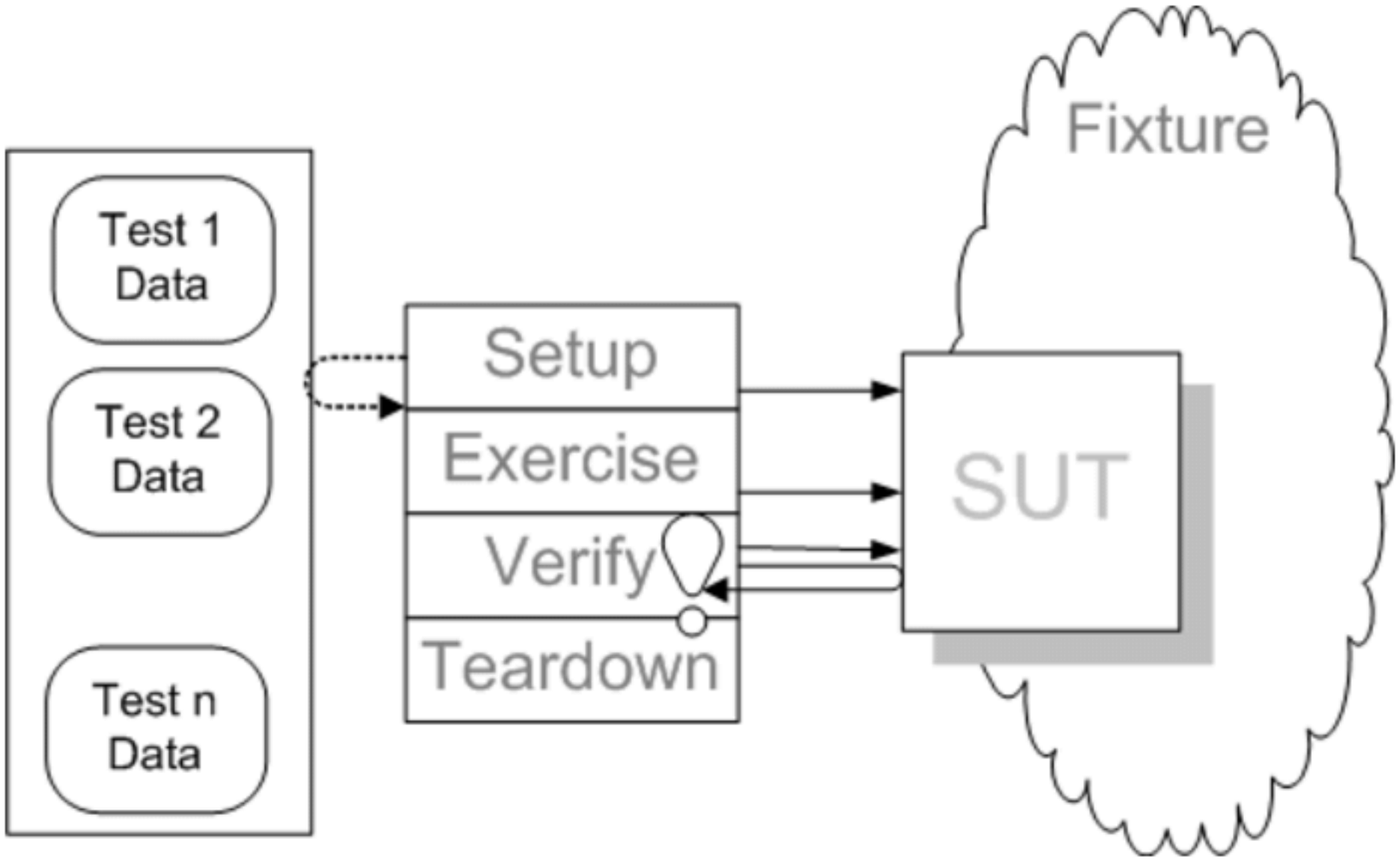
Data-Driven Testing



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Data-Driven Testing

JUnit Parameterized
JUnitParams

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1. JUnit Parameterized

JUnit Parameterized
JUnitParams

https://github.com/junit-team/junit4/wiki/parameterized-tests

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Working with Parameterized

RunWith class Parameterized
Add @Parameters in data method
Create constructor of test to receive data
Write test case with data

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Working with Parameterized (1)

1

```
@RunWith(Parameterized.class)
public class MainActivityValidateInputParameterizedTest {

    @Parameters
    public static Collection<Object[]> data() {
        return Arrays.asList(new Object[][] {
                { "", "12345", "Invalid email" }
        });
    }
```

2

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Working with Parameterized (2)

Create datas and constructor

```
private String email;
private String password;
private String expectedResult;

public MainActivityValidateInputParameterizedTest(
        String email, String password, String expectedResult) {
    this.email = email;
    this.password = password;
    this.expectedResult = expectedResult;
}
```


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Working with Parameterized (3)

Create test case and use datas

```
@Test
public void validate() {
    onView(withId(R.id.edtEmail))
            .perform(
                    typeText(this.email),
                    closeSoftKeyboard());
    onView(withId(R.id.edtPassword))
            .perform(
                    typeText(this.password),
                    closeSoftKeyboard()
            );
    onView(withId(R.id.btnLogin))
            .perform(click());

    onView(withId(R.id.edtEmail))
            .check(matches(hasErrorText(this.expectedResult)));
}
```

1

2

3

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Run your test

$gradlew cAT

Class com.example.somkiat.hello.MainActivityValidateInputParameterizedTest

all > com.example.somkiat.hello > MainActivityValidateInputParameterizedTest

1	0	2.585s
tests	failures	duration

100%
successful

Tests

Test	Nexus_5X_API_28(AVD) - 9
validate[0]	passed (2.585s)

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2. JUnitParams

Add dependency in /app/build.gradle

```
dependencies {
    implementation fileTree(dir: 'libs', include: ['*.jar'])
    implementation 'com.android.support:appcompat-v7:28.0.0-rc01'
    implementation 'com.android.support.constraint:constraint-layout:
    testImplementation 'junit:junit:4.12'
    androidTestImplementation 'com.android.support.test:runner:1.0.2'
    androidTestImplementation 'com.android.support.test:rules:1.0.2'
    androidTestImplementation 'com.android.support.test.espresso:espre
```

```
androidTestImplementation 'pl.pragmatists:JUnitParams:1.1.1'
```

https://github.com/Pragmatists/JUnitParams

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Using JUnitParams

```
@RunWith(JUnitParamsRunner.class)
public class MainActivityValidateInputJUnitParamsTest {
```

1

```
    @Test
    @Parameters({", 12345, Invalid email" })
    public void validate(String email, String password, String expectedResult) {
        onView(withId(R.id.edtEmail))
                .perform(
                        typeText(email),
                        closeSoftKeyboard());
        onView(withId(R.id.edtPassword))
                .perform(
                        typeText(password),
                        closeSoftKeyboard()
                );
```

2

https://github.com/Pragmatists/JUnitParams

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Unit testing

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Unit testing with validation input

How to testing with unit test ?
How to write test cases ?

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Create new class in /app/src/main

Class Validation

```
import android.text.TextUtils;

public class Validation {

    public boolean isEmpty(String input) {
        return TextUtils.isEmpty(input);
    }

}
```


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Create unit test of validation

Create file in /app/test

```
public class ValidationTest {

    @Test
    public void isEmpty() {
        Validation validation = new Validation();
        assertTrue(validation.isEmpty(""));
    }
}
```


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Run unit test

$gradlew testDebugUnitTest

Found error :: Method isEmpty in android.text.TextUtils not mock

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Change code to use pure Java

```
public class Validation {

    public boolean isEmpty(String input) {
        return input == null ||
                input.trim().length() == 0;
    }

}
```


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Add more test cases

```
@Test
public void with_empty_string() {
    Validation validation = new Validation();
    assertTrue(validation.isEmpty(""));
}

@Test
public void with_null() {
    Validation validation = new Validation();
    assertTrue(validation.isEmpty(null));
}

@Test
public void with_space() {
    Validation validation = new Validation();
    assertTrue(validation.isEmpty(" "));
}
```


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Run unit test again

$gradlew testDebugUnitTest

Class com.example.somkiat.hello.ValidationTest

all > com.example.somkiat.hello > ValidationTest

3	0	0	0.005s
tests	failures	ignored	duration

100%
successful

Tests

Test	Duration	Result
with_empty_string	0s	passed
with_null	0s	passed
with_space	0.005s	passed

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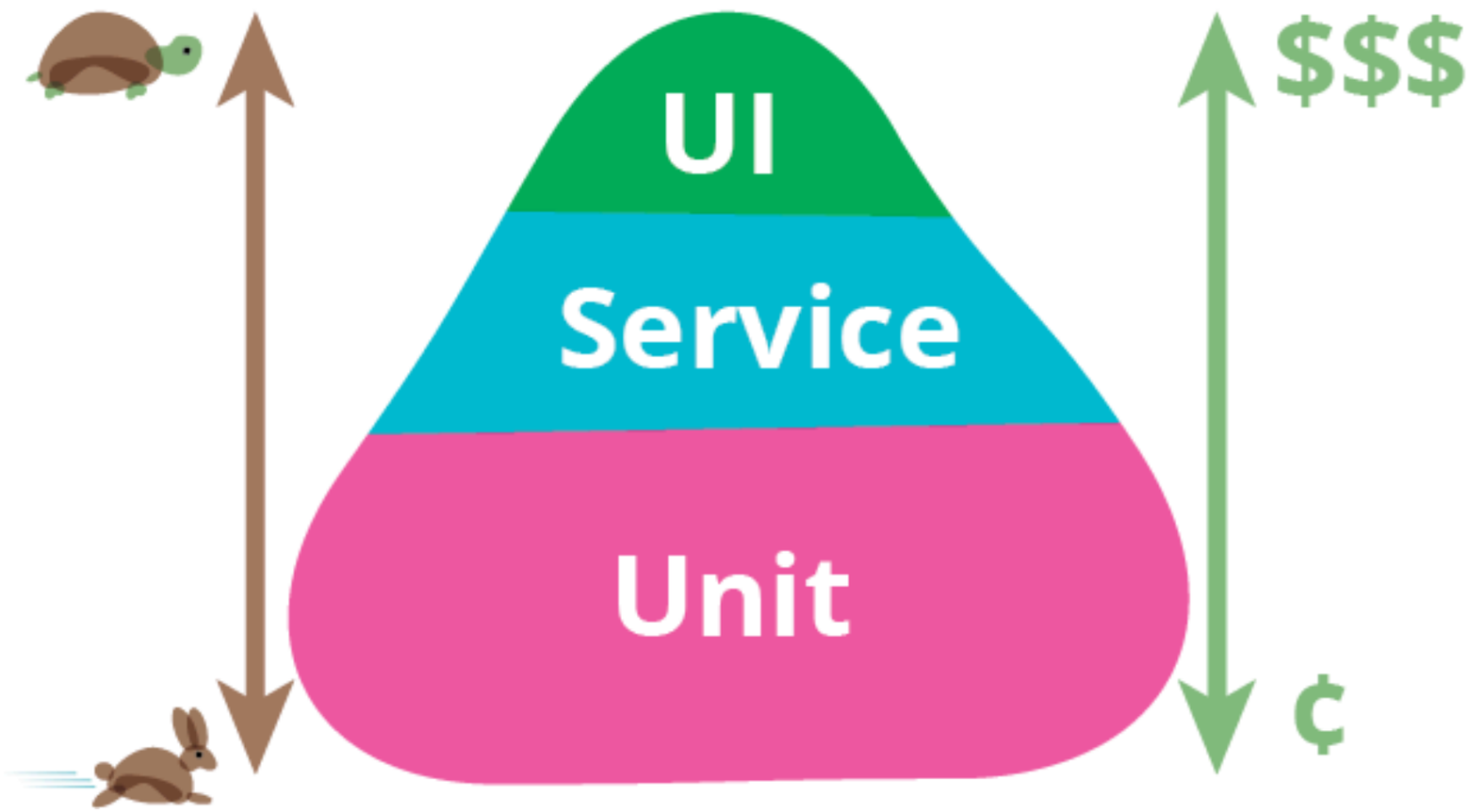
Unit vs UI testing ?



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Record Espresso Test

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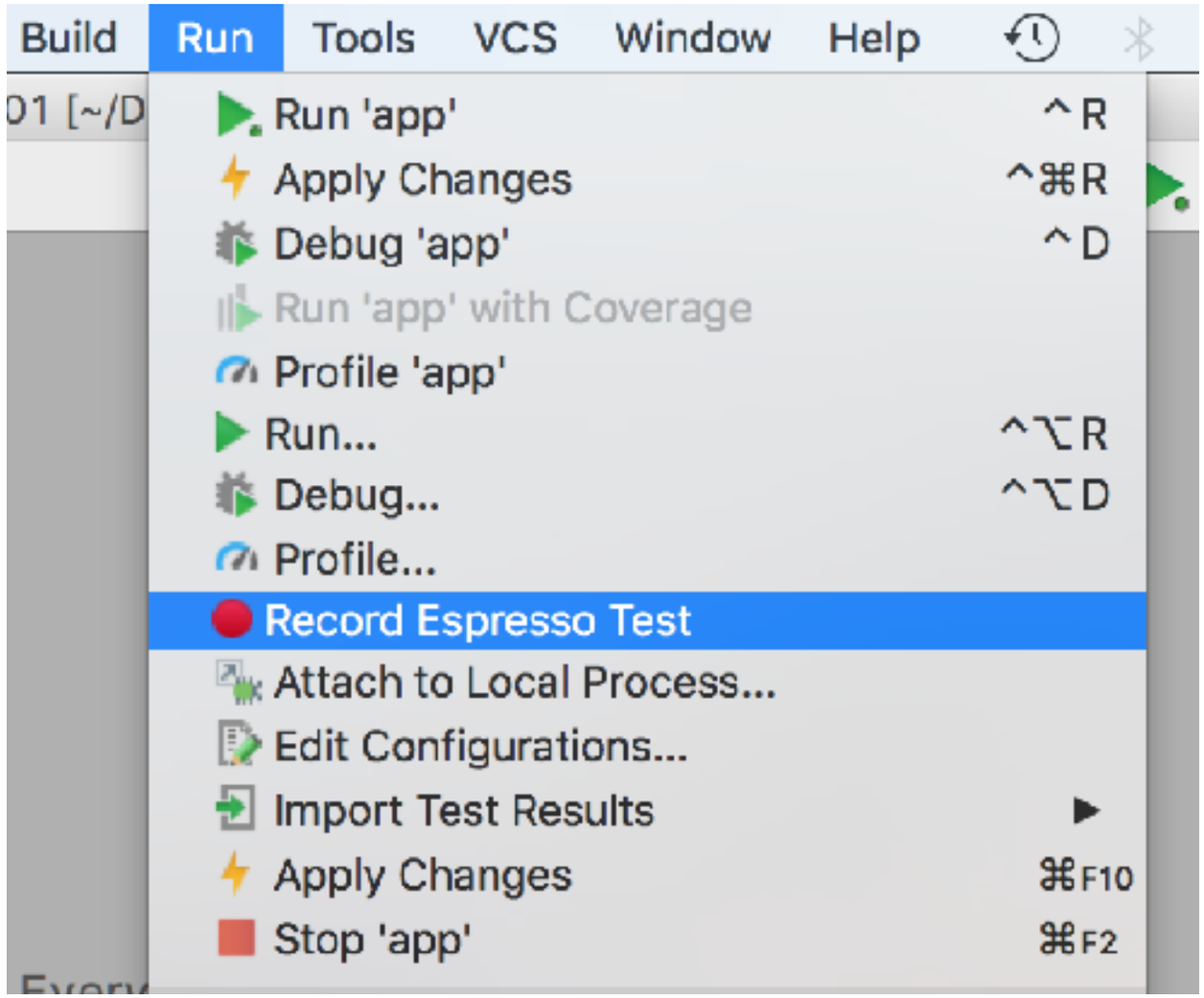
Record Espresso Test

Run -> Record Espresso Test



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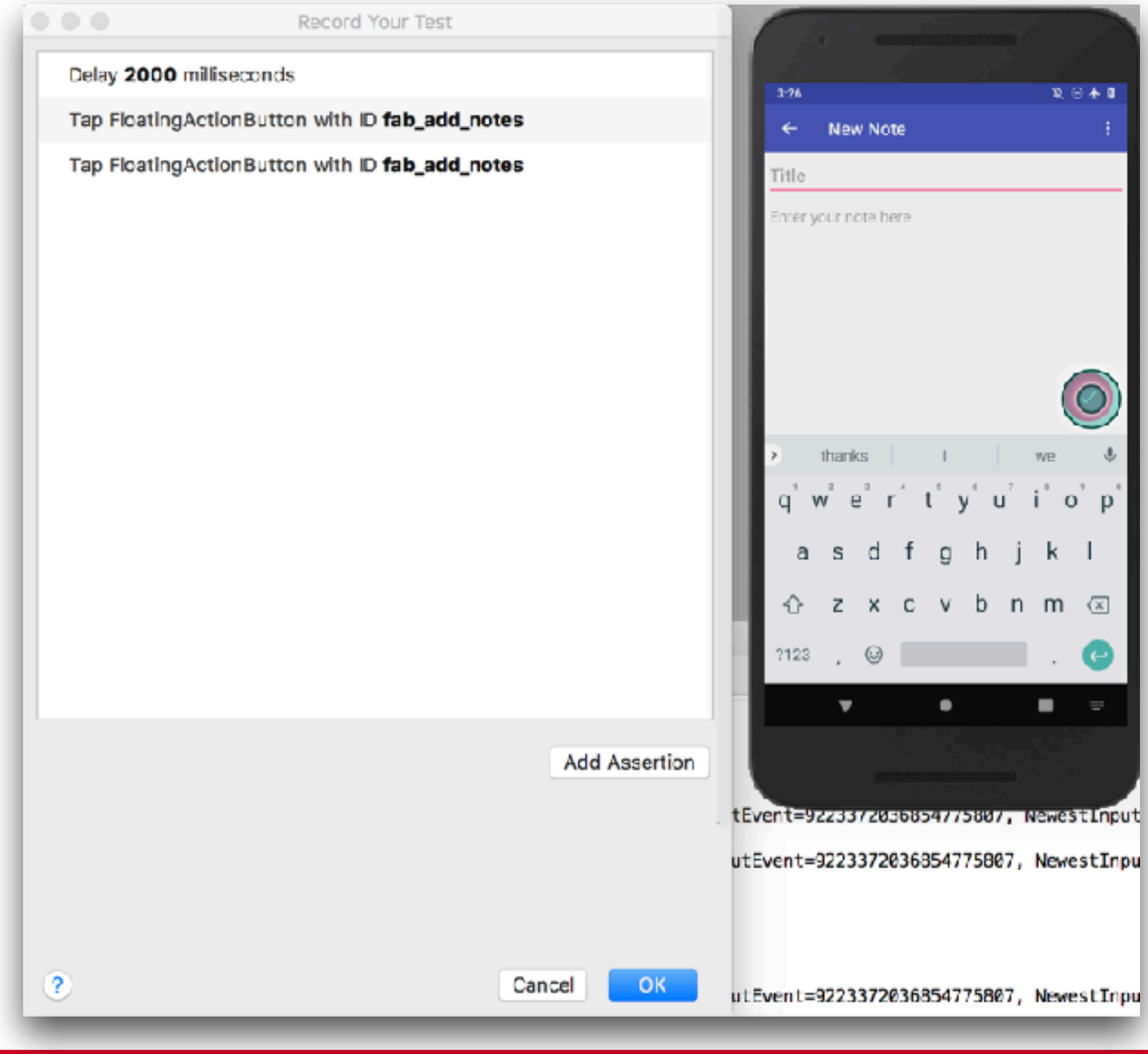
Record Espresso Test



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Code coverage problem

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Code coverage for android

Separate unit test and android test

Unit test

```
class HelloTest {

    @Test
    fun `login success with
    // Arrange or Given
    lo = Hello()
```

Run 'HelloTest' ^⇧R
Debug 'HelloTest' ^⇧D
Run 'HelloTest' with Coverage

androidTest

```
@Test
fun success() {
    onView(withId(R.id.e
        replaceText(
        closeSoftKey
```

Run 'success()' ^⇧R
Debug 'success()' ^⇧D
Profile 'success()'

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1. Merge result of coverage

Create new grade's task

```
task jacocoTestReport(type: JacocoReport, dependsOn: ['testDebugUnitTest',

    reports {
        xml.enabled = true
        html.enabled = true
    }

    def fileFilter = [ '**/R.class', '**/R$*.class', '**/BuildConfig.*', '*
    def debugTree = fileTree(dir: "$project.buildDir/tmp/kotlin-classes/deb
    def mainSrc = "$project.projectDir/src/main/java"

    sourceDirectories = files([mainSrc])
    classDirectories = files([debugTree])
    executionData = fileTree(dir: project.buildDir, includes: [
            'jacoco/testDebugUnitTest.exec', 'outputs/code-coverage/connect
    ])
}
```


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2. Run test with code coverage

$gradlew clean jacocoTestReport

Result in /app/build/reports/jacoco/jacocoTestReport

app > demo.loginapplication

demo.loginapplication

Element	Missed Instructions	Cov.	Missed Branches	Cov.	Missed	Cxty	Missed	Lines
MainActivity		82%		50%	7	13	1	13
Hello		100%		n/a	0	2	0	2
Total	18 of 119	84%	7 of 14	50%	7	15	1	15

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More detail of coverage

app > demo.loginapplication > MainActivity.kt

MainActivity.kt

```
1.  package demo.loginapplication
2.
3.  import android.support.v7.app.AppCompatActivity
4.  import android.os.Bundle
5.  import android.view.View
6.  import android.widget.Toast
7.  import kotlinx.android.synthetic.main.activity_main.*
8.
9.  class MainActivity : AppCompatActivity(), View.OnClickListener {
10.
11.     override fun onCreate(savedInstanceState: Bundle?) {
12.         super.onCreate(savedInstanceState)
13.         setContentView(R.layout.activity_main)
14.
15.         email_sign_in_button.setOnClickListener(this)
16.     }
17.
18.     override fun onClick(v: View?) {
19.         when(v?.id) {
20.             R.id.email_sign_in_button -> {
21.                 processLogin()
22.             }
23.         }
24.     }
25.
26.     private fun processLogin() {
27.         if(email.text.toString().equals("somkiat@xxx.com")) {
28.             Toast.makeText(this@MainActivity, "Success", Toast.LENGTH_SHORT).show()
29.         } else {
30.             Toast.makeText(this@MainActivity, "Fail", Toast.LENGTH_SHORT).show()
31.         }
32.     }
33. }
```

Miss in branch coverage

Miss in line coverage

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Capture screenshot with Screengrab

https://docs.fastlane.tools/getting-started/android/screenshots/

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1. Install Screengrab

```
$sudo gem install fastlane -NV
$sudo gem install screengrab
```


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2. Add dependency

In file /app/build.gradle

```
dependencies {

    testImplementation 'junit:junit:4.12'
    androidTestImplementation 'com.android.support.test:runner:1
    androidTestImplementation 'com.android.support.test:rules:1.
    androidTestImplementation 'com.android.support.test.espresso

    androidTestImplementation 'com.agoda.kakao:kakao:1.3.0'
    androidTestImplementation 'tools.fastlane:screengrab:1.0.0'
}
```


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3. Create file AndroidManifest.xml

In folder **/app/src/debug/**

```
<!-- Allows unlocking your device and activating its screen so UI tests can succeed -->
<uses-permission android:name="android.permission.DISABLE_KEYGUARD"/>
<uses-permission android:name="android.permission.WAKE_LOCK"/>

<!-- Allows for storing and retrieving screenshots -->
<uses-permission android:name="android.permission.WRITE_EXTERNAL_STORAGE" />
<uses-permission android:name="android.permission.READ_EXTERNAL_STORAGE" />

<!-- Allows changing locales -->
<uses-permission android:name="android.permission.CHANGE_CONFIGURATION"
    tools:ignore="ProtectedPermissions" />
```


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4. Add screengrab to UI test

In folder **/app/src/debug/**

```
class MainActivityUITest {

    @get:Rule
    val rule: ActivityTestRule<MainActivity>
            = ActivityTestRule(MainActivity::class.java)
```

```
@get:Rule
val local: LocaleTestRule = LocaleTestRule();
```


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4. Add screengrab to UI test

```
@Test
fun success() {
    Screengrab.screenshot( screenshotName: "step01");

    onView(withId(R.id.email)).perform(
            replaceText( stringToBeSet: "somkiat@xxx.com"),
            closeSoftKeyboard())

    onView(withId(R.id.password)).perform(
            replaceText( stringToBeSet: ""),
            closeSoftKeyboard())

    Screengrab.screenshot( screenshotName: "step02");

    onView(withId(R.id.email_sign_in_button)).perform(click())

    Screengrab.screenshot( screenshotName: "step03");

    onView(withText( text: "Success"))
            .inRoot(withDecorView(not(rule.activity.window.decorView)))
            .check(matches(isDisplayed()))
}
```


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5. Run

$gradlew assembleDebug assembleAndroidTest

$fastlane screengrab

```
[✔] 🚀
[07:19:15]: Get started using a Gemfile for fastlane https:/
ls/getting-started/ios/setup/#use-a-gemfile
[07:19:15]: To not be asked about this value, you can specif
ckage_name'
[07:19:15]: The package name of the app under test (e.g.
com.yourcompany.yourapp):
```


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6. Try to config screngrabfile

$screengrab init

```
app_package_name('demo.loginapplication')

app_apk_path('app/build/outputs/apk/debug/app-debug.apk')
tests_apk_path('app/build/outputs/apk/androidTest/debug/app-debug-androidTest.apk')

locales(['en-US', 'fr-FR', 'it-IT'])

# clear all previously generated screenshots in your local output directory before c
clear_previous_screenshots(true)
```


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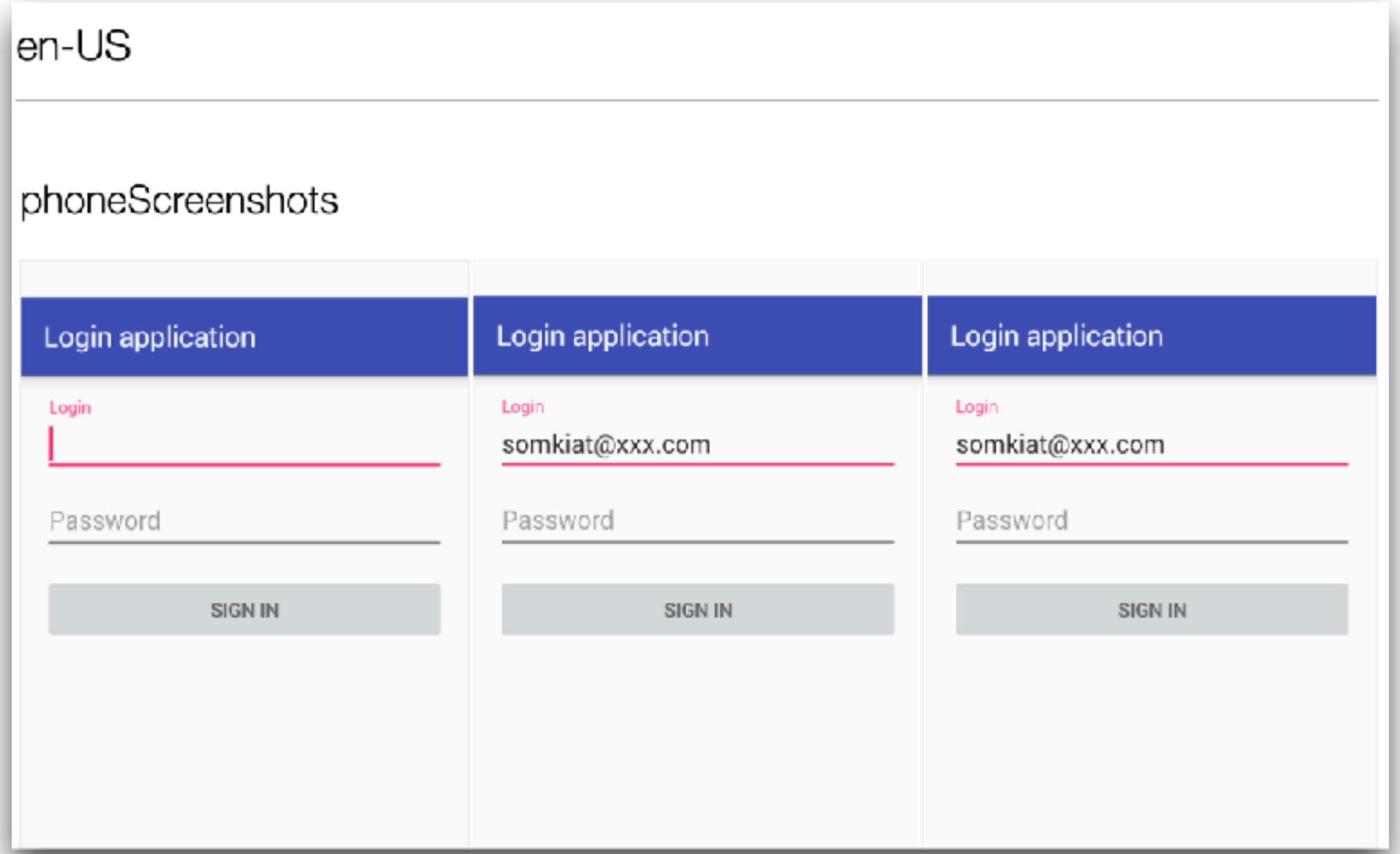
7. See result

In folder **/fastlane**



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Problem with Screengrab

Version of screen grab for Android N+

Solution :: reduce version of screengrab

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Workshop with Testing

https://github.com/up1/android-testing-workshop/archive/step01.zip

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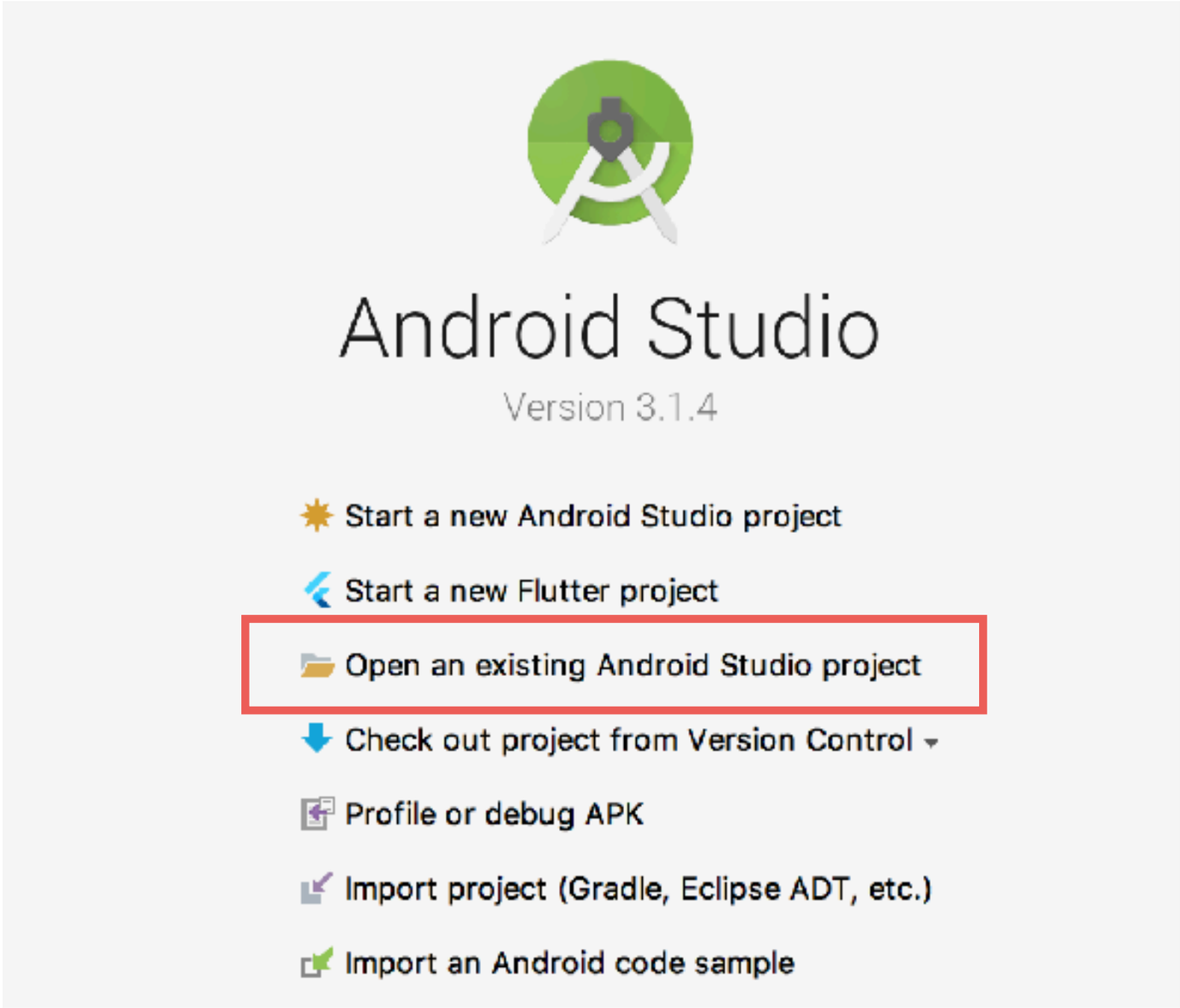
Open an existing project



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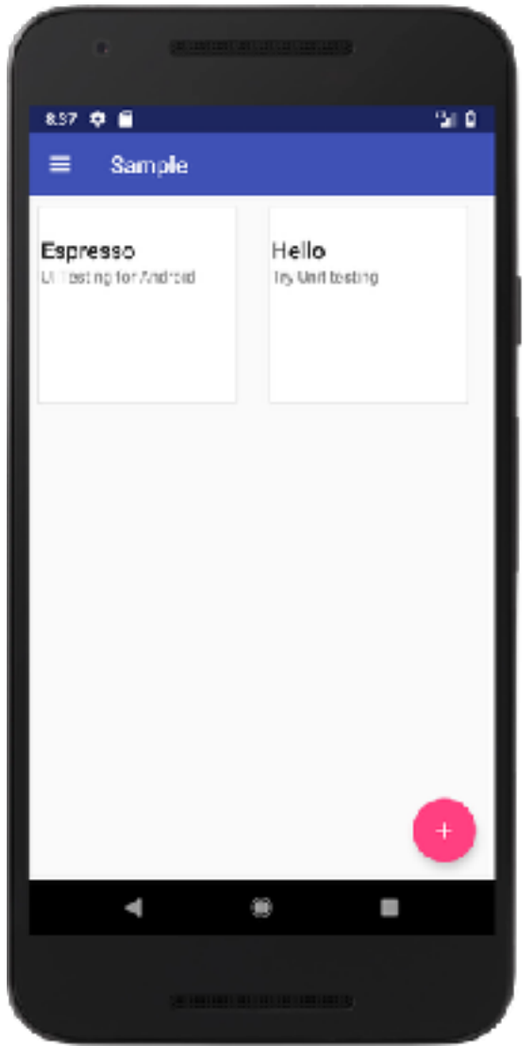
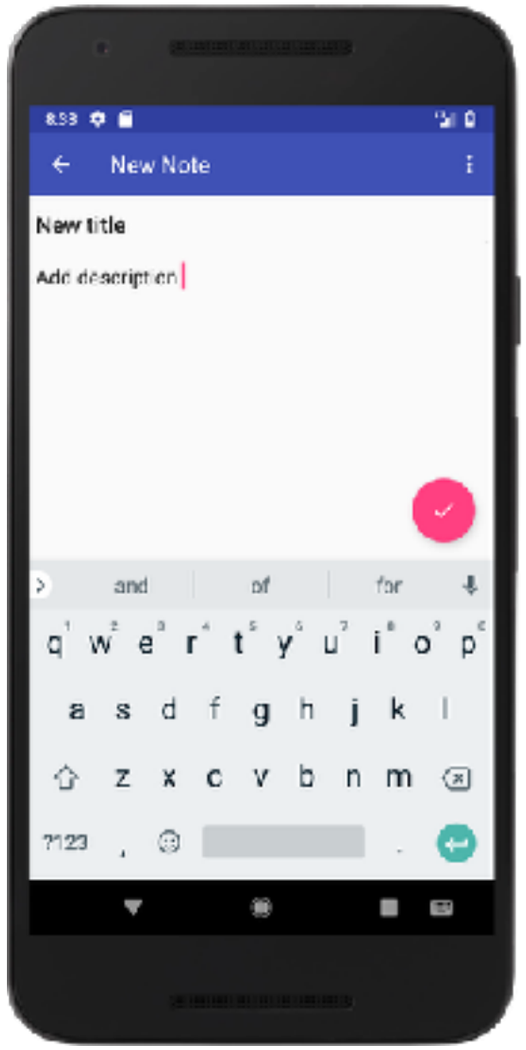
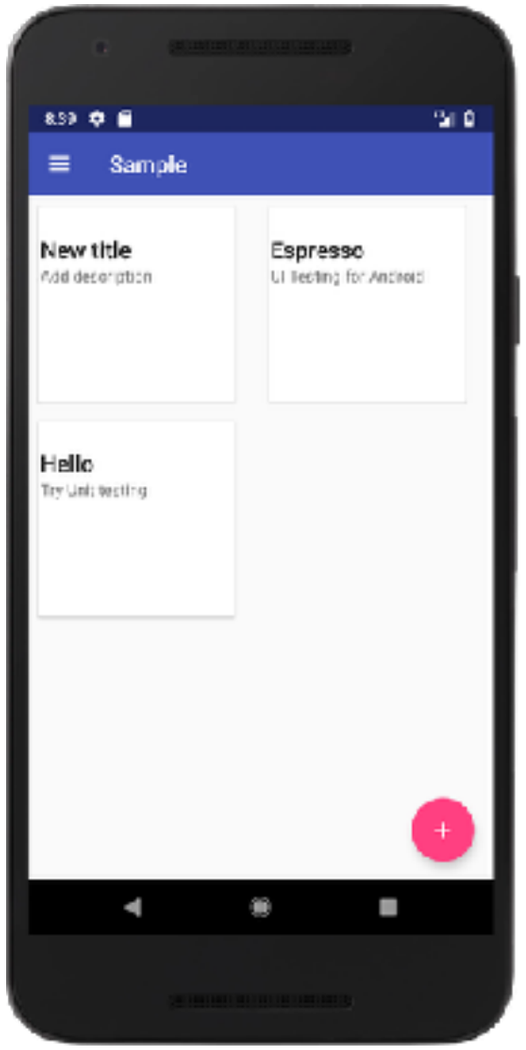
Main



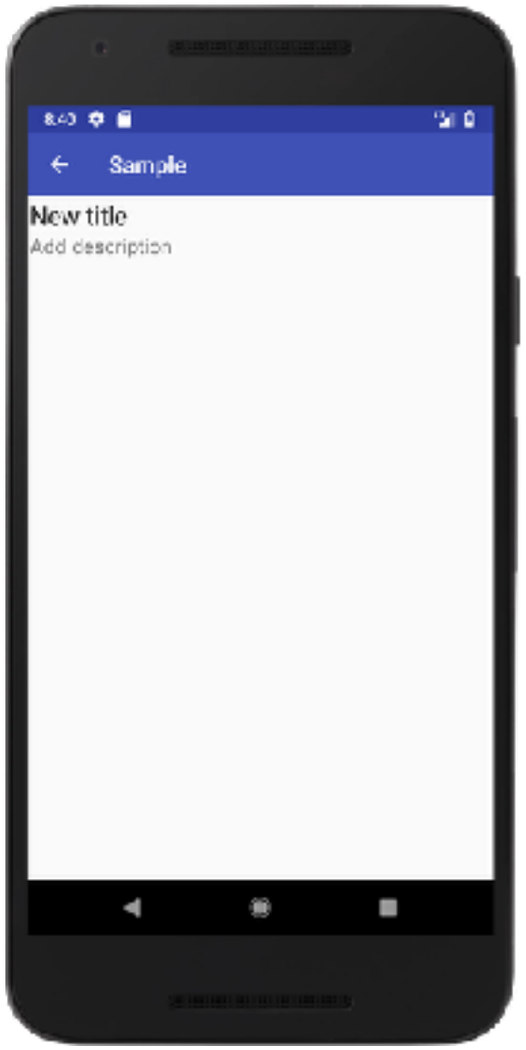
Add



Main



Detail



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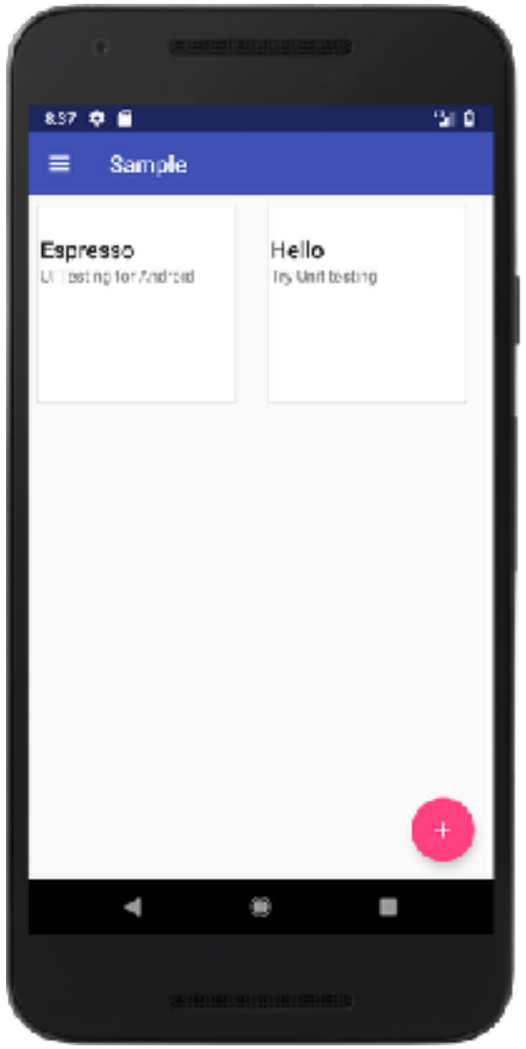
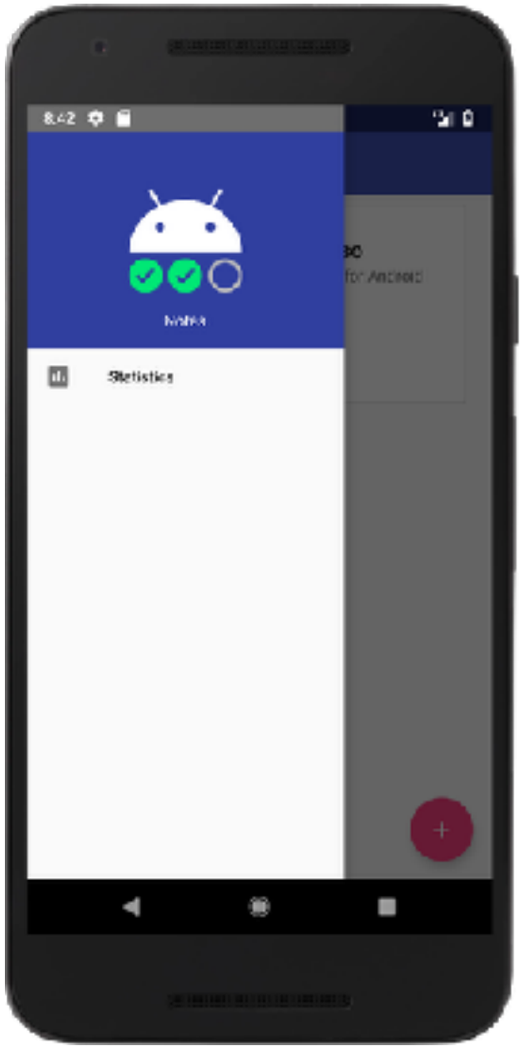
Main



Menu



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Test cases ?

Test Case Name			Expected Result
Add new note			
Show detail of note			

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Add new note

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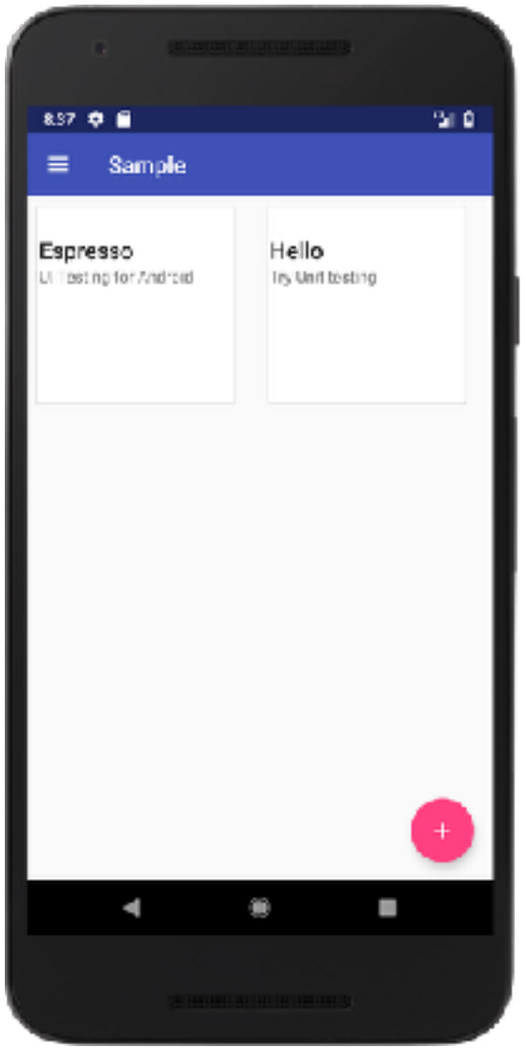
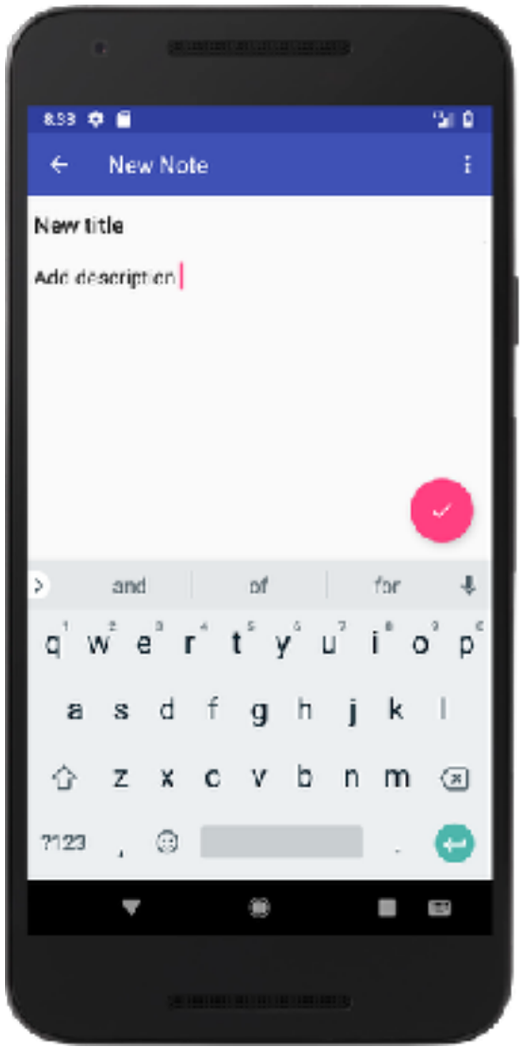
Add new note

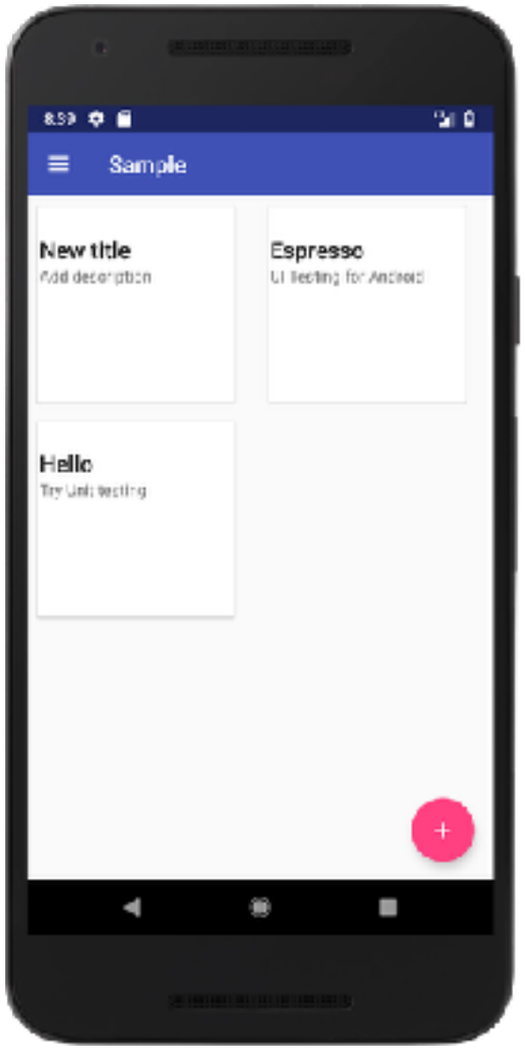
Main



Add



Main



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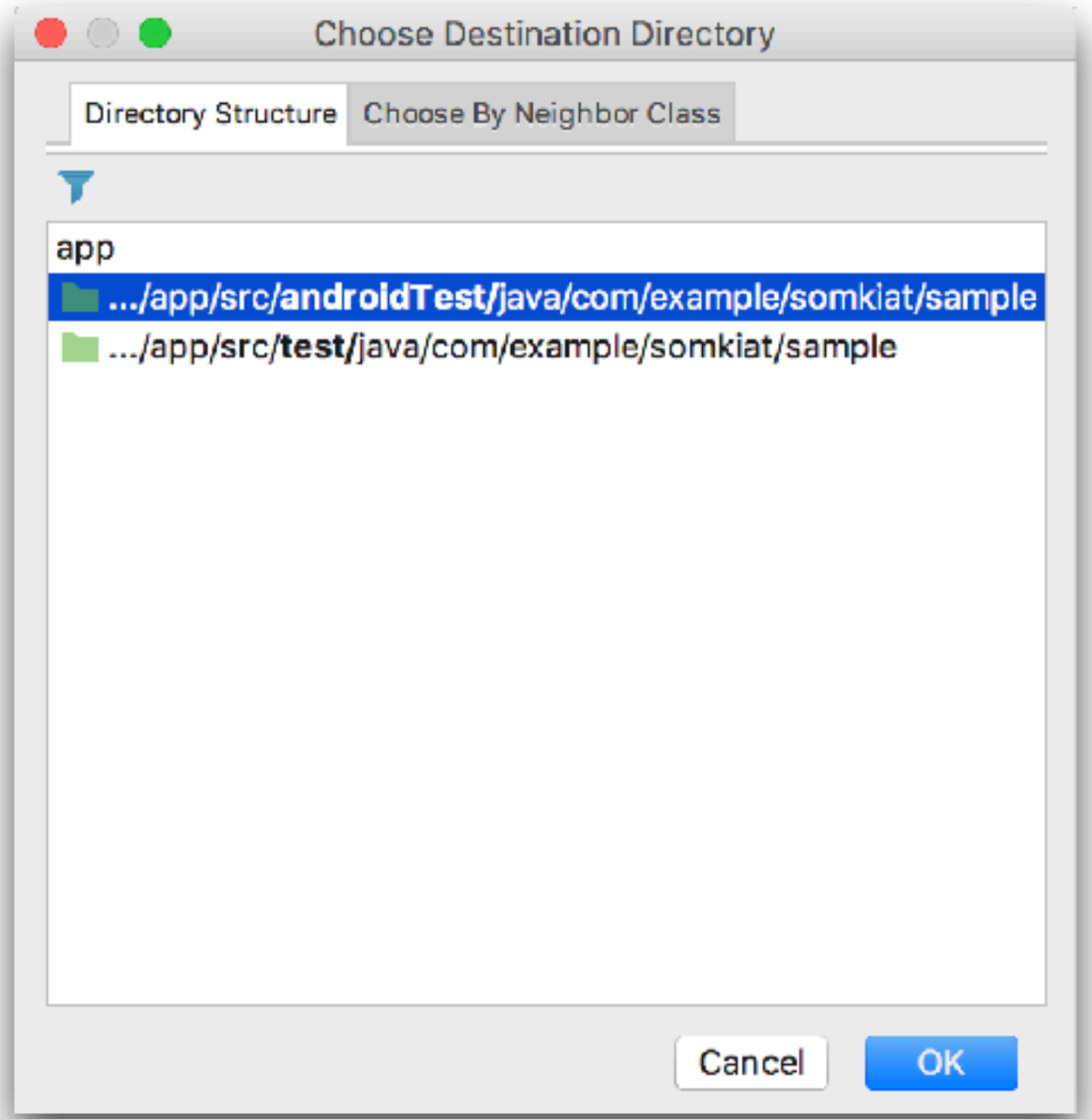
Create file MainActivityTest.java

In folder /app/src/androidTest/java



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Test case 1 :: Click add button

Try in click add button

```
@Rule
public ActivityTestRule<MainActivity> mainPage =
        new ActivityTestRule<>(MainActivity.class);

@Test
public void click_add_button_should_be_open_add_note_page() {
    // Act
    onView(withId(R.id.fab_add_notes))
            .perform(click());

    // Assert
    onView(withId(R.id.add_note_title))
            .check(matches(isDisplayed()));
    onView(withId(R.id.add_note_description))
            .check(matches(isDisplayed()));
}
```


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Test case 2 :: Add new note

```
@Test
public void add_new_note_to_list_of_notes() {
    onView(withId(R.id.fab_add_notes))
            .perform(click());

    // Add new note with title and description
    onView(withId(R.id.add_note_title))
            .perform(typeText("New Title"),
                    closeSoftKeyboard());
    onView(withId(R.id.add_note_description))
            .perform(typeText("New description"),
                    closeSoftKeyboard());

    onView(withId(R.id.fab_add_notes))
            .perform(click());


    // Assert ?
}
```


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Working with RecyclerView

1. Add new dependency in /app/build.gradle
2. Scroll to new note
3. Check data in recycler view

```
implementation 'com.android.support:support-v4:27.1.1'
testImplementation 'junit:junit:4.12'
androidTestImplementation 'com.android.support.test:runner:1.0.2'
androidTestImplementation 'com.android.support.test:rules:1.0.2'
androidTestImplementation 'com.android.support.test.espresso:espresso-core:3.0.2'
androidTestImplementation "com.android.support.test.espresso:espresso-contrib:3.0.2"
androidTestImplementation "com.android.support.test.espresso:espresso-intents:3.0.2"
```


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Scroll to new note

Use scrollTo() from
android.support.test.espresso.contrib.RecyclerViewActions

```
// Assert ?
onView(withId(R.id.notes_list))
        .perform(RecyclerViewActions.scrollTo(
                hasDescendant(withText("New description"))));

onView(withItemText("New description"))
        .check(matches(isDisplayed()));
```


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Custom matcher

```
private Matcher<View> withItemText(final String input) {
    return new TypeSafeMatcher<View>() {
        @Override
        protected boolean matchesSafely(View item) {
            return allOf(
                    isDescendantOfA(
                            isAssignableFrom(RecyclerView.class)),
            withText(input)).matches(item);
        }

        @Override
        public void describeTo(Description description) {
            description
                    .appendText("is isDescendantOfA RV with text "
        }
    };
}
```


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Run test in command line

$./gradlew clean cAT

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Try to add more note !!

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Show detail of note

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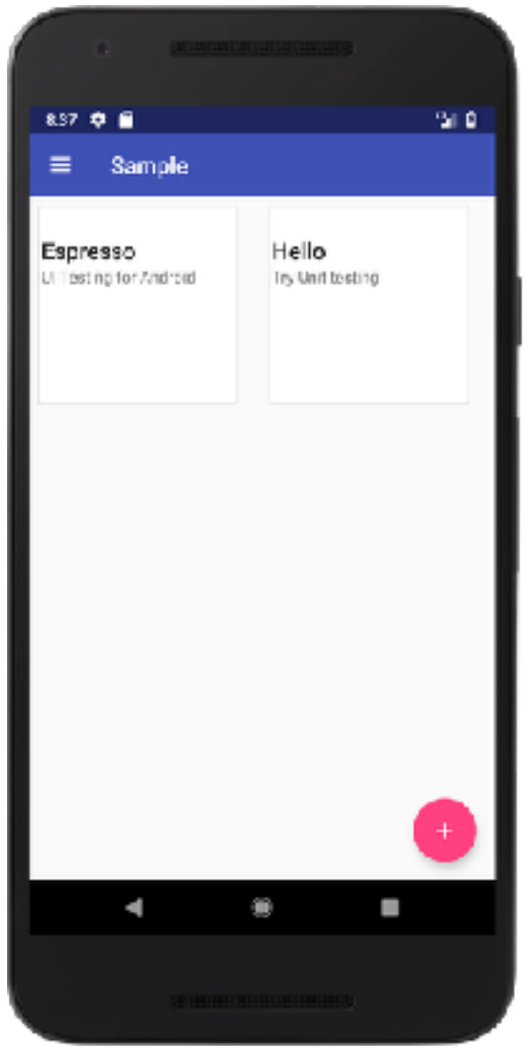
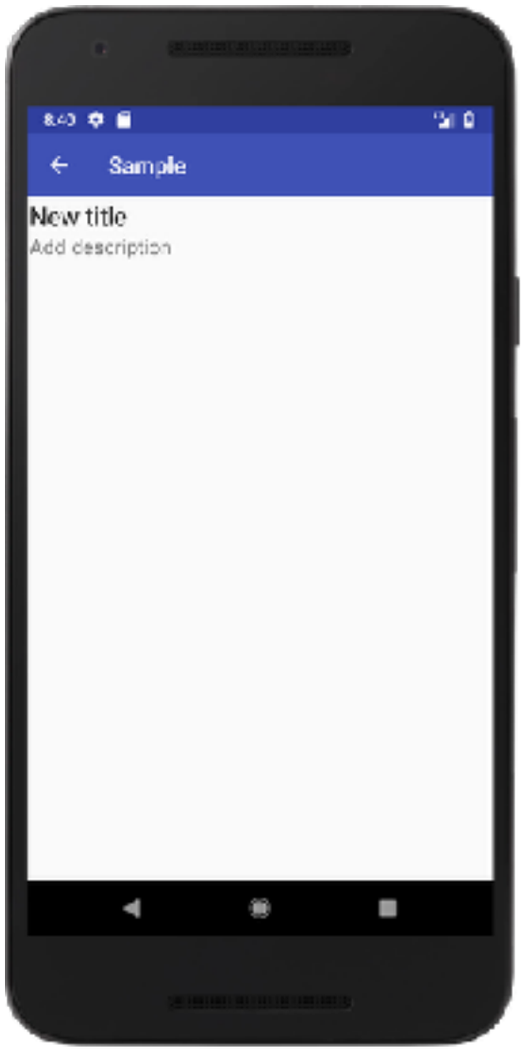
Show detail of note

Main



Detail



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Show detail of note

Create new test class :: NoteDetailScreenTest.kt

```
class NoteDetailScreenTest {
    @get:Rule
    private val rule: ActivityTestRule<NoteDetailActivity> =
            ActivityTestRule(NoteDetailActivity::class.java,
                true,  // Initial touch mode
                false) // Lazily launch activity
```


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Show detail of note

Create a test case

```
@Test
fun show_detail_of_note_in_screen() {
    // Arrange and Act
    val startIntent = Intent()
    // ID of note ?
    startIntent.putExtra(NoteDetailActivity.EXTRA_NOTE_ID, "0")
    rule.launchActivity(startIntent)

    // Assert
    onView(withId(R.id.note_detail_title))
            .check(matches(withText("")))  // Expected value ?
    onView(withId(R.id.note_detail_description))
            .check(matches(withText(""))); // Expected value ?
}
```


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Problem ?

Note ID ?

```
@Test
fun show_detail_of_note_in_screen() {
    // Arrange and Act
    val startIntent = Intent()
    // ID of note ?
    startIntent.putExtra(NoteDetailActivity.EXTRA_NOTE_ID, "0")
    rule.launchActivity(startIntent)

    // Assert
    onView(withId(R.id.note_detail_title))
            .check(matches(withText("")))  // Expected value ?
    onView(withId(R.id.note_detail_description))
            .check(matches(withText(""))); // Expected value ?
}
```


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Problem ?

Expected result/value ?

```
@Test
fun show_detail_of_note_in_screen() {
    // Arrange and Act
    val startIntent = Intent()
    // ID of note ?
    startIntent.putExtra(NoteDetailActivity.EXTRA_NOTE_ID, "0")
    rule.launchActivity(startIntent)

    // Assert
    onView(withId(R.id.note_detail_title))
            .check(matches(withText("")))  // Expected value ?
    onView(withId(R.id.note_detail_description))
            .check(matches(withText(""))); // Expected value ?
}
```


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Your project can test or not ?

Testable application ?

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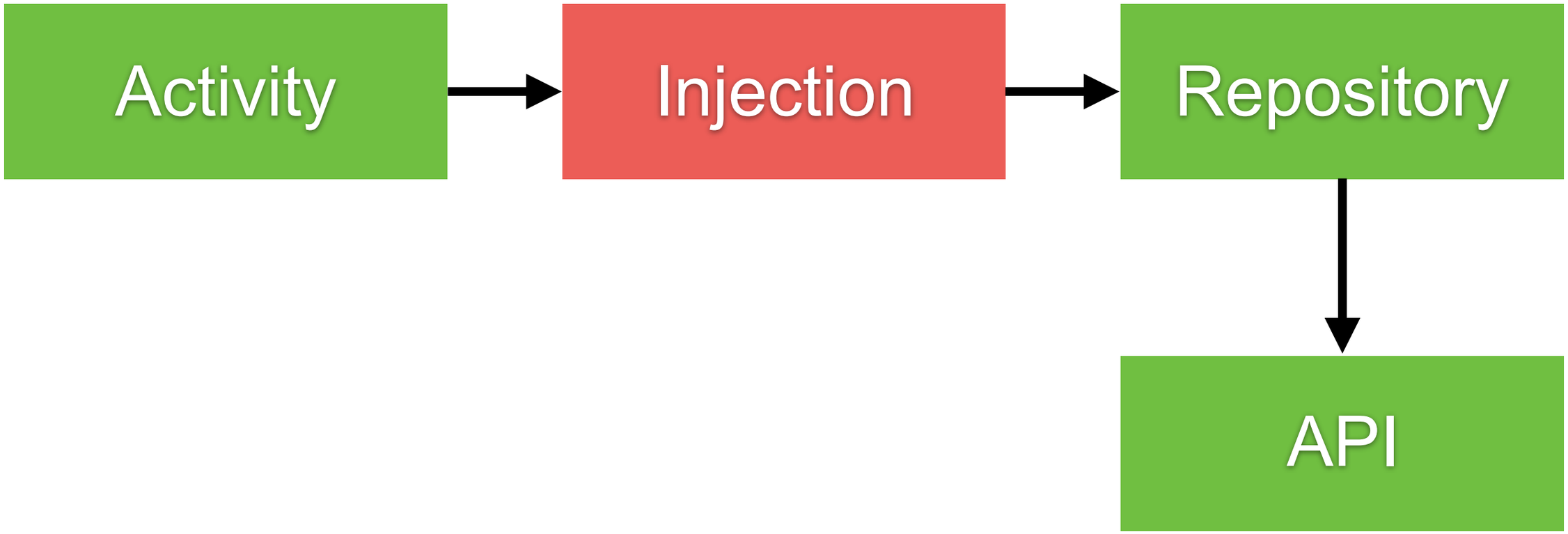
Look inside your project



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Injection.java

Use to create Repository and API

```
public class Injection {
    public static ImageStorage provideImageFile() {
        return new ImageFile();
    }

    public static NoteRepository provideNotesRepository() {
        return new InMemoryNotesRepository(new MockNoteServiceApi());
    }
}
```


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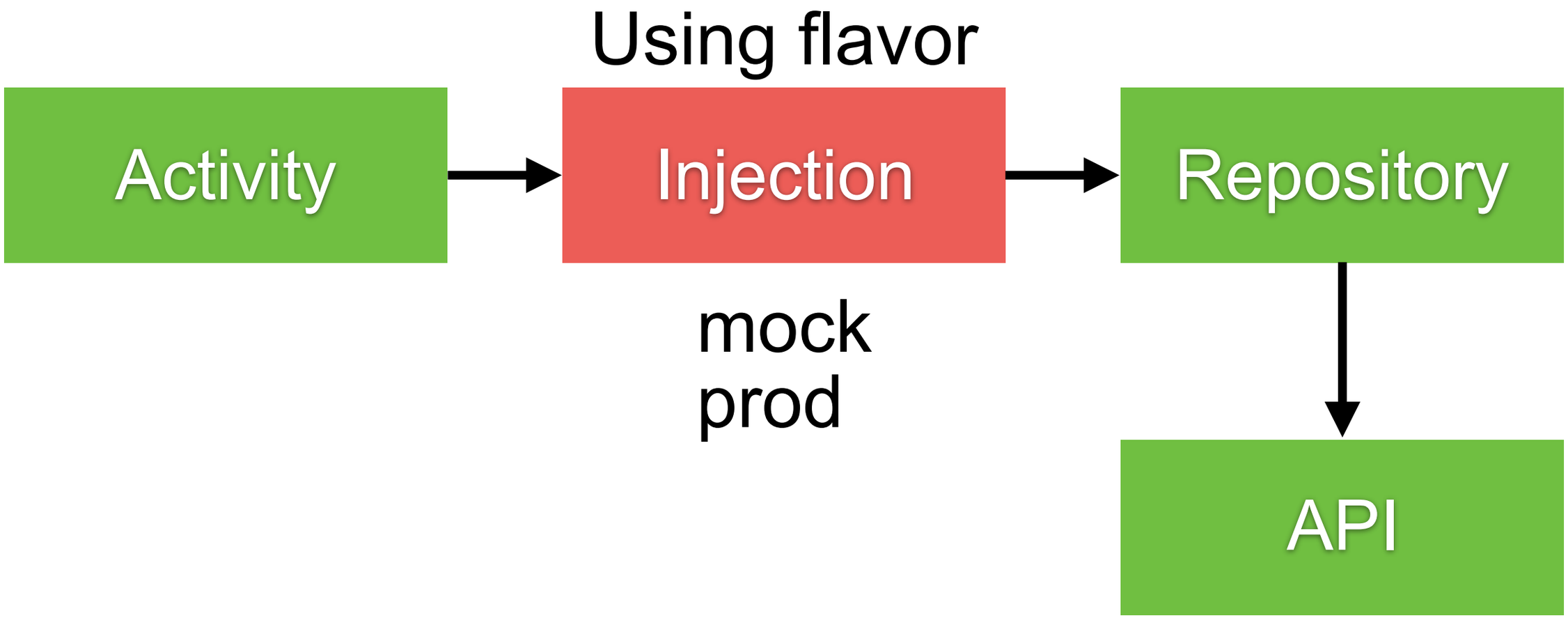
Concept :: More testable



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Add product flavour

To file /app/build.gradle

```
flavorDimensions "mock"

// If you need to add more flavors, consider using flavor dimensions.
productFlavors {
    mock {
        applicationIdSuffix = ".mock"
        dimension "mock"
    }
    prod {

    }
}

// Remove mockRelease as it's not needed.
android.variantFilter { variant ->
    if(variant.buildType.name.equals('release')
            && variant.getFlavors().get(0).name.equals('mock')) {
        variant.setIgnore(true);
    }
}
```

https://github.com/up1/android-testing-workshop/wiki

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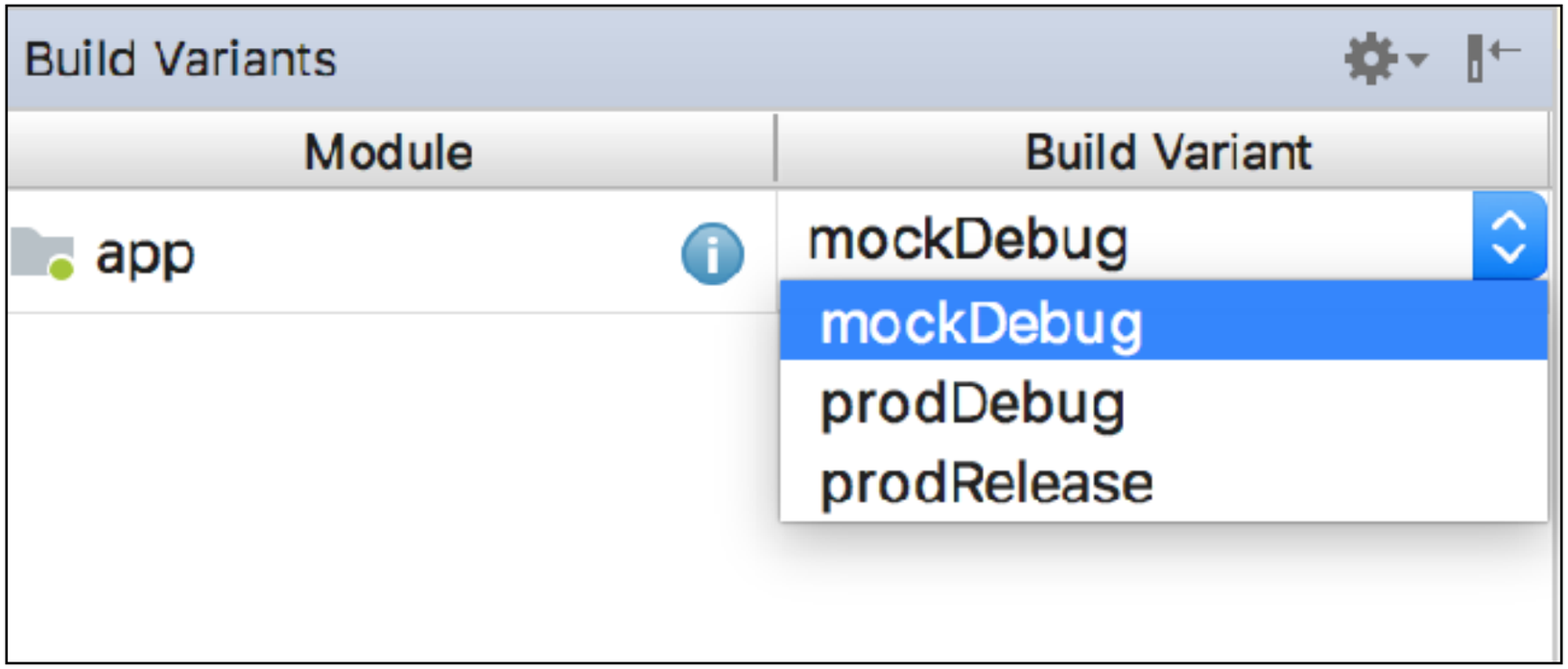
Add product flavour

See result in Build Variants



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Create new folder in /app/src

mock/java/com/example/somkiat/sample
prod/java/com/example/somkiat/sample

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Move class Injection into prod

prod/java/com/example/somkiat/sample

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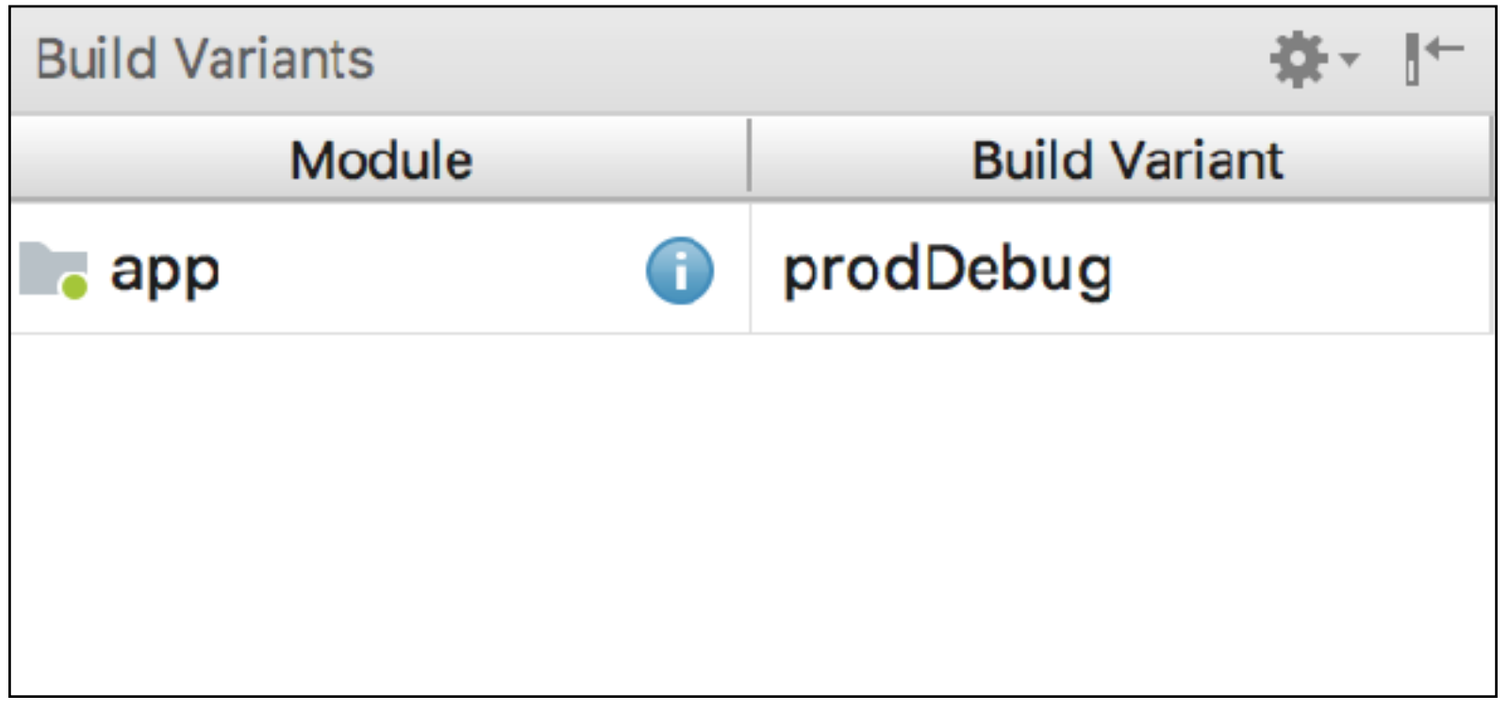
Run with prodDebug



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Run with prodDebug

```
$./gradlew clean connectedProdDebugAndroidTest
```


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Create class Injection in mock

mock/java/com/example/somkiat/sample

```
public class Injection {
    public static ImageStorage provideImageFile() {
        return new FakeImageFile();
    }

    public static NoteRepository provideNotesRepository() {
        return new InMemoryNotesRepository(new FakeNoteServiceApi());
    }
}
```

Create file **FakeNoteServiceApi**

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Create class FakeNoteServiceApi

mock/java/com/example/somkiat/sample

```java
class FakeNoteServiceApi implements NoteServiceApi {
    private static final Map<String, Note> NOTES_SERVICE_DATA = new HashMap<>();

    @Override
    public void getAllNotes(NotesServiceCallback<List<Note>> callback) {
        callback.onLoaded(Lists.newArrayList(NOTES_SERVICE_DATA.values()));
    }

    @Override
    public void getNote(String noteId, NotesServiceCallback<Note> callback) {
        Note note = NOTES_SERVICE_DATA.get(noteId);
        callback.onLoaded(note);
    }

    @Override
    public void saveNote(Note note) {
        NOTES_SERVICE_DATA.put(note.getId(), note);
    }

    @VisibleForTesting
    public static void addNotes(Note... notes) {
        for (Note note : notes) {
            NOTES_SERVICE_DATA.put(note.getId(), note);
        }
    }
}
```

https://github.com/up1/android-testing-workshop/wiki

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Create new folder in /app/src

androidTestMock/java/com/example/somkiat/sample

Move your test class to this folder

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Back to show detail test

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Show detail of note

```
@Test
fun show_detail_of_note_in_screen() {
    // Arrange and Act
    val newNote = Note("Fake title", "Fake description");
    FakeNoteServiceApi.addNotes(newNote);
    val startIntent = Intent()
    startIntent.putExtra(NoteDetailActivity.EXTRA_NOTE_ID, newNote.id)
    rule.launchActivity(startIntent)

    // Assert
    onView(withId(R.id.note_detail_title))
            .check(matches(withText(newNote.title)))
    onView(withId(R.id.note_detail_description))
            .check(matches(withText(newNote.description)));
}
```


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Run with mockDebug

```
$./gradlew clean connectedMockDebugAndroidTest
```


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Test result

Test Summary

4	0	11.064s
tests	failures	duration

100%
successful

Packages Classes

Package	Tests	Failures	Duration	Success rate
com.example.somkiat.sample	2	0	10.707s	100%
com.example.somkiat.sample.addnote	1	0	0.220s	100%
com.example.somkiat.sample.notedetail	1	0	0.137s	100%

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Improve UI Testing with Espresso

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1. Improve test structure

Robot or Page Object pattern

https://martinfowler.com/bliki/PageObject.html

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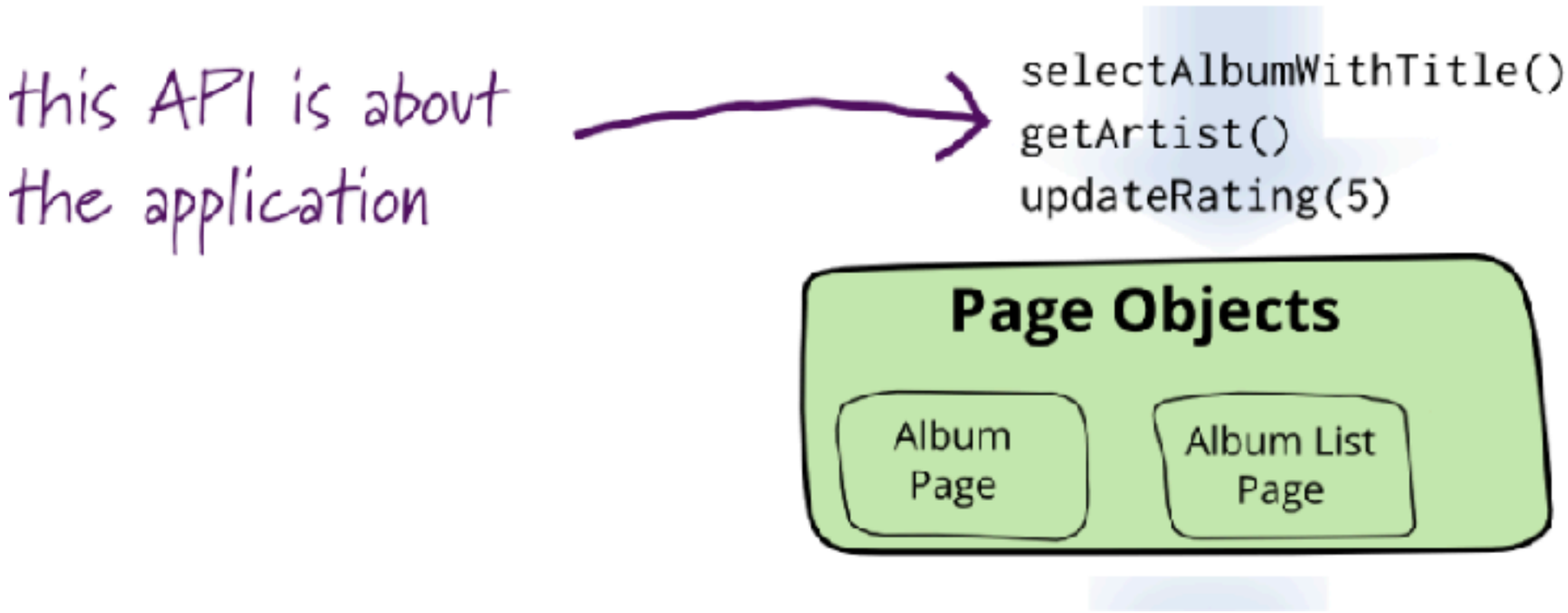
Page Object / Robot pattern



https://proandroiddev.com/kotlin-using-test-robots-to-make-espresso-8cec2d746973

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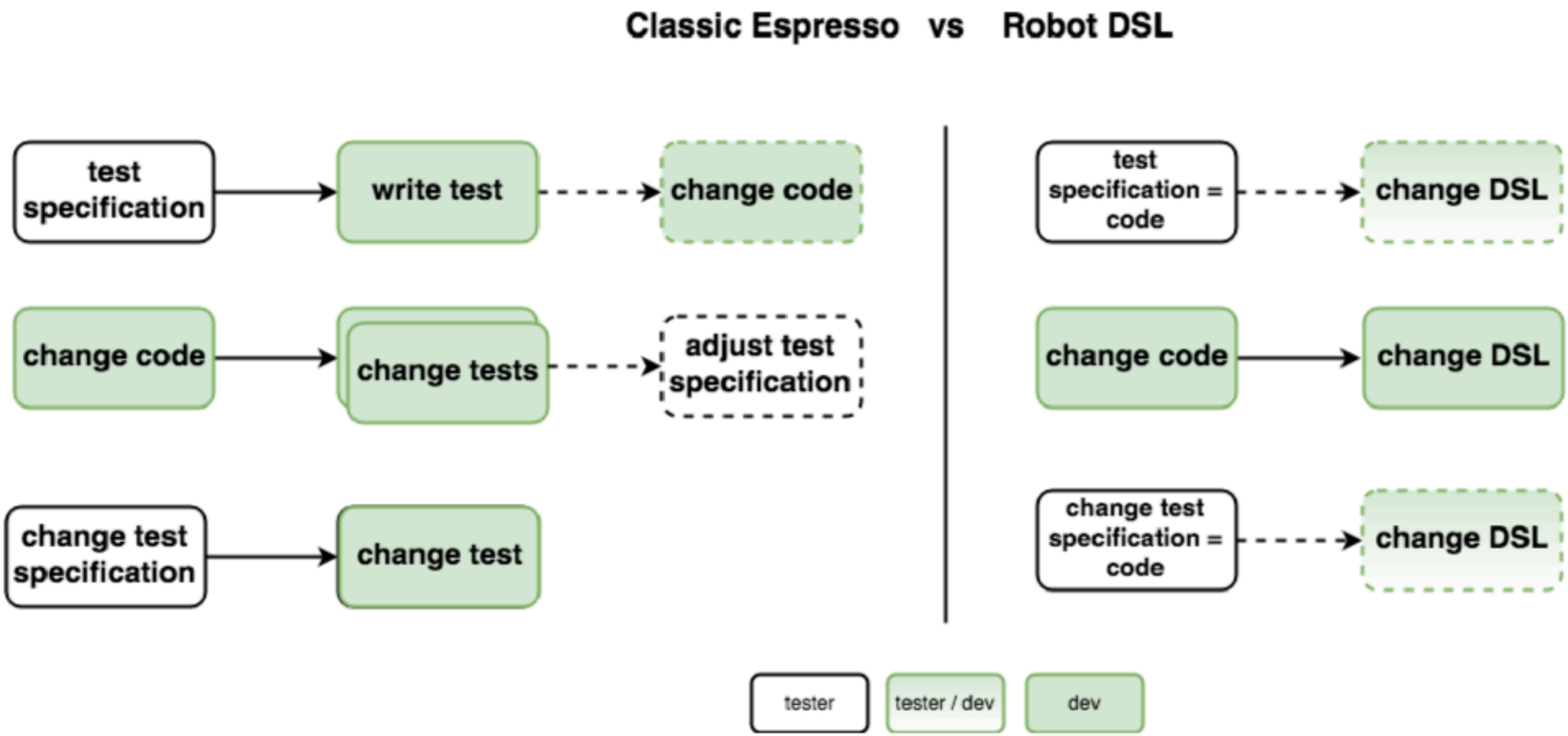
Page Object / Robot pattern



https://proandroiddev.com/kotlin-using-test-robots-to-make-espresso-8cec2d746973

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Easy to read and understand

Robot or Page Object pattern

```
@Test
fun success_with_robot() {
    robot
            .setEmail("somkiat@xxx.com")
            .setPassword("")
            .clickLogin()
            .mustShow( text: "Success")
}
```


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Create Login page

Create file LoginRobot.kt

```
class LoginRobot(val activity: Activity){

    fun setEmail(email: String)
          = apply { fillEditText(R.id.email, email) }
    fun setPassword(password: String)
          = apply { fillEditText(R.id.password, password) }
    fun clickLogin() = apply { clickButton(R.id.email_sign_in_button) }
    fun mustShow(text: String) = apply { toast(text) }
```


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Create Login page

Create file LoginRobot.kt

```
private fun fillEditText(resId: Int, text: String): ViewInteraction =
        onView(withId(resId))
                .perform(replaceText(text),
                        closeSoftKeyboard())

private fun clickButton(resId: Int): ViewInteraction =
        onView((withId(resId))).perform(click())

private fun matchText(viewInteraction: ViewInteraction,
                      text: String): ViewInteraction = viewInteraction
        .check(ViewAssertions.matches(ViewMatchers.withText(text)))
```


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2. Use library/DSL :: Kakao

https://github.com/agoda-com/Kakao

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Add dependencies

In file /app/build.gradle

```
dependencies {
    androidTestImplementation 'com.agoda.kakao:kakao:1.3.0'
}
```


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Easy to read and understand

```
fun success_with_kakao() {
    screen {
        email {
            replaceText("somkiat@xxx.com")
            closeSoftKeyboard()
        }
        password {
            replaceText("")
        }
        login {
            click()
        }
    }
```


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Login Screen

```
open class TestLoginScreen: Screen<TestLoginScreen>() {

    val email: KEditText = KEditText { withId(R.id.email)}
    val password: KEditText = KEditText { withId(R.id.password)}
    val login: KButton = KButton { withId(R.id.email_sign_in_button) }

}
```


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More topics …

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Demo CI/CD with Jenkins

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