Parul® University
Vadodara, Gujarat

NAAC GRADE A++

FACULTY OF ENGINEERING AND
TECHNOLOGY BACHELOR OF TECHNOLOGY

MOBILE APP DEVELOPMENT LABORATORY
(303105380)

VI SEMESTER

CSE Department

Laboratory Manual
Session 2025-26

CERTIFICATE

This is to certify that

Mr / Ms _____ with enrollment no. _____ has successfully completed his/her laboratory experiments in the **Mobile App Development** (303105380) from the department of **COMPUTER SCIENCE & ENGINEERING** during the academic year 2025-2026.

Date of Submission:..... Staff In charge:.....

Head Of Department:.....

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9.	Create a shopping list app using checkboxes: Build an app with checkboxes for shopping list items. As items are checked off, the selected items should be displayed in a TextView.						
10.	Create a login and registration app: Develop a login application that verifies the username and password. Include a registration page for new users. Upon successful login, show a "Welcome User" pop-up message						
11.	Create a login app with navigation to another activity: The login screen should verify the username and password. After successful login, navigate to a new activity that displays a "Welcome User" message in a TextView and a "Logout" button. On clicking "Logout," show a confirmation dialog with "OK" and "Cancel" buttons. "OK" should return to the login screen, while "Cancel" should keep the user on the current activity.						
12.	Create an app with a menu: Implement a menu with five options. The selected option should be displayed in a TextView.						
13.	Build an app using LinearLayout: Create a simple app that uses LinearLayout. It should take the contents of a predefined TextView, convert it to uppercase on button click, and display it in an EditText. Additionally, create an app that responds to key events in the EditText without needing a button press						
14.	Create an app with TableLayout and custom styles: Use a TableLayout with a TextView, EditText, and buttons. Also, create a custom styles.xml in the res/values directory to style the TextView.						
15.	Create an app with SQLite database operations: Build an app that allows the user to perform CRUD operations (Create, Read, Update, Delete) with an SQLite database						
16.	Create an app with three vertically aligned buttons: Develop an app with three buttons arranged vertically. When any button is selected, the screen color should change accordingly.						

PRACTICAL NO: 01

AIM: To develop an Android application that displays “Hello World” at the center of the screen.

THEORY: A basic Android app uses TextView inside a layout. The setContentView() method loads the UI on the screen. The gravity attribute is used to center the text.

CODE SNIPPET:

activity_main.xml code:

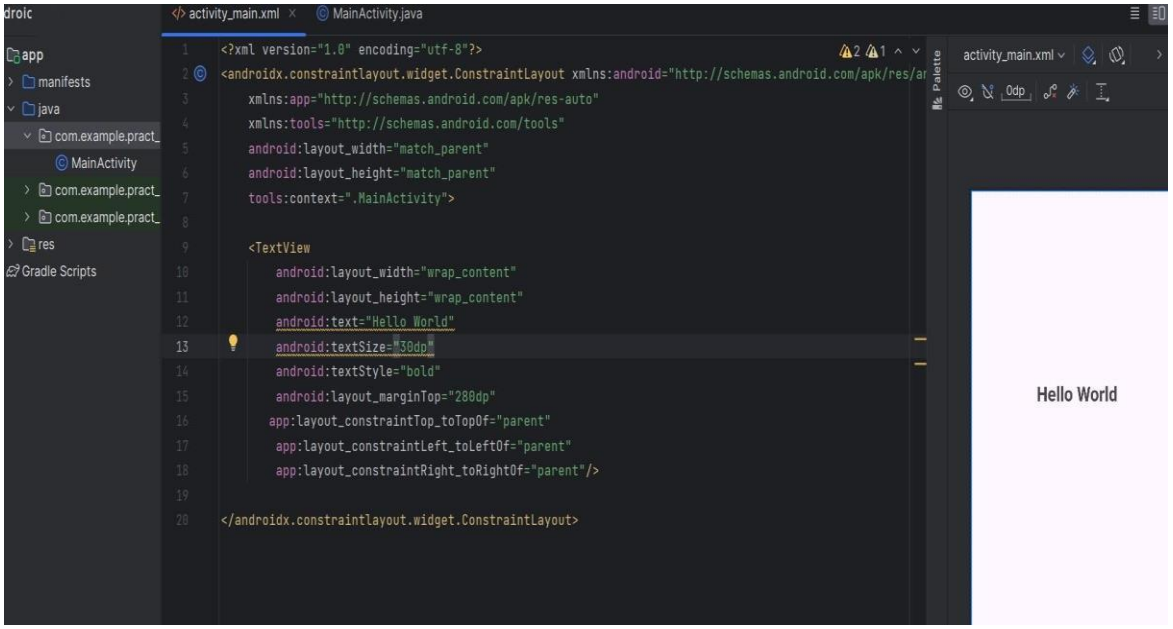
```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity">
    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="HelloWorld"
        android:textSize="30dp"
        android:textStyle="bold"
        android:layout_marginTop="280dp"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintLeft_toLeftOf="parent"
        app:layout_constraintRight_toRightOf="parent"/>

</androidx.constraintlayout.widget.ConstraintLayout>
```

MainActivity.java code:

```
package com.example.pract_4_hello_world;
import androidx.appcompat.app.AppCompatActivity;
import android.os.Bundle;
public class MainActivity extends AppCompatActivity {
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
    }
}
```

OUTPUT:



PRACTICAL NO: 2

AIM: To develop an app that displays messages for each lifecycle method.

THEORY: Android Activity lifecycle describes the states an activity goes through from creation to destruction. Understanding lifecycle is essential for correct resource management, persisting UI state, and responding to configuration changes.

Common lifecycle callbacks:

- onCreate(Bundle savedInstanceState) — called once when activity is first created. Initialize UI, restore state.
- onStart() — activity becomes visible to the user (but not yet interactive).
- onResume() — activity starts interacting with the user (at top of the stack). Register listeners, start animations.
- onPause() — activity is partially obscured (e.g., another semi-transparent activity on top) or user is leaving; quick operations, persist lightweight data.
- onStop() — activity no longer visible. Release resources that aren't needed while visible.
- onRestart() — called when activity moves from stopped to started again.
- onDestroy() — final cleanup before activity is removed from memory (may not be called if system kills process).

Common user actions and lifecycle effects:

- Rotate device (configuration change): default behavior destroys and recreates activity, so you will see onPause → onStop → onDestroy → onCreate → onStart → onResume. (You can override this with configChanges, but in this lab we keep default.)
- Tap Home: onPause → onStop. Returning: onRestart → onStart → onResume.
- Open new activity: current activity onPause (maybe onStop if fully hidden); new activity onCreate → onStart → onResume.
- Press Back on an activity: onPause → onStop → onDestroy.

This app logs lifecycle callbacks to:

1. Android Logcat (Log.d) — useful for debugging.
2. Toasts — brief on-screen messages for immediate observation.
3. A scrollable TextView that accumulates lifecycle events for demonstration and printing.

CODE SNIPPET:

activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/rootLayout"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:padding="12dp">
```

```
<TextView
    android:id="@+id/titleTxt"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Lifecycle Demo - MainActivity"
    android:textSize="20sp"
    android:gravity="center"
    android:padding="8dp" />

<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    android:layout_marginTop="8dp"
    android:gravity="center">

    <Button
        android:id="@+id/btnOpenSecond"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Open Second Activity" />

    <Button
        android:id="@+id/btnClear"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Clear Log"
        android:layout_marginStart="12dp" />
</LinearLayout>

<TextView
    android:id="@+id/logLabel"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Lifecycle Events:"
    android:layout_marginTop="12dp"
    android:textStyle="bold" />

<ScrollView
    android:id="@+id/scrollView"
    android:layout_width="match_parent"
    android:layout_height="0dp"
    android:layout_weight="1"
    android:fillViewport="true"
    android:background="#F6F6F6"
    android:padding="8dp">

    <TextView
        android:id="@+id/logTextView"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text=""
        android:textSize="14sp" />
```

```
    </ScrollView>

</LinearLayout>
```

activity_second.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:id="@+id/rootSecond"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:padding="12dp">

    <TextView
        android:id="@+id/titleSecond"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Lifecycle Demo - SecondActivity"
        android:textSize="20sp"
        android:gravity="center"
        android:padding="8dp" />

    <Button
        android:id="@+id/btnFinish"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Finish (Back)" />

    <TextView
        android:id="@+id/logTextViewSecond"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Events will appear here..."
        android:layout_marginTop="12dp" />
</LinearLayout>
```

MainActivity.java

```
package com.example.lifecycle;

import android.content.Intent;
import android.os.Bundle;
import android.util.Log;
import android.view.View;
import android.widget.Button;
import android.widget.ScrollView;
import android.widget.TextView;
import android.widget.Toast;

import androidx.appcompat.app.AppCompatActivity;
```

```
public class MainActivity extends AppCompatActivity {
    private static final String TAG = "MainActivityLifecycle";
    private TextView logTextView;
    private ScrollView scrollView;
    private Button btnOpenSecond, btnClear;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        logTextView = findViewById(R.id.logTextView);
        scrollView = findViewById(R.id.scrollView);
        btnOpenSecond = findViewById(R.id.btnOpenSecond);
        btnClear = findViewById(R.id.btnClear);

        btnOpenSecond.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View view) {
                Intent i = new Intent(MainActivity.this, SecondActivity.class);
                startActivity(i);
            }
        });

        btnClear.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View view) {
                logTextView.setText("");
            }
        });

        logAndShow("onCreate");
    }

    @Override
    protected void onStart() {
        super.onStart();
        logAndShow("onStart");
    }

    @Override
    protected void onResume() {
        super.onResume();
        logAndShow("onResume");
    }

    @Override
    protected void onPause() {
        super.onPause();
        logAndShow("onPause");
    }

    @Override
    protected void onStop() {
```

```
        super.onStop();
        logAndShow("onStop");
    }

    @Override
    protected void onRestart() {
        super.onRestart();
        logAndShow("onRestart");
    }

    @Override
    protected void onDestroy() {
        super.onDestroy();
        logAndShow("onDestroy");
    }

    private void logAndShow(String methodName) {
        String message = methodName + " called at " + System.currentTimeMillis();
        // log to Logcat
        Log.d(TAG, message);
        // show Toast
        Toast.makeText(this, methodName, Toast.LENGTH_SHORT).show();
        // append to on-screen log
        logTextView.append(methodName + "\n");
        // scroll to bottom so latest event is visible
        scrollView.post(new Runnable() {
            @Override
            public void run() {
                scrollView.fullScroll(View.FOCUS_DOWN);
            }
        });
    }
}
```

SecondActivity.java

```
package com.example.lifecycle;

import android.os.Bundle;
import android.util.Log;
import android.view.View;
import android.widget.Button;
import android.widget.TextView;
import android.widget.Toast;

import androidx.appcompat.app.AppCompatActivity;

public class SecondActivity extends AppCompatActivity {
    private static final String TAG = "SecondActivityLifecycle";
    private TextView logTextViewSecond;
    private Button btnFinish;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_second);
        logTextViewSecond = findViewById(R.id.logTextViewSecond);
        btnFinish = findViewById(R.id.btnFinish);

        btnFinish.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View view) {
                finish(); // ends this activity and returns to MainActivity
            }
        });

        logAndShow("onCreate");
    }

    @Override
    protected void onStart() {
        super.onStart();
        logAndShow("onStart");
    }

    @Override
    protected void onResume() {
        super.onResume();
        logAndShow("onResume");
    }

    @Override
    protected void onPause() {
        super.onPause();
        logAndShow("onPause");
    }
```

```
    @Override
    protected void onStop() {
        super.onStop();
        logAndShow("onStop");
    }

    @Override
    protected void onRestart() {
        super.onRestart();
        logAndShow("onRestart");
    }

    @Override
    protected void onDestroy() {
        super.onDestroy();
        logAndShow("onDestroy");
    }

    private void logAndShow(String methodName) {
        String message = methodName + " called";
        Log.d(TAG, message);
        Toast.makeText(this, methodName, Toast.LENGTH_SHORT).show();
        // Append to TextView (simple)
        logTextViewSecond.append(methodName + "\n");
    }
}
```

OUTPUT :

PRACTICAL NO: 03

AIM: To develop an Android application with two activities where the first activity takes user input from an EditText and sends it to the second activity using an explicit intent, and the second activity displays the received message in a TextView.

CODE SNIPPET:

activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:padding="20dp">

    <EditText
        android:padding="50dp"
        android:layout_margin="@android:dimen/app_icon_size"
        android:id="@+id/etMessage"
        android:layout_width="match_parent"
        android:layout_height="150dp"
        android:hint="Enter Your Message"
        android:gravity="top"
        android:inputType="textMultiLine"/>

    <Button
        android:id="@+id/btnSend"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginTop="16dp"
        android:text="Send" />


</LinearLayout>
```

activity_second.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:gravity="center"
    android:padding="20dp">
```

```
    <TextView
        android:id="@+id/tvMessage"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:textSize="20sp"
        android:textStyle="bold"/>

    <Button
        android:id="@+id/btnGoBack"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="30dp"
        android:text="Go Back to First Screen"
        android:textSize="16sp"/>

</LinearLayout>
```

MainActivity.java

```
package com.example.intentdemo;
import android.content.Intent;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.Toast;

import androidx.appcompat.app.AppCompatActivity;

public class MainActivity extends AppCompatActivity {


    EditText etMessage;
    Button btnSend;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        etMessage = findViewById(R.id.etMessage);
        btnSend = findViewById(R.id.btnSend);

        btnSend.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
```

```
            String message = etMessage.getText().toString();

            Intent intent = new Intent(MainActivity.this, SecondActivity.class);
            intent.putExtra("msg", message);
            startActivity(intent)          ;
        }
    }
    );
}
```

SecondActivity.java

```
import android.content.Intent;
import android.os.Bundle;
import android.widget.Button;
import android.widget.TextView;

import androidx.appcompat.app.AppCompatActivity;

public class SecondActivity extends AppCompatActivity {

    TextView tvMessage;
    Button btnGoBack;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_second);

        tvMessage = findViewById(R.id.tvMessage);
        btnGoBack = findViewById(R.id.btnGoBack);

        // Get data from Intent
        String receivedMessage = getIntent().getStringExtra("msg");

        tvMessage.setText(receivedMessage);

        btnGoBack.setOnClickListener(v -> {
            finish(); // Back to MainActivity
        });
    }
}
```

OUTPUT:

PRACTICAL NO: 04

AIM: To create an Android application where the first activity contains an EditText and a Send button. When the button is clicked, an implicit intent with the **SEND** action is used to open an app chooser so the user can select any supported application (Messages, Email, WhatsApp, Notes, etc.) to display/share the entered text.

CODE SNIPPET:

activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:id="@+id/main"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:padding="16dp"
    tools:context=".MainActivity">

    <EditText
        android:id="@+id/editTextMessage"
        android:layout_width="0dp"
        android:layout_height="wrap_content"
        android:layout_marginTop="100dp"
        android:hint="Enter your message here"
        android:inputType="textMultiLine"
        android:minLines="5"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent" />

    <Button
        android:id="@+id/buttonSend"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginTop="24dp"
        android:text="Send"
        android:textSize="16sp"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
```

```
app:layout_constraintTop_toBottomOf="@+id/editTextMessage" />

</androidx.constraintlayout.widget.ConstraintLayout>
```

MainActivity.java

```
package com.example.implicitintentapp;


import android.content.Intent;
import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.Toast;

import androidx.activity.EdgeToEdge;
import androidx.appcompat.app.AppCompatActivity;
import androidx.core.graphics.Insets;
import androidx.core.view.ViewCompat;
import androidx.core.view.WindowInsetsCompat;

public class MainActivity extends AppCompatActivity {

    private EditText editTextMessage;
    private Button buttonSend;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        EdgeToEdge.enable(this);
        setContentView(R.layout.activity_main);

        editTextMessage = findViewById(R.id.editTextMessage);
        buttonSend = findViewById(R.id.buttonSend);

        buttonSend.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                sendMessage();
            }
        });
```

```
    }

    private void sendMessage() {
        String message = editTextMessage.getText().toString().trim();

        if (message.isEmpty()) {
            Toast.makeText(this, "Please enter a message",
Toast.LENGTH_SHORT).show();
            return;
        }

        Intent sendIntent = new Intent();

sendIntent.setAction(Intent.ACTION_SEND).putExtra(Intent.EXTRA_
TEXT, message).setType("text/plain");
        Intent chooser = Intent.createChooser(sendIntent, "Send
message via:");

        if (sendIntent.resolveActivity(getPackageManager()) != null) {
            startActivity(chooser);
        } else {
            Toast.makeText(this, "No apps available to handle this action",
Toast.LENGTH_SHORT).show();
        }
    }
}

}
```

OUTPUT:

PRACTICAL NO : 05

AIM: To create an Android application that performs basic arithmetic operations such as **addition, subtraction, multiplication, and division** on two numbers entered by the user.

CODE SNIPPET:

activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:id="@+id/main"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    android:padding="20dp"
    android:background="@drawable/gradient_background"
    tools:context=".MainActivity">

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="0dp"
        android:layout_weight="1"
        android:orientation="vertical"
        android:background="@drawable/display_background"
        android:elevation="8dp"
        android:padding="24dp"
        android:layout_marginBottom="24dp">

        <TextView
            android:id="@+id/tvSecondaryDisplay"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:gravity="end"
            android:text=""
            android:textColor="#80FFFFFF"
            android:textSize="18sp"
            android:fontFamily="sans-serif-light"
            android:layout_marginBottom="8dp"
            android:minHeight="24dp" />

        <TextView
            android:id="@+id/tvDisplay"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:gravity="end|center_vertical"
            android:text="0"
            android:textColor="#FFFFFF"
            android:textSize="48sp"
```

```
        android:fontFamily="sans-serif-light"
        android:layout_gravity="bottom"
        android:maxLines="1"
        android:autoSizeTextType="uniform"
        android:autoSizeMinTextSize="24sp"
        android:autoSizeMaxTextSize="48sp" />

    </LinearLayout>

    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:orientation="vertical">

        <LinearLayout
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:orientation="horizontal"
            android:layout_marginBottom="12dp">

            <Button
                android:id="@+id/btnClear"
                style="@style/CalculatorButtonSecondary"
                android:layout_width="0dp"
                android:layout_weight="2"
                android:text="AC"
                android:textSize="20sp" />

            <Button
                android:id="@+id/btnBackspace"
                style="@style/CalculatorButtonSecondary"
                android:layout_width="0dp"
                android:layout_weight="1"
                android:text="⌫"
                android:textSize="20sp" />

            <Button
                android:id="@+id/btnDivide"
                style="@style/CalculatorButtonOperator"
                android:layout_width="0dp"
                android:layout_weight="1"
                android:text="÷" />
        </LinearLayout>

        <LinearLayout
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:orientation="horizontal"
            android:layout_marginBottom="12dp">
```

```
    <Button
        android:id="@+id/btn7"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="7" />

    <Button
        android:id="@+id/btn8"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="8" />

    <Button
        android:id="@+id/btn9"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="9" />

    <Button
        android:id="@+id/btnMultiply"
        style="@style/CalculatorButtonOperator"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="×" />
</LinearLayout>

<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    android:layout_marginBottom="12dp">

    <Button
        android:id="@+id/btn4"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="4" />

    <Button
        android:id="@+id/btn5"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="5" />

    <Button
        android:id="@+id/btn6"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
```

```
        android:layout_weight="1"
        android:text="6" />

    <Button
        android:id="@+id/btnSubtract"
        style="@style/CalculatorButtonOperator"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="−" />
</LinearLayout>

<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="horizontal"
    android:layout_marginBottom="12dp">

    <Button
        android:id="@+id/btn1"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="1" />

    <Button
        android:id="@+id/btn2"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="2" />

    <Button
        android:id="@+id/btn3"
        style="@style/CalculatorButtonNumber"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="3" />

    <Button
        android:id="@+id/btnAdd"
        style="@style/CalculatorButtonOperator"
        android:layout_width="0dp"
        android:layout_weight="1"
        android:text="+" />
</LinearLayout>

<LinearLayout
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:orientation="horizontal">

    <Button
        android:id="@+id/btn0"
```

```
            style="@style/CalculatorButtonNumber"
            android:layout_width="0dp"
            android:layout_weight="2"
            android:text="0" />

        <Button
            android:id="@+id/btnDecimal"
            style="@style/CalculatorButtonNumber"
            android:layout_width="0dp"
            android:layout_weight="1"
            android:text="." />

        <Button
            android:id="@+id/btnEquals"
            style="@style/CalculatorButtonEquals"
            android:layout_width="0dp"
            android:layout_weight="1"
            android:text="=" />
    </LinearLayout>

  </LinearLayout>

</LinearLayout>
```

MainActivity.java

```
package com.example.calculator;

import android.os.Bundle;
import android.view.View;
import android.widget.Button;
import android.widget.LinearLayout;
import android.widget.TextView;
import android.widget.Toast;

import androidx.activity.EdgeToEdge;
import androidx.appcompat.app.AppCompatActivity;
import androidx.core.graphics.Insets;
import androidx.core.view.ViewCompat;
import androidx.core.view.WindowInsetsCompat;

public class MainActivity extends AppCompatActivity implements
View.OnClickListener {

    private TextView tvDisplay;
    private TextView tvSecondaryDisplay;
```

```
    private String currentNumber = "";
    private String operator = "";
    private String firstNumber = "";
    private boolean isNewOperation = true;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        EdgeToEdge.enable(this);
        setContentView(R.layout.activity_main);
        ViewCompat.setOnApplyWindowInsetsListener(findViewById(R.id.main),
(v, insets) -> {
            Insets systemBars =
insets.getInsets(WindowInsetsCompat.Type.systemBars());
            v.setPadding(systemBars.left, systemBars.top, systemBars.right,
systemBars.bottom);
            return insets;
        });

        initializeViews();
        setClickListeners();
    }

    private void initializeViews() {
        tvDisplay = findViewById(R.id.tvDisplay);
        tvSecondaryDisplay = findViewById(R.id.tvSecondaryDisplay);
    }

    private void setClickListeners() {
        findViewById(R.id.btn0).setOnClickListener(this);
        findViewById(R.id.btn1).setOnClickListener(this);
        findViewById(R.id.btn2).setOnClickListener(this);
        findViewById(R.id.btn3).setOnClickListener(this);
        findViewById(R.id.btn4).setOnClickListener(this);
        findViewById(R.id.btn5).setOnClickListener(this);
        findViewById(R.id.btn6).setOnClickListener(this);
        findViewById(R.id.btn7).setOnClickListener(this);
        findViewById(R.id.btn8).setOnClickListener(this);
        findViewById(R.id.btn9).setOnClickListener(this);
```

```
        findViewById(R.id.btnAdd).setOnClickListener(this);
        findViewById(R.id.btnSubtract).setOnClickListener(this);
        findViewById(R.id.btnMultiply).setOnClickListener(this);
        findViewById(R.id.btnDivide).setOnClickListener(this);
        findViewById(R.id.btnEquals).setOnClickListener(this);

        findViewById(R.id.btnClear).setOnClickListener(this);
        findViewById(R.id.btnBackspace).setOnClickListener(this);
        findViewById(R.id.btnDecimal).setOnClickListener(this);
    }

    @Override
    public void onClick(View v) {
        Button button = (Button) v;
        String buttonText = button.getText().toString();

        int id = v.getId();

        if (id == R.id.btn0 || id == R.id.btn1 || id == R.id.btn2 || id == R.id.btn3 ||
            id == R.id.btn4 || id == R.id.btn5 || id == R.id.btn6 || id == R.id.btn7 ||
            id == R.id.btn8 || id == R.id.btn9) {
            handleNumberInput(buttonText);
        } else if (id == R.id.btnDecimal) {
            handleDecimalInput();
        } else if (id == R.id.btnAdd || id == R.id.btnSubtract || id == R.id.btnMultiply
|| id == R.id.btnDivide) {
            handleOperatorInput(buttonText);
        } else if (id == R.id.btnEquals) {
            handleEqualsInput();
        } else if (id == R.id.btnClear) {
            handleClearInput();
        } else if (id == R.id.btnBackspace) {
            handleBackspaceInput();
        }
    }

    private void handleNumberInput(String number) {
        if (isNewOperation) {
```

```
            currentNumber = number;
            isNewOperation = false;
        } else {
            if (currentNumber.equals("0")) {
                currentNumber = number;
            } else {
                currentNumber += number;
            }
        }
        updateDisplay(currentNumber);
    }

    private void handleDecimalInput() {
        if (isNewOperation) {
            currentNumber = "0.";
            isNewOperation = false;
        } else if (!currentNumber.contains(".")) {
            if (currentNumber.isEmpty()) {
                currentNumber = "0.";
            } else {
                currentNumber += ".";
            }
        }
        updateDisplay(currentNumber);
    }

    private void handleOperatorInput(String op) {
        if (!currentNumber.isEmpty()) {
            if (!firstNumber.isEmpty() && !operator.isEmpty()) {
                handleEqualsInput();
                firstNumber = currentNumber;
            } else {
                firstNumber = currentNumber;
            }

            String displayOp = op;
            switch (op) {
                case "×":
                    operator = "*";
                    break;
```

```
            case "÷":
                operator = "/";
                break;
            case "−":
                operator = "-";
                displayOp = "−";
                break;
            default:
                operator = op;
                break;
            }

            updateSecondaryDisplay(firstNumber + " " + displayOp);
            currentNumber = "";
            isNewOperation = true;
        }
    }

    private void handleEqualsInput() {
        if (!firstNumber.isEmpty() && !currentNumber.isEmpty() &&
!operator.isEmpty()) {
            try {
                double num1 = Double.parseDouble(firstNumber);
                double num2 = Double.parseDouble(currentNumber);
                double result = 0;

                switch (operator) {
                case "+":
                    result = num1 + num2;
                    break;
                case "-":
                    result = num1 - num2;
                    break;
                case "*":
                    result = num1 * num2;
                    break;
                case "/":
                    if (num2 != 0) {
```

```
                    result = num1 / num2;
                } else {
                    Toast.makeText(this, "Cannot divide by zero",
Toast.LENGTH_SHORT).show();
                    return;
                }
                break;
            }

            String resultString;
            if (result == (long) result) {
                resultString = String.valueOf((long) result);
            } else {
                resultString = String.valueOf(result);
            }

            currentNumber = resultString;
            updateDisplay(currentNumber);

            firstNumber = "";
            operator = "";
            isNewOperation = true;
            updateSecondaryDisplay("");

        } catch (NumberFormatException e) {
            Toast.makeText(this, "Invalid calculation",
Toast.LENGTH_SHORT).show();
            handleClearInput();
        }
    }
}

private void handleClearInput() {
    currentNumber = "";
    firstNumber = "";
    operator = "";
    isNewOperation = true;
    updateDisplay("0");
    updateSecondaryDisplay("");
}
```

```
    private void handleBackspaceInput() {
        if (!currentNumber.isEmpty() && !isNewOperation) {
            currentNumber = currentNumber.substring(0, currentNumber.length() -
1);
            if (currentNumber.isEmpty()) {
                updateDisplay("0");
                isNewOperation = true;
            } else {
                updateDisplay(currentNumber);
            }
        }
    }

    private void updateDisplay(String value) {
        if (value.isEmpty()) {
            tvDisplay.setText("0");
        } else {
            tvDisplay.setText(value);
        }
    }

    private void updateSecondaryDisplay(String value) {
        tvSecondaryDisplay.setText(value);
    }
}
```

res/values/themes.xml

```
<resources xmlns:tools="http://schemas.android.com/tools">
    <!-- Base application theme. -->
    <style name="Base.Theme.Calculator"
    parent="Theme.Material3.DayNight.Dialog.Alert">
        <item name="colorPrimary">#1E1E1E</item>
        <item name="colorPrimaryVariant">#000000</item>
        <item name="colorOnPrimary">#FFFFFF</item>
        <item name="android:statusBarColor">@android:color/transparent</item>
        <item
    name="android:navigationBarColor">@android:color/transparent</item>
        <item name="android:windowLightStatusBar">false</item>
    </style>
```

```
    <style name="Theme.Calculator" parent="Base.Theme.Calculator" />

    <style name="CalculatorButtonBase"
parent="Widget.Material3.Button.UnelevatedButton">
        <item name="android:layout_height">72dp</item>
        <item name="android:layout_margin">6dp</item>
        <item name="android:textSize">28sp</item>
        <item name="android:fontFamily">sans-serif-light</item>
        <item name="cornerRadius">20dp</item>
        <item name="android:elevation">0dp</item>
        <item name="android:stateListAnimator">@null</item>
        <item name="rippleColor">#40FFFFFF</item>
    </style>

    <style name="CalculatorButtonNumber" parent="CalculatorButtonBase">
        <item name="android:textColor">#FFFFFF</item>
        <item name="backgroundTint">#2D2D2D</item>
        <item name="android:textSize">32sp</item>
    </style>

    <style name="CalculatorButtonOperator" parent="CalculatorButtonBase">
        <item name="android:textColor">#FFFFFF</item>
        <item name="backgroundTint">#FF9500</item>
        <item name="android:textSize">32sp</item>
        <item name="android:fontFamily">sans-serif</item>
    </style>

    <style name="CalculatorButtonSecondary" parent="CalculatorButtonBase">
        <item name="android:textColor">#1E1E1E</item>
        <item name="backgroundTint">#A6A6A6</item>
        <item name="android:textSize">24sp</item>
        <item name="android:fontFamily">sans-serif-medium</item>
    </style>

    <style name="CalculatorButtonEquals" parent="CalculatorButtonBase">
        <item name="android:textColor">#FFFFFF</item>
        <item name="backgroundTint">#FF9500</item>
        <item name="android:textSize">36sp</item>
        <item name="android:fontFamily">sans-serif-light</item>
    </style>
</resources>
```

res/drawable/button_number_ selector.xml

```
<?xml version="1.0" encoding="utf-8"?>
<selector xmlns:android="http://schemas.android.com/apk/res/android">
   <item android:state_pressed="true">
      <shape android:shape="rectangle">
         <solid android:color="#404040" />
         <corners android:radius="20dp" />
      </shape>
   </item>
   <item>
      <shape android:shape="rectangle">
         <solid android:color="#2D2D2D" />
         <corners android:radius="20dp" />
      </shape>
   </item>
</selector>
```

res/drawable/button_operator_selector.xml

```
<?xml version="1.0" encoding="utf-8"?>
<selector xmlns:android="http://schemas.android.com/apk/res/android">
   <item android:state_pressed="true">
      <shape android:shape="rectangle">
         <solid android:color="#FFB84D" />
         <corners android:radius="20dp" />
      </shape>
   </item>
   <item>
      <shape android:shape="rectangle">
         <solid android:color="#FF9500" />
         <corners android:radius="20dp" />
      </shape>
   </item>
</selector>
```

res/drawable/display_background.xml

```
<?xml version="1.0" encoding="utf-8"?>
<shape xmlns:android="http://schemas.android.com/apk/res/android">
   <gradient
      android:angle="90"
      android:startColor="#3A3A3A"
      android:endColor="#2A2A2A"
      android:type="linear" />
```

```
    <corners android:radius="24dp" />
    <stroke
        android:width="1dp"
        android:color="#4A4A4A" />
</shape>
```

res/drawable/gradient_background.xml

```
<?xml version="1.0" encoding="utf-8"?>
<shape xmlns:android="http://schemas.android.com/apk/res/android">
    <gradient
        android:angle="135"
        android:startColor="#1E1E1E"
        android:centerColor="#2D2D2D"
        android:endColor="#1A1A1A"
        android:type="linear" />
</shape>
```

OUTPUT: