**Assignment No: B3**

# 1. TITLE

A mobile application needs to be designed for using a Calculator (+, - ,\*, /, Sin, Cos, sqroot) with Memory Save/Recall using Extended precision floating point number format. Give the Required modeling, Design and Positive-Negative test cases.

# 2. PREREQUISITES

* 64-bit Fedora or equivalent OS with 64-bit Intel-i5/i7
* Java 1.7.0
* Android Studio

# 3. OBJECTIVE

* To learn the Android Studio.
* To study the design and implementation of mobile application for calculator.

**4. THEORY**

# Android Studio Overview

Android Studio is the official IDE for Android application development, based on IntelliJ IDEA.

On top of the capabilities you expect from IntelliJ, Android Studio offers:

* Flexible Gradle-based build system
* Build variants and multiple apk file generation
* Code templates to help you build common app features
* Rich layout editor with support for drag and drop theme editing
* lint tools to catch performance, usability, version compatibility, and other problems
* ProGuard and app-signing capabilities
* Built-in support for Google Cloud Platform, making it easy to integrate Google Cloud Messaging and App Engine
* And much more

# Android Project Structure

By default, Android Studio displays your project files in the *Android* project view. This view shows a flattened version of your project's structure that provides quick access to the key source files of Android projects and helps you work with the Gradle-based build system. The *Android* project view:

* Shows the most important source directories at the top level of the module hierarchy.
* Groups the build files for all modules in a common folder.
* Groups all the manifest files for each module in a common folder.
* Shows resource files from all Gradle source sets.
* Groups resource files for different locales, orientations, and screen types in a single group per resource type

java/ - Source files for the module.

manifests/ - Manifest files for the module.

res/ - Resource files for the module.

Gradle Scripts/ - Gradle build and property files.

**Positive Testing:**

|  |  |  |  |
| --- | --- | --- | --- |
| Test  Case ID | Expected Result | Actual Result | Status |
| 1 | Check if all the numbers are  working ( 0 to 9) | All the numbers are working ( 0 to 9) |  |
| 2 | Check if the arithmetic keys ( +, -, \*, %, /) are working | The arithmetic keys ( +, -, \*, %, /) are working |  |
| 3 | Check if the brackets keys are working | The bracket keys are working |  |
| 4 | Check if the square and square root key is working | The square and square root key is working |  |
| 5 | Check if the sin, cos, tan, cot keys are working | The sin, cos, tan, cot keys are working |  |
| 6 | Check if it is showing the correct values for sin, cos, tan and cot | It is showing the correct values for sin, cos, tan and cot |  |
| 7 | Check the addition of two sin and cos values | The addition of two sin and cos values |  |
| 8 | Check the addition of two tan and cot values | The addition of two tan and cot values |  |
| 9 | Check that it is returning the float values or integer values | It is returning the float values or integer values |  |
| 10 | Check if the functionality using  BODMAS/BIDMAS works as  expected | Working Properly |  |

**Negative Testing:**

|  |  |  |  |
| --- | --- | --- | --- |
| Test  Case ID | Expected Result | Actual Result | Status |
| 1 | Check if it is allowing letters instead of numbers | It is taking only numbers as input |  |
| 2 | Check if it is returning float values instead of integer | It is returning integer values only |  |
| 3 | Check if it is returning integer values instead of float | It is returning float values only |  |
| 4 | Check if the functionality using  BODMAS/BIDMAS works as  expected | Functioning Properly |  |

**5 . MATHEMATICAL MODEL**

Let, S be the System Such that,

A={ S, E, I,O, F, DD, NDD, success, failure }

Where,

S= Start state,

E= End State,

I= Set of Input

O= Set of Out put

F =Set of Function

DD=Deterministic Data

NDD=Non Deterministic Data

Success Case: It is the case when all the inputs are given by system are entered correctly. Failure Case: It is the case when the input does not match the validation Criteria.

**6. APPLICATION FLOW**

1 You can use Android studio IDE/android-adt-bundle to create an Android application under a package com.example.calci.myapplication;. While creating this project, make sure you Target SDK and Compile With at the latest version of Android SDK to use higher levels of APIs.

2 Modify src/MainActivity.java file to add Calculator code.

3 Modify the res/layout/activity\_main to add respective XML components

4 Create a new folder under Calculator

5 Run the application and choose a running android device and install the application on it and verify the results

# 7. CONCLUSION

A mobile application is designed for a Calculator (+, - ,\*, /, Sin, Cos, sq-root) with Memory Save/Recall using Extended precision floating point number format.

**MainActivity.java**

package example.com.calculator;

import java.io.IOException;

import java.text.DecimalFormat;

import android.annotation.SuppressLint;

import android.app.Activity;

import android.os.Bundle;

import android.view.View;

import android.view.View.OnClickListener;

import android.view.Window;

import android.view.WindowManager;

import android.widget.Button;

import android.widget.TextView;

/\*\*

\* Created by -- on 19-03-2016.

\*/

public class MainActivity extends Activity implements OnClickListener {

private TextView mCalculatorDisplay;

private Boolean userIsInTheMiddleOfTypingANumber = false;

private CalculatorBrain mCalculatorBrain;

private static final String DIGITS = "0123456789.";

   DecimalFormat df = new DecimalFormat("@###########");

   @SuppressLint("NewApi")

@Override

protected void onCreate(Bundle savedInstanceState) {

    // hide the window title.

    requestWindowFeature(Window.FEATURE\_NO\_TITLE);

    // hide the status bar and other OS-level chrome

       getWindow().addFlags(WindowManager.LayoutParams.FLAG\_FULLSCREEN);

       super.onCreate(savedInstanceState);

       setContentView(R.layout.activity\_main);

       mCalculatorBrain = new CalculatorBrain();

       mCalculatorDisplay = (TextView) findViewById(R.id.textView1);

       df.setMinimumFractionDigits(0);

       df.setMinimumIntegerDigits(1);

       df.setMaximumIntegerDigits(8);

       findViewById(R.id.button0).setOnClickListener(this);

       findViewById(R.id.button1).setOnClickListener(this);

       findViewById(R.id.button2).setOnClickListener(this);

       findViewById(R.id.button3).setOnClickListener(this);

    findViewById(R.id.button4).setOnClickListener(this);

       findViewById(R.id.button5).setOnClickListener(this);

       findViewById(R.id.button6).setOnClickListener(this);

       findViewById(R.id.button7).setOnClickListener(this);

       findViewById(R.id.button8).setOnClickListener(this);

       findViewById(R.id.button9).setOnClickListener(this);

       findViewById(R.id.buttonAdd).setOnClickListener(this);

       findViewById(R.id.buttonSubtract).setOnClickListener(this);

       findViewById(R.id.buttonMultiply).setOnClickListener(this);

       findViewById(R.id.buttonDivide).setOnClickListener(this);

       findViewById(R.id.buttonToggleSign).setOnClickListener(this);

       findViewById(R.id.buttonDecimalPoint).setOnClickListener(this);

       findViewById(R.id.buttonEquals).setOnClickListener(this);

       findViewById(R.id.buttonClear).setOnClickListener(this);

       findViewById(R.id.buttonClearMemory).setOnClickListener(this);

       findViewById(R.id.buttonAddToMemory).setOnClickListener(this);

       findViewById(R.id.buttonSubtractFromMemory).setOnClickListener(this);

       findViewById(R.id.buttonRecallMemory).setOnClickListener(this);

    if (findViewById(R.id.buttonSquareRoot) != null) {

           findViewById(R.id.buttonSquareRoot).setOnClickListener(this);

    }

    if (findViewById(R.id.buttonSquared) != null) {

           findViewById(R.id.buttonSquared).setOnClickListener(this);

    }

    if (findViewById(R.id.buttonInvert) != null) {

           findViewById(R.id.buttonInvert).setOnClickListener(this);

    }

    if (findViewById(R.id.buttonSine) != null) {

           findViewById(R.id.buttonSine).setOnClickListener(this);

    }

    if (findViewById(R.id.buttonCosine) != null) {

           findViewById(R.id.buttonCosine).setOnClickListener(this);

    }

    if (findViewById(R.id.buttonTangent) != null) {

           findViewById(R.id.buttonTangent).setOnClickListener(this);

    }

}

@Override

public void onClick(View v) {

    String buttonPressed = ((Button) v).getText().toString();

    if (DIGITS.contains(buttonPressed)) {

        // digit was pressed

        if (userIsInTheMiddleOfTypingANumber) {

               if (buttonPressed.equals(".") && mCalculatorDisplay.getText().toString().contains(".")) {

                   // ERROR PREVENTION

                   // Eliminate entering multiple decimals

               } else {

                   mCalculatorDisplay.append(buttonPressed);

           }

        } else {

               if (buttonPressed.equals(".")) {

                   // ERROR PREVENTION

                   // This will avoid error if only the decimal is hit before an operator, by placing a leading zero

                   // before the decimal

                   mCalculatorDisplay.setText(0 + buttonPressed);

               } else {

                   mCalculatorDisplay.setText(buttonPressed);

               }

               userIsInTheMiddleOfTypingANumber = true;

        }

    } else {

        // operation was pressed

        if (userIsInTheMiddleOfTypingANumber) {

               mCalculatorBrain.setOperand(Double.parseDouble(mCalculatorDisplay.getText().toString()));

               userIsInTheMiddleOfTypingANumber = false;

        }

        try {

               mCalculatorBrain.performOperation(buttonPressed);

        } catch (IOException e) {

               e.printStackTrace();

        }

           mCalculatorDisplay.setText(df.format(mCalculatorBrain.getResult()));

    }

}

@Override

protected void onSaveInstanceState(Bundle outState) {

       super.onSaveInstanceState(outState);

    // Save variables on screen orientation change

       outState.putDouble("OPERAND", mCalculatorBrain.getResult());

       outState.putDouble("MEMORY", mCalculatorBrain.getMemory());

}

@Override

protected void onRestoreInstanceState(Bundle savedInstanceState) {

       super.onRestoreInstanceState(savedInstanceState);

    // Restore variables on screen orientation change

       mCalculatorBrain.setOperand(savedInstanceState.getDouble("OPERAND"));

       mCalculatorBrain.setMemory(savedInstanceState.getDouble("MEMORY"));

       mCalculatorDisplay.setText(df.format(mCalculatorBrain.getResult()));

  }

}

**CalculatorBrain.java**

package example.com.calculator;

import android.content.Context;

import java.io.FileOutputStream;

import java.io.IOException;

import java.io.OutputStreamWriter;

/\*\*

\* Created by -- on 19-03-2016.

\*/

public class CalculatorBrain {

// 3 + 6 = 9

// 3 & 6 are called the operand.

// The + is called the operator.

// 9 is the result of the operation.

private double mOperand;

private double mWaitingOperand;

private String mWaitingOperator;

private double mCalculatorMemory;

// operator types

public static final String ADD = "+";

public static final String SUBTRACT = "-";

public static final String MULTIPLY = "\*";

public static final String DIVIDE = "/";

public static final String CLEAR = "C" ;

public static final String CLEARMEMORY = "MC";

public static final String ADDTOMEMORY = "M+";

public static final String SUBTRACTFROMMEMORY = "M-";

public static final String RECALLMEMORY = "MR";

public static final String SQUAREROOT = "√";

public static final String SQUARED = "x²";

public static final String INVERT = "1/x";

public static final String TOGGLESIGN = "+/-";

public static final String SINE = "sin";

public static final String COSINE = "cos";

public static final String TANGENT = "tan";

// public static final String EQUALS = "=";

// constructor

public CalculatorBrain() {

    // initialize variables upon start

       mOperand = 0;

       mWaitingOperand = 0;

       mWaitingOperator = "";

       mCalculatorMemory = 0;

}

public void setOperand(double operand) {

       mOperand = operand;

}

public double getResult() {

    return mOperand;

}

// used on screen orientation change

public void setMemory(double calculatorMemory) {

       mCalculatorMemory = calculatorMemory;

}

// used on screen orientation change

public double getMemory() {

    return mCalculatorMemory;

}

public String toString() {

    return Double.toString(mOperand);

}

protected double performOperation(String operator) throws IOException {

    if (operator.equals(CLEAR)) {

           mOperand = 0;

           mWaitingOperator = "";

           mWaitingOperand = 0;

        // mCalculatorMemory = 0;

    } else if (operator.equals(CLEARMEMORY)) {

           mCalculatorMemory = 0;

    } else if (operator.equals(ADDTOMEMORY)) {

           mCalculatorMemory = mCalculatorMemory + mOperand;

    } else if (operator.equals(SUBTRACTFROMMEMORY)) {

           mCalculatorMemory = mCalculatorMemory - mOperand;

    } else if (operator.equals(RECALLMEMORY)) {

           mOperand = mCalculatorMemory;

    } else if (operator.equals(SQUAREROOT)) {

           mOperand = Math.sqrt(mOperand);

    } else if (operator.equals(SQUARED)) {

           mOperand = mOperand \* mOperand;

    } else if (operator.equals(INVERT)) {

        if (mOperand != 0) {

               mOperand = 1 / mOperand;

        }

    } else if (operator.equals(TOGGLESIGN)) {

           mOperand = -mOperand;

    } else if (operator.equals(SINE)) {

           mOperand = Math.sin(Math.toRadians(mOperand)); // Math.toRadians(mOperand) converts result to degrees

    } else if (operator.equals(COSINE)) {

           mOperand = Math.cos(Math.toRadians(mOperand)); // Math.toRadians(mOperand) converts result to degrees

    } else if (operator.equals(TANGENT)) {

           mOperand = Math.tan(Math.toRadians(mOperand)); // Math.toRadians(mOperand) converts result to degrees

    } else {

           performWaitingOperation();

        mWaitingOperator = operator;

           mWaitingOperand = mOperand;

    }

    return mOperand;

}

protected void performWaitingOperation() {

    if (mWaitingOperator.equals(ADD)) {

           mOperand = mWaitingOperand + mOperand;

   } else if (mWaitingOperator.equals(SUBTRACT)) {

           mOperand = mWaitingOperand - mOperand;

    } else if (mWaitingOperator.equals(MULTIPLY)) {

           mOperand = mWaitingOperand \* mOperand;

    } else if (mWaitingOperator.equals(DIVIDE)) {

        if (mOperand != 0) {

               mOperand = mWaitingOperand / mOperand;

        }

    }

}

}

**activity\_main.xml (in res/layout)**

<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"

   android:id="@+id/functionPad"

   android:layout\_width="match\_parent"

   android:layout\_height="match\_parent"

   android:layout\_gravity="center"

   android:orientation="vertical"

   android:paddingBottom="@dimen/activity\_vertical\_margin"

   android:paddingLeft="@dimen/activity\_horizontal\_margin"

   android:paddingRight="@dimen/activity\_horizontal\_margin"

   android:paddingTop="@dimen/activity\_vertical\_margin" >

   <LinearLayout

       android:id="@+id/row1"

    android:layout\_width="match\_parent"

       android:layout\_height="0dp"

       android:layout\_weight=".12" >

       <TextView

           android:id="@+id/textView1"

           android:layout\_width="match\_parent"

           android:layout\_height="wrap\_content"

           android:gravity="right"

           android:maxLines="1"

           android:paddingLeft="10dp"

           android:paddingRight="10dp"

           android:text="0"

           android:textAppearance="?android:attr/textAppearanceLarge"

           android:textSize="40sp" />

   </LinearLayout>

   <LinearLayout

       android:id="@+id/row2"

       android:layout\_width="match\_parent"

       android:layout\_height="0dp"

       android:layout\_weight=".12" >

       <Button

           android:id="@+id/buttonClearMemory"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonClearMemory"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonAddToMemory"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonAddToMemory"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonSubtractFromMemory"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

       android:layout\_weight=".25"

           android:text="@string/buttonSubtractFromMemory"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonRecallMemory"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonRecallMemory"

           android:textSize="25sp" />

   </LinearLayout>

   <LinearLayout

       android:id="@+id/row7"

       android:layout\_width="match\_parent"

       android:layout\_height="0dp"

       android:layout\_weight=".12" >

       <Button

           android:id="@+id/buttonSquareRoot"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonSquareRoot"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonSquared"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonSquared"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonInvert"

           android:layout\_width="0dp"

      android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonInvert"

           android:textSize="17sp" />

       <Button

           android:id="@+id/buttonSine"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonSine"

           android:textSize="17sp" />

       <Button

           android:id="@+id/buttonCosine"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonCosine"

           android:textSize="17sp" />

       <Button

           android:id="@+id/buttonTangent"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonTangent"

           android:textSize="17sp" />

   </LinearLayout>

<LinearLayout

       android:id="@+id/row3"

       android:layout\_width="match\_parent"

       android:layout\_height="0dp"

       android:layout\_weight=".12" >

       <Button

           android:id="@+id/buttonClear"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonClear"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonToggleSign"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonToggleSign"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonDivide"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonDivide"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonMultiply"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonMultiply"

           android:textSize="25sp" />

   </LinearLayout>

   <LinearLayout

       android:id="@+id/row4"

       android:layout\_width="match\_parent"

       android:layout\_height="0dp"

       android:layout\_weight=".12" >

       <Button

           android:id="@+id/button7"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/button7"

           android:textSize="25sp" />

       <Button

           android:id="@+id/button8"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/button8"

           android:textSize="25sp" />

       <Button

           android:id="@+id/button9"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/button9"

           android:textSize="25sp" />

       <Button

       android:id="@+id/buttonSubtract"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonSubtract"

           android:textSize="25sp" />

   </LinearLayout>

   <LinearLayout

       android:id="@+id/row5"

       android:layout\_width="match\_parent"

       android:layout\_height="0dp"

       android:layout\_weight=".12" >

       <Button

           android:id="@+id/button4"

        android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/button4"

           android:textSize="25sp" />

       <Button

           android:id="@+id/button5"

       android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/button5"

           android:textSize="25sp" />

       <Button

           android:id="@+id/button6"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/button6"

           android:textSize="25sp" />

       <Button

           android:id="@+id/buttonAdd"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonAdd"

           android:textSize="25sp" />

</LinearLayout>

   <LinearLayout

       android:id="@+id/row6"

       android:layout\_width="match\_parent"

       android:layout\_height="0dp"

       android:layout\_weight=".24"

       android:baselineAligned="false" >

       <LinearLayout

       android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".75"

           android:orientation="vertical" >

           <LinearLayout

               android:id="@+id/linearLayout1"

               android:layout\_width="match\_parent"

               android:layout\_height="0dp"

               android:layout\_weight=".50"

               android:textSize="25sp" >

               <Button

                   android:id="@+id/button1"

                   android:layout\_width="0dp"

                   android:layout\_height="match\_parent"

                   android:layout\_weight=".33"

                   android:text="@string/button1"

                   android:textSize="25sp" />

           <Button

                   android:id="@+id/button2"

                   android:layout\_width="0dp"

                   android:layout\_height="match\_parent"

                   android:layout\_weight=".33"

                   android:text="@string/button2"

                   android:textSize="25sp" />

               <Button

                   android:id="@+id/button3"

                   android:layout\_width="0dp"

                   android:layout\_height="match\_parent"

                   android:layout\_weight=".34"

                   android:text="@string/button3"

                   android:textSize="25sp" />

           </LinearLayout>

           <LinearLayout

               android:id="@+id/linearLayout2"

               android:layout\_width="match\_parent"

               android:layout\_height="0dp"

               android:layout\_weight=".50" >

               <Button

                   android:id="@+id/button0"

                   android:layout\_width="0dp"

                   android:layout\_height="match\_parent"

                   android:layout\_weight=".66"

                   android:text="@string/button0"

                   android:textSize="25sp" />

               <Button

                   android:id="@+id/buttonDecimalPoint"

                   android:layout\_width="0dp"

                   android:layout\_height="match\_parent"

                   android:layout\_weight=".34"

                   android:text="@string/buttonDecimalPoint"

               android:textSize="25sp" />

           </LinearLayout>

       </LinearLayout>

       <Button

           android:id="@+id/buttonEquals"

           android:layout\_width="0dp"

           android:layout\_height="match\_parent"

           android:layout\_weight=".25"

           android:text="@string/buttonEquals"

           android:textSize="25sp" />

   </LinearLayout>

</LinearLayout>

**strings.xml (in res/values)**

<?xml version="1.0" encoding="utf-8"?>

<resources>

<string name="app\_name">Calculator</string>

<string name="menu\_settings">Settings</string>

<string name="action\_settings">Settings</string>

<string name="button0">0</string>

<string name="button1">1</string>

<string name="button2">2</string>

<string name="button3">3</string>

<string name="button4">4</string>

<string name="button5">5</string>

<string name="button6">6</string>

<string name="button7">7</string>

<string name="button8">8</string>

<string name="button9">9</string>

<string name="buttonAdd">+</string>

<string name="buttonSubtract">-</string>

<string name="buttonMultiply">\*</string>

<string name="buttonDivide">/</string>

<string name="buttonToggleSign">+/-</string>

<string name="buttonDecimalPoint">.</string>

<string name="buttonEquals">=</string>

<string name="buttonClear">C</string>

<string name="buttonClearMemory">MC</string>

<string name="buttonAddToMemory">M+</string>

<string name="buttonSubtractFromMemory">M-</string>

<string name="buttonRecallMemory">MR</string>

<string name="buttonSquareRoot">√</string>

<string name="buttonSquared">x²</string>

<string name="buttonInvert">1/x</string>

<string name="buttonSine">sin</string>

<string name="buttonCosine">cos</string>

<string name="buttonTangent">tan</string>

</resources>

