Part 1 – Environment Set-up

For this Lab, I have installed Android Studio Version 3.3, SDK Tool version 26.1.1 and Android Platform version – API 28 (Pie).

I have used Google's mobile application development SDK called 'Flutter' to execute lab1. Though we can run the app on both IOS and Android, I have focused and tested on Android Mobile (API 28 – OnePlus5).

Part 2 - Simple Calculator App

To start with, I created a new Flutter Project in Android Studio and provided the path of my flutter SDK folder which contains 'Dart package' (the language of Flutter). In my PC, Dart is located in *C:\Users\Likhith\Documents\flutter\bin\cache\dart-sdk.*

In order to test the app, I have used my Android Device. On successful build and run, the following outputs were captured :-
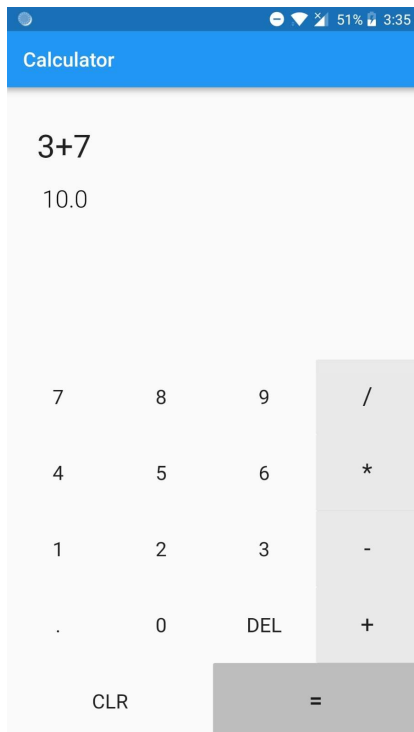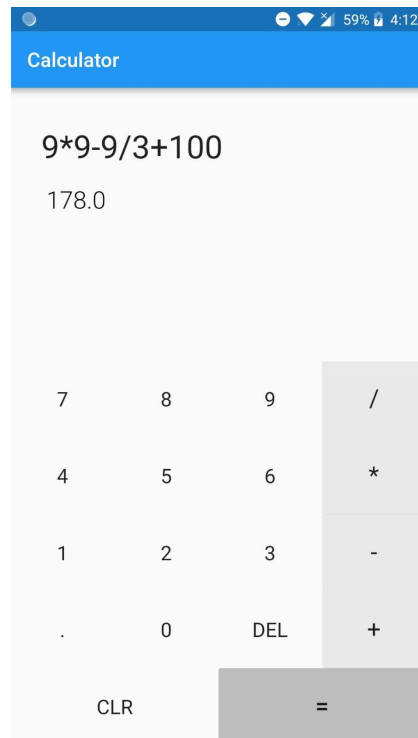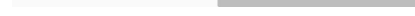
Fig: *Simple addition*   **Fig:** *Solving an expression*

The above figure demonstrates the results of calculator app. Addition, subtraction, multiplication and division are supported and accurate result is shown to the user. Also, the output of the current expression is shown before the user clicks on "=" and thus saving ~1second of the user where he has to manually click on "=" to see the results.

Fig: *Error Handling*

Fig: *Handling screen overflow*

In the above figures, I have tried to show the error handling that is being taken care of, as we know if a number is divided by 0, it results in an exception and causes the application to crash. But, in my application I the exception is handled in a better way and an error message is displayed as shown above.

The right image shows how screen overflow is handled, since I am using a text field, I have used a feature called 'Media Query' available in flutter to check the width of the screen and move to the next line before it crashes with the edge of the screen.

Part 3 - Questions

1. What is difference between Gradle and Maven? Why is Gradle used extensively in Android project developments?

Gradle	Maven
1. It is an open source build automation tool focused on performance and flexibility. 2. Doesn't use XML, it is based on DSL (Domain Specific Language). 3. It is written in Java, Gradle and Kotlin. 4. It supports multi project builds, various ways to manage builds, provides an easy way to migrate and increases productivity.	1. It is a software project management tool that manages project builds, documents and reports. 2. It uses XML(packaged jar file, pom.xml). 3. It is written using Java. 4. It allows transparent migration to latest features and makes the build process easier.

Gradle is extensively used in android application development because it is a plugin based and JVM based build system which is built after the well-established tools like Ant/Maven and thus has overcome their disadvantages and added more features. As a developer, it is important to treat the build code like any another piece of program we write that can be extended, tested and maintained, which can be achieved using Gradle. Gradle scripts are readable as they use groovy instead of xml. It uses less code to achieve same goals as achieved by maven(uses lengthier code).

2. What is project structure in Android Studio? List down the folder structure created for your application.

A *project folder* in android studio includes everything that defines the workspace for an app, which contains source code, assets, test code and build configurations. When you start a new project, android studio creates the necessary structure for all your files and makes them visible in the project window which is present on the left side of the IDE (click on View→Tool →Windows→Project).

The project structure is as follows:-

simple_calculator>.gradle

simple_calculator >.idea

simple_calculator>app>build,libs,src>android Test,main>java>com.example.simple_calculator>simple_calculator.res>Android Manifest.xml,.gitignore,app.iml,build.gradle,proguard-rules.pro

simple_calculator>gradle(.gitignore,build.gradle,gradle.properties,gradlew,gradlew.bat,local.properties, simple_calculator.iml,settings.gradle)

simple_calculator>External Libraries> Dart packages, Dart SDK, Flutter for Android
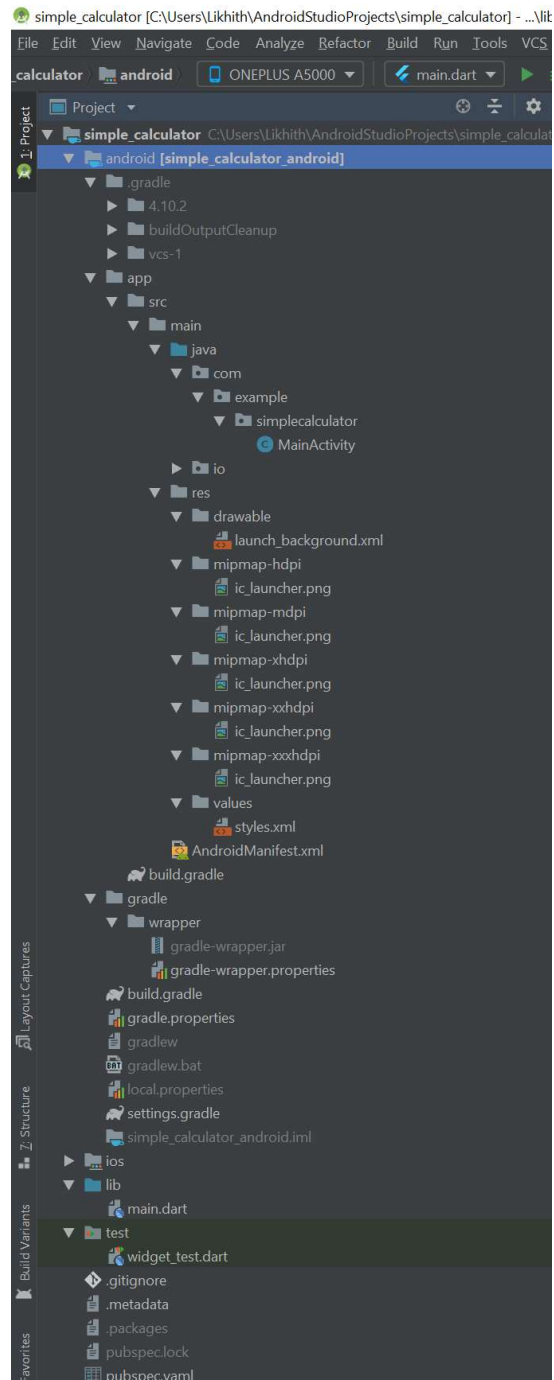
Fig: *Android Project Structure of my Calculator App*

3. What is "adb" and where is it located? What is the importance of "adb"?

ADB - Android Debug Bridge (adb) is a flexible command-line tool which helps the developer to communicate with the android device. i.e. this application will run in your PC(Windows/Mac/Linux) and on your android device. It has 3 components:-

1. **Client** – runs on development machine, which you can invoke via commands (using android studio's terminal window).
2. **Server** - acts as a communication bridge b/w client and server.
3. **Daemon** - a background process on each device.

Also, the adb command facilitates access to a Unix shell which use to run a variety of commands on a device. We can connect to device using USB cable or over a Wi-Fi.

Location of ADB – It is situated in the Android SDK platform-tools package. The below screenshot shows its location in my PC.

Importance of ADB - Helps you to install/uninstall app from the android device , debug the android application etc. One of the commands that helped me in executing this lab was "*adb uninstall 'package-name*"". I had a problem where I was not able install the updated .apk file in to my device in spite of uninstalling existing app (manually) from the device. But, when I used the above command, it automatically deleted the app for all users and installed the updated app for me.
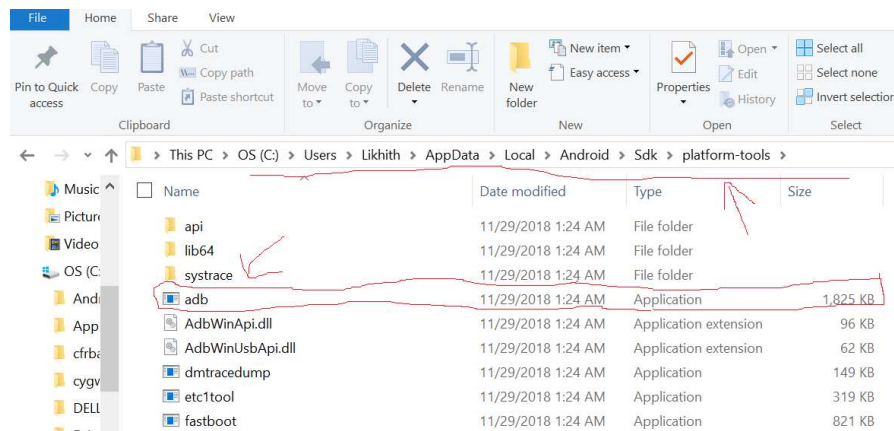

Fig: *Snapshot of Adb location in Windows 10 PC*

4. Use "Android Monitor" for your application and attach screenshots of your application graphs from Android Monitor, in report.

In this Lab, as I have used Flutter, I have attached **Flutter Performance Profiling** screenshots below:-
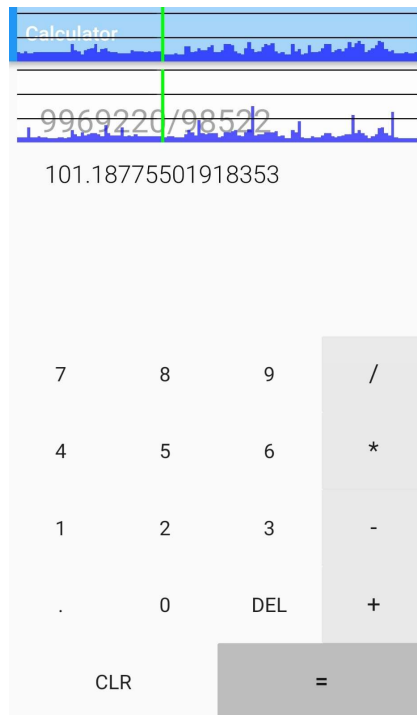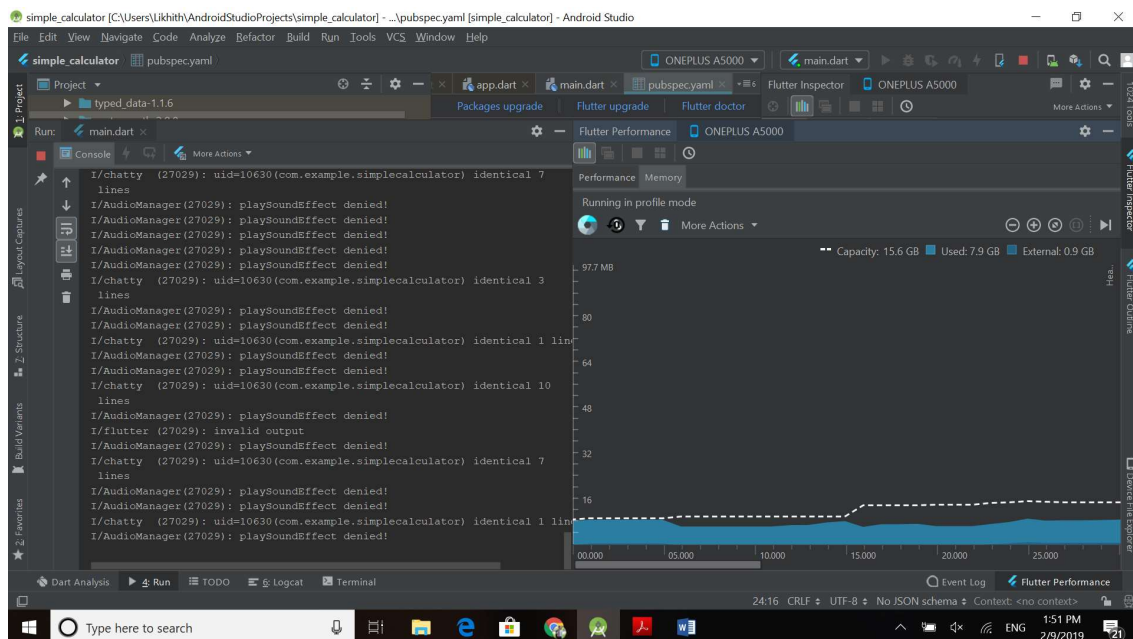

Fig: *Performance recorded on App*
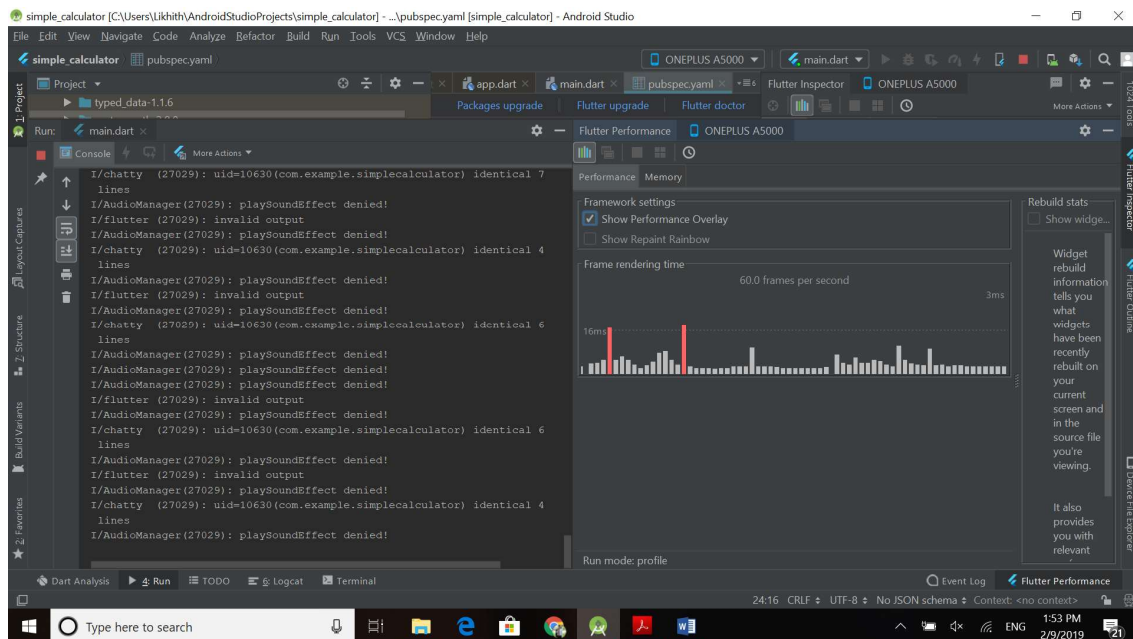
Fig*: Memory usage recorded in Android Studio*

Fig*: Performance of the app recorded in Android Studio*

4. REFERENCES and LINKS

- https://flutter.io/
- Android Programming: The Big Nerd Ranch Guide (By: B. Phillips, C. Stewart, B. Hardy and K. Marsicano)
- https://developer.android.com