

Exercise 1 - Designing Health Insurance Form using GUI Components

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CSE-B

Aim

Generate a Health Insurance registration form to register the patient details under each group.

Patient Details - Title, Patient Name, Patient Phone Number (Mobile or Landline use Checkbox), Address, Age, DOB, Gender, Marital Status

Employer Details - Patient Employer, Employment Status (full time, parttime, unemployed, retired, student, other Checkbox)

Emergency contact Details - Name, Relationship, Address, Phone Number

Use Submit (Button) to submit the details and display the contents. Use the Reset button to clear the form. Display using Table layout.

Code

activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<ScrollView 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">
    <LinearLayout
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        android:layout_marginLeft="16dp"
        android:layout_marginRight="16dp"
        android:layout_marginBottom="8dp"
        android:orientation="vertical"
        tools:context=".MainActivity">
        <TextView
            android:id="@+id/titleTextView"
            android:layout_width="match_parent"
            android:layout_height="128dp"
            android:gravity="center"
            android:text="Health Insurance Registration"
            android:textSize="32sp"
            android:textStyle="bold"
            android:typeface="serif" >
        <TextView
            android:id="@+id/title"
            android:layout_width="match_parent"
            android:layout_height="32dp"
            android:gravity="left"
            android:text="Patient Details"
            android:textSize="22sp"
            android:textStyle="bold"
            android:typeface="serif" >
        <TextView
            android:id="@+id/name"
```

```

        android:layout_width="match_parent"
        android:layout_height="26dp"
        android:layout_marginTop="16dp"
        android:gravity="left"
        android:text="Name"
        android:textSize="18sp"
        android:textStyle="bold"
        android:typeface="normal" >
<EditText
    android:id="@+id/editName"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Name:"
    android:inputType="text"
    android:textColor="#0000FF"
    android:typeface="sans" >
<TextView
    android:id="@+id/number"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="Number"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<RadioGroup
    android:id="@+id/radio_group_id"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_marginTop="4dp">
    <RadioButton
        android:id="@+id/phone_radio_button_id"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Phone" >
    <RadioButton
        android:id="@+id/landline_radio_button_id"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Landline" >
</RadioGroup>
<EditText
    android:id="@+id/editNumber"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Number:"
    android:inputType="phone" >
<TextView
    android:id="@+id/address"
    android:layout_width="match_parent"

```

```

        android:layout_height="26dp"
        android:layout_marginTop="16dp"
        android:gravity="left"
        android:text="Address"
        android:textSize="18sp"
        android:textStyle="bold"
        android:typeface="normal" >
<EditText
    android:id="@+id/editAddress"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Address:"
    android:inputType="text"
    android:textColor="#0000FF"
    android:typeface="sans" >
<TextView
    android:id="@+id/age"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="Age"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<EditText
    android:id="@+id/editAge"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Age:"
    android:inputType="number"
    android:textColor="#0000FF"
    android:typeface="sans" >
<TextView
    android:id="@+id/dob"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="DOB"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<DatePicker
    android:id="@+id/dobPicker"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:gravity="center" >

```

```

<TextView
    android:id="@+id/gender"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="Gender"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<RadioGroup
    android:id="@+id/gender_group"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_marginTop="4dp">
    <RadioButton
        android:id="@+id/male"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Male" >

    <RadioButton
        android:id="@+id/female"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="Female" >
</RadioGroup>
<TextView
    android:id="@+id/marital_status"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="Marital Status"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<Spinner
    android:id="@+id/marital_status_spinner"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:entries="@array/marital_status_options" >
<TextView
    android:id="@+id/employer"
    android:layout_width="match_parent"
    android:layout_height="32dp"
    android:layout_marginTop="48dp"
    android:gravity="left"
    android:text="Employer Details"
    android:textSize="22sp"

```

```

        android:textStyle="bold"
        android:typeface="serif" >
<TextView
    android:id="@+id/employer_name"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="Employer Name"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<EditText
    android:id="@+id/editEmployerName"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Employer Name:"
    android:inputType="text"
    android:textColor="#0000FF"
    android:typeface="sans" >
<TextView
    android:id="@+id/employment_status"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="Employment Status"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<Spinner
    android:id="@+id/employment_status_spinner"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:entries="@array/employment_status_options" >
<TextView
    android:id="@+id/emergency"
    android:layout_width="match_parent"
    android:layout_height="32dp"
    android:layout_marginTop="48dp"
    android:gravity="left"
    android:text="Emergency Details"
    android:textSize="22sp"
    android:textStyle="bold"
    android:typeface="serif" >
<TextView
    android:id="@+id/emergency_name"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"

```

```

        android:text="Emergency Contact Name"
        android:textSize="18sp"
        android:textStyle="bold"
        android:typeface="normal" >
<EditText
    android:id="@+id/edit_emergency_name"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Employer Contact Name:"
    android:inputType="text"
    android:textColor="#0000FF"
    android:typeface="sans" >
<TextView
    android:id="@+id/emergency_relationship"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="Relationship"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<EditText
    android:id="@+id/edit_emergency_relationship"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Relationship:"
    android:inputType="text"
    android:textColor="#0000FF"
    android:typeface="sans" >
<TextView
    android:id="@+id/emergency_address"
    android:layout_width="match_parent"
    android:layout_height="26dp"
    android:layout_marginTop="16dp"
    android:gravity="left"
    android:text="Address"
    android:textSize="18sp"
    android:textStyle="bold"
    android:typeface="normal" >
<EditText
    android:id="@+id/edit_emergency_address"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Address:"
    android:inputType="text"
    android:textColor="#0000FF"
    android:typeface="sans" >
<TextView

```

```

        android:id="@+id/emergency_phone"
        android:layout_width="match_parent"
        android:layout_height="26dp"
        android:layout_marginTop="16dp"
        android:gravity="left"
        android:text="Phone"
        android:textSize="18sp"
        android:textStyle="bold"
        android:typeface="normal" >
<EditText
    android:id="@+id/edit_emergency_phone"
    android:layout_width="match_parent"
    android:layout_height="54dp"
    android:hint="Phone Number:"
    android:inputType="phone"
    android:textColor="#0000FF"
    android:typeface="sans" >
<Button
    android:id="@+id/submit"
    android:layout_width="match_parent"
    android:layout_height="64dp"
    android:layout_marginTop="32dp"
    android:backgroundTint="#4CAF50"
    android:gravity="center"
    android:hint="Register"
    android:onClick="openTableActivity" > <Button

    android:id="@+id/reset"
    android:layout_width="match_parent"
    android:layout_height="64dp"
    android:layout_marginTop="16dp"
    android:backgroundTint="#F44336"
    android:gravity="center"
    android:hint="Reset"
    android:onClick="resetFormFields" >
/LinearLayout>
/ScrollView>

```

MainActivity.java

```

package com.example.a1;
import android.content.Intent;
import android.support.v7.app.AppCompatActivity; import
android.os.Bundle;
import android.view.View;
import android.widget.DatePicker;
import android.widget.EditText;
import android.widget.RadioButton;
import android.widget.Spinner;
import java.util.Calendar;
public class MainActivity extends AppCompatActivity {

```

```

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

public void openTableActivity(View view) {
    Intent intent = new Intent(this, TableActivity.class);
    intent.putExtra("name", ((EditText)
findViewById(R.id.editName)).getText().toString()); if (((RadioButton)
findViewById(R.id.phone_radio_button_id)).isChecked())
    intent.putExtra("number_type", "Phone");
    else if (((RadioButton)
findViewById(R.id.phone_radio_button_id)).isChecked())
    intent.putExtra("number_type", "Landline");
    intent.putExtra("number", ((EditText)
findViewById(R.id.editNumber)).getText().toString());
    intent.putExtra("address", ((EditText)
findViewById(R.id.editAddress)).getText().toString());
    intent.putExtra("age", ((EditText)
findViewById(R.id.editAge)).getText().toString());
    DatePicker datePicker = findViewById(R.id.dobPicker);
    int day = datePicker.getDayOfMonth();
    int month = datePicker.getMonth();
    int year = datePicker.getYear();
    Calendar calendar = Calendar.getInstance();
    calendar.set(year, month, day);
    intent.putExtra("dob", calendar.getTime().toString());
    if (((RadioButton) findViewById(R.id.male)).isChecked())
intent.putExtra("gender", "Male");
    else if (((RadioButton) findViewById(R.id.female)).isChecked())
    intent.putExtra("gender", "Female");
    intent.putExtra("marital_status", ((Spinner)
findViewById(R.id.marital_status_spinner)).getSelectedItem().toString());
    intent.putExtra("employer_name", ((EditText)
findViewById(R.id.editEmployerName)).getText().toString());
    intent.putExtra("employment_status", ((Spinner)
findViewById(R.id.employment_status_spinner)).getSelectedItem().toString());
    intent.putExtra("emergency_name", ((EditText)
findViewById(R.id.edit_emergency_name)).getText().toString());
    intent.putExtra("emergency_relationship", ((EditText)
findViewById(R.id.edit_emergency_relationship)).getText().toString());
    intent.putExtra("emergency_address", ((EditText)
findViewById(R.id.edit_emergency_address)).getText().toString());
    intent.putExtra("emergency_phone", ((EditText)
findViewById(R.id.edit_emergency_phone)).getText().toString());
    startActivity(intent);
}

public void resetFormFields(View view) {

```



```

        ((EditText) findViewById(R.id.editName)).setText("");
        ((RadioButton)
findViewById(R.id.phone_radio_button_id)).setChecked(false); ((RadioButton)
findViewById(R.id.landline_radio_button_id)).setChecked(false); ((EditText)
findViewById(R.id.editNumber)).setText("");
        ((EditText) findViewById(R.id.editAddress)).setText("");
        ((EditText) findViewById(R.id.editAge)).setText("");
        ((DatePicker) findViewById(R.id.dobPicker)).updateDate(1970, 0, 1); ((RadioButton)
findViewById(R.id.male)).setChecked(false);
        ((RadioButton) findViewById(R.id.female)).setChecked(false); ((Spinner)
findViewById(R.id.marital_status_spinner)).setSelection(0);
        ((EditText) findViewById(R.id.editEmployerName)).setText(""); ((Spinner)
findViewById(R.id.employment_status_spinner)).setSelection(0);
        ((EditText) findViewById(R.id.edit_emergency_name)).setText(""); ((EditText)
findViewById(R.id.edit_emergency_relationship)).setText(""); ((EditText)
findViewById(R.id.edit_emergency_address)).setText(""); ((EditText)
findViewById(R.id.edit_emergency_phone)).setText(""); }
    }

```

activity_table.xml

```

<?xml version="1.0" encoding="utf-8"?>
<TableLayout xmlns:android="http://schemas.android.com/apk/res/android"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:stretchColumns="*">
    <TableRow>
        <TextView
            android:id="@+id/textView_title1"
            android:layout_width="100dp"
            android:layout_height="wrap_content"
            android:text="Patient details"
            android:textAlignment="center"
            android:textSize="48px"
            android:textStyle="bold" >
    /TableRow>
    <TableRow>
        <TextView
            android:id="@+id/textView_name"
            android:layout_width="100dp"
            android:layout_height="wrap_content"
            android:text="Name" >
        <TextView
            android:id="@+id/textView_name_value"
            android:layout_width="match_parent"
            android:layout_height="wrap_content" > /TableRow>
    <TableRow>
        <TextView
            android:id="@+id/textView_number"

```

```

        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Number" >
    <TextView
        android:id="@+id/textView_number_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" > /TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_address"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Address" >
    <TextView
        android:id="@+id/textView_address_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" > /TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_age"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Age" >
    <TextView
        android:id="@+id/textView_age_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" > /TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_dob"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="DOB" >
    <TextView
        android:id="@+id/textView_dob_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" > /TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_gender"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Gender" >
    <TextView
        android:id="@+id/textView_gender_value"
        android:layout_width="match_parent"

```

```

        android:layout_height="wrap_content" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_marital_status"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Marital Status" >
    <TextView
        android:id="@+id/textView_marital_status_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_title2"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:layout_marginTop="32px"
        android:text="Employer details"
        android:textAlignment="center"
        android:textSize="48px"
        android:textStyle="bold" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_employer_name"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Employer Name" >
    <TextView
        android:id="@+id/textView_employer_name_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_employment_status"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Employment Status" >
    <TextView
        android:id="@+id/textView_employment_status_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_title3"
        android:layout_width="100dp"

```

```

        android:layout_height="wrap_content"
        android:layout_marginTop="32px"
        android:text="Emergency details"
        android:textAlignment="center"
        android:textSize="48px"
        android:textStyle="bold" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_emergency_name"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Emergency name" >
    <TextView
        android:id="@+id/textView_emergency_name_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_emergency_relationship"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Emergency relationship" >
    <TextView
        android:id="@+id/textView_emergency_relationship_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_emergency_address"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Emergency address" >
    <TextView
        android:id="@+id/textView_emergency_address_value"
        android:layout_width="match_parent"
        android:layout_height="wrap_content" >
/TableRow>
<TableRow>
    <TextView
        android:id="@+id/textView_emergency_phone"
        android:layout_width="100dp"
        android:layout_height="wrap_content"
        android:text="Emergency phone" >
    <TextView
        android:id="@+id/textView_emergency_phone_value"
        android:layout_width="match_parent"

```

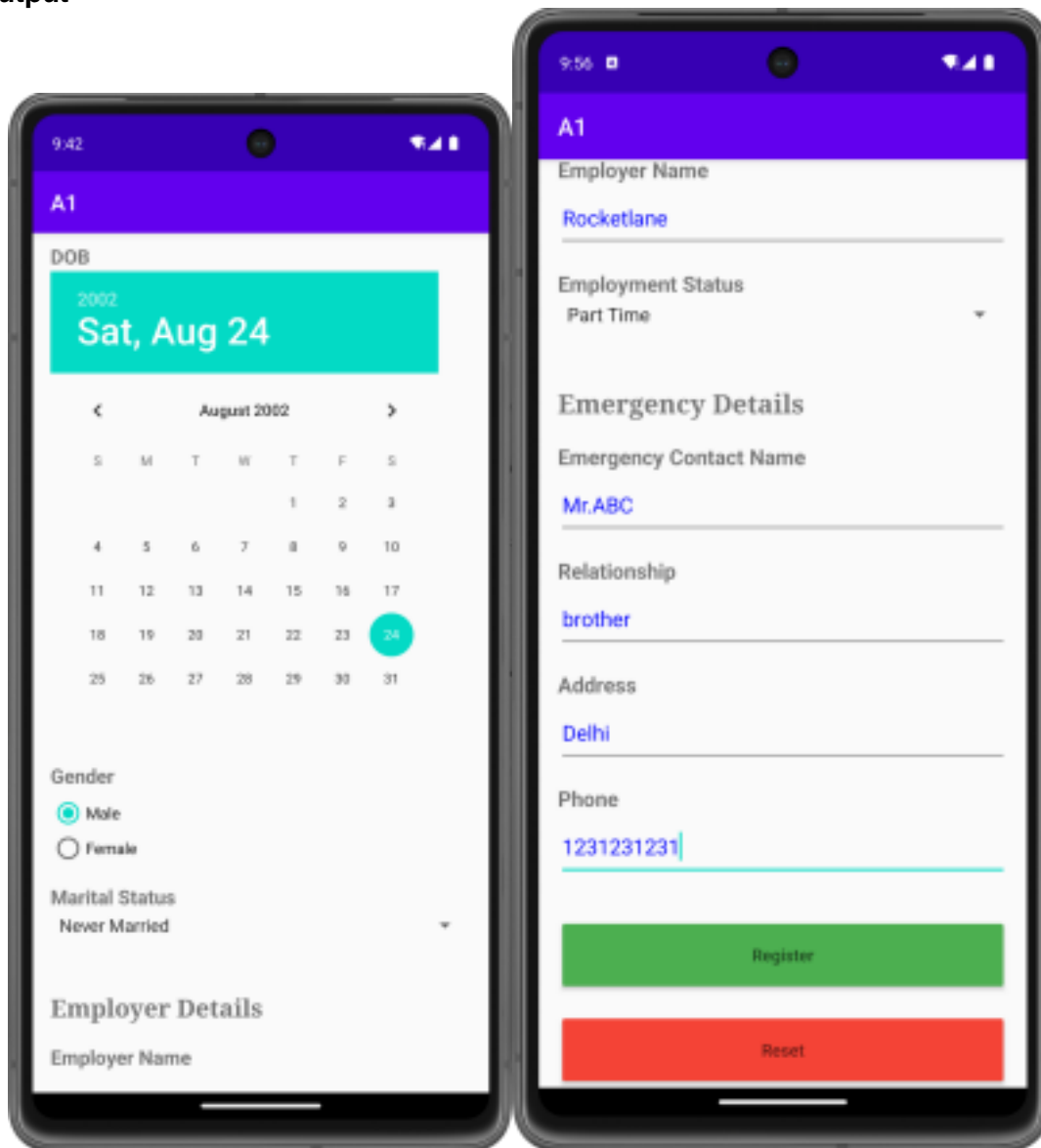


```

        <item>Divorced /item>
        <item>Separated /item>
    /string-array>
    <string-array name="employment_status_options">
        <item>Full Time /item>
        <item>Part Time /item>
        <item>Unemployed /item>
        <item>Retired /item>
        <item>Student /item>
        <item>Other /item>
    /string-array>
    <string name="title_activity_table">All Details /string> /resources>

```

Output



Learning outcomes

Basic GUI components and layouts that are available
 Passing data between activities

Exercise 2 - Keyboard application

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CSE-A

Aim

To implement a keyboard application using Android Studio

Code

activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical"
    tools:context=".MainActivity">

    <TextView
        android:id="@+id/text_bar"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginLeft="6dp"
        android:layout_marginTop="24dp"
        android:layout_marginRight="6dp"
        android:hint="Enter text..."
        android:text=""
        android:textSize="24sp" />

    <GridLayout
        android:id="@+id/keyboard"
        android:layout_width="match_parent"
        android:layout_height="200dp"
        android:layout_alignParentBottom="true"
        android:background="#202020"
        android:padding="1dp" />
</RelativeLayout>
```

MainActivity.java

```
package com.example.qwerty;

import androidx.appcompat.app.AppCompatActivity;
import androidx.core.content.res.ResourcesCompat;
import android.os.Bundle;
import android.util.DisplayMetrics;
import android.view.Gravity;
import android.widget.Button;
import android.widget.GridLayout;
import android.widget.TextView;
import android.graphics.Typeface;
```

```

public class MainActivity extends AppCompatActivity {
    private final String[][] letterKeys = {
        {"Q", "W", "E", "R", "T", "Y", "U", "I", "O", "P"},
        {"A", "S", "D", "F", "G", "H", "J", "K", "L"},
        {"↑", "Z", "X", "C", "V", "B", "N", "M", "←"},
        {"?123", " ", " ", " ", " ", " ", " ", "↵"}
    };
    private final String[][] numberKeys = {
        {"1", "2", "3", "4", "5", "6", "7", "8", "9", "0"},
        {"@", "#", "€", "_", "&", "-", "+", "(", ")", "/"},
        {"*", "\'", "\"", ":", ";", "!", "?", "<", ">", "=", "←"},
        {"ABC", " ", " ", " ", " ", " ", " ", "↵"}
    };
    private TextView textBar;

    private GridLayout keyboard;
    private DisplayMetrics displayMetrics;
    private Boolean isCaps = false;
    private Typeface customFont;

    private void init() {
        textBar = findViewById(R.id.text_bar);
        textBar.setText("|");
        keyboard = findViewById(R.id.keyboard);

        displayMetrics = new DisplayMetrics();
        getWindowManager().getDefaultDisplay().getMetrics(displayMetrics);

        customFont = ResourcesCompat.getFont(this, R.font.oswald);
    }
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        init();
        initKeyboard(letterKeys);
    }

    private void initKeyboard(String[][] keys) {
        keyboard.removeAllViews();

        int rowIndex = 0;
        for (String[] row : keys) {
            int colIndex = 0;
            int width = displayMetrics.widthPixels / (row.length + 4);

            for (String letter : row) {

```



```

        addButtonTextToKeyboard(letter, width, rowIndex, colIndex);
        colIndex++;
    }
    rowIndex++;
}
}

```

```

private boolean isChar(String key) {
    return key.length() == 1 && Character.isLetter(key.charAt(0));
}

```

```

private void addButtonTextToKeyboard(String key, int width, int row, int col) {
    Button button = new Button(this);
    if (isChar(key)) button.setText(key.toLowerCase());
    else {
        button.setText(key);
        button.setTypeface(customFont);
        button.setWidth(0);
        button.setPadding(0, 0, 0, 0);
    }
}

```

```

GridLayout.LayoutParams params = new GridLayout.LayoutParams();
params.width = width;
params.height = GridLayout.LayoutParams.WRAP_CONTENT;
params.rowSpec = GridLayout.spec(row);
params.columnSpec = GridLayout.spec(col);
params.setGravity(Gravity.FILL);

```

```

button.setLayoutParams(params);
button.setClickable(true);
setHandler(button, key);

```

```

keyboard.addView(button);
}

```

```

private void setHandler(Button button, String key) {
    if (key.length() == 1 && Character.isLetter(key.charAt(0))) {
        button.setOnClickListener(view -> {
            if (isCaps) textBar.append(key.toUpperCase());
            else textBar.append(key.toLowerCase());
        });
        return;
    }
}

```

```

switch (key) {
    case "↑":
        button.setOnClickListener(view -> isCaps = !isCaps);
        break;
}

```

```

case "←":
    button.setOnClickListener(view -> {
        CharSequence currentText = textBar.getText();
        if(currentText.length() != 0) {
            CharSequence newText = currentText.subSequence(0, currentText.length() - 1);
            textBar.setText(newText);
        }
    });
    break;
case "?123":
    button.setOnClickListener(view -> initKeyboard(numberKeys));
    break;
case "ABC":
    button.setOnClickListener(view -> initKeyboard(letterKeys));
    break;
    case "↵":
        button.setOnClickListener(view -> textBar.append("\n"));
        break;
default:
    button.setOnClickListener(view -> {
        CharSequence currentText = textBar.getText();
        CharSequence newText = currentText.subSequence(0, currentText.length() - 1);
        textBar.setText(newText);
        textBar.append(String.valueOf(key.charAt(0)));
        textBar.append("|");
    }
    );
    break;
}

}

}

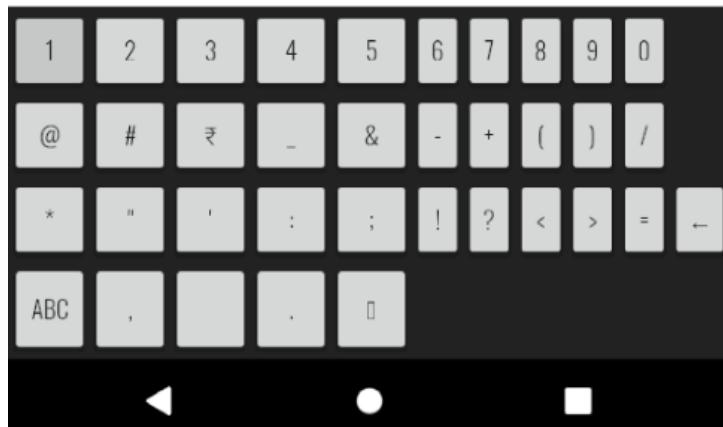
```

Output

Android Emulator - Pixel_2_API_30:5554



ERROR_404|



Learning outcomes

Thus a keyboard was implemented using Android Studio

Exercise 3 - Application Development using basic graphicalPrimitives

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CSE-B

Aim

Design a CAR using Shape drawables with the help of relevant shapes such as Line, Circle, Rectangle and Arc.

a. Move the car forward by pressing forward button so that car moves from a predefined

starting point to the predefined endpoint.

b. On pressing backward button, rotate the car to 180 degrees from the current point to the starting point.

c. Implement a Tap-to-zoom animation on any image.

d. Implement the Card flipping animation.

Code

Drawables:

car.xml

```
<layer-list xmlns:android="http://schemas.android.com/apk/res/android">

    <item android:drawable="@drawable/car_body" />

    <item
        android:drawable="@drawable/car_roof"
        android:gravity="top"
    />

    <item
        android:drawable="@drawable/car_window"
        android:top="10dp"
        android:left="20dp"
        android:right="50dp"
        android:bottom="20dp"
    />

    <item
        android:drawable="@drawable/car_window"
        android:top="10dp"
        android:left="75dp"
        android:right="20dp"
        android:bottom="20dp"
    />

    <item
        android:drawable="@drawable/car_wheel"
        android:gravity="left|bottom"
        android:left="5dp"
        android:bottom="0dp"
    />

    <item
        android:drawable="@drawable/car_wheel"
        android:gravity="right|bottom"
        android:right="5dp"
        android:bottom="0dp"
    />

</layer-list>
```

car_body.xml

```
<shape xmlns:android="http://schemas.android.com/apk/res/android">
    <solid android:color="#123" />
</shape>
```

```
        <corners android:radius="8dp" />
        <size android:width="100dp" android:height="40dp"/>
</shape>
```

car_roof.xml

```
<shape xmlns:android="http://schemas.android.com/apk/res/android">
    <solid android:color="#000000" />
    <corners android:radius="2dp" />
    <size android:width="20dp" android:height="15dp" />
</shape>
```

car_wheel.xml

```
<shape android:shape="oval"
    xmlns:android="http://schemas.android.com/apk/res/android">
    <solid android:color="#000000" />
    <size android:width="20dp" android:height="20dp" />
    <corners android:radius="3dp" />
</shape>
```

car_window.xml

```
<?xml version="1.0" encoding="utf-8"?>
<shape xmlns:android="http://schemas.android.com/apk/res/android">
    <solid android:color="#333" />
    <corners android:radius="4dp" />
    <size android:width="20dp" android:height="20dp" />
</shape>
```

lane_marking.xml

```
<shape xmlns:android="http://schemas.android.com/apk/res/android">
    <solid android:color="#FFFFFF" />
    <size android:width="10dp" android:height="2dp" />
</shape>
```

road.xml

```
<layer-list xmlns:android="http://schemas.android.com/apk/res/android">
    <!-- Road Background (Gray) -->
    <item>
        <shape android:shape="rectangle">
            <solid android:color="#333" />
        </shape>
    </item>
    <item android:drawable="@drawable/lane_marking"
        android:top="10dp"
        android:right="80dp"
        android:left="10dp"
        android:bottom="10dp"/>
```

```

<item android:drawable="@drawable/lane_marking"
      android:top="10dp"
      android:right="45dp"
      android:left="45dp"
      android:bottom="10dp"/>
<item android:drawable="@drawable/lane_marking"
      android:top="10dp"
      android:right="10dp"
      android:left="80dp"
      android:bottom="10dp"/>
</layer-list>

```

Layout :

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:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity">

    <ImageView
        android:id="@+id/carImageView"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:src="@drawable/car"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintVertical_bias="0.302"
        tools:layout_editor_absoluteX="0dp" />

    <ImageView
        android:id="@+id/roadImageView"
        android:layout_width="410dp"
        android:layout_height="111dp"
        android:layout_marginTop="256dp"
        android:layout_marginEnd="1dp"
        android:layout_marginBottom="364dp"
        android:src="@drawable/road"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.0"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent" />

    <Button

```

```

        android:id="@+id/forwardButton"
        android:layout_width="117dp"
        android:layout_height="45dp"
        android:layout_marginTop="60dp"
        android:text="Forward"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/roadImageView" />
<Button
    android:id="@+id/sunFlipId"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_marginBottom="108dp"
    android:text="Flip Image"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintHorizontal_bias="0.496"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toBottomOf="@+id/backwardButton"
    app:layout_constraintVertical_bias="0.384" />
<Button
    android:id="@+id/backwardButton"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_marginTop="16dp"
    android:text="Backward"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toBottomOf="@+id/forwardButton" />
<ImageView
    android:id="@+id/sunId"
    android:layout_width="79dp"

    android:layout_height="55dp"
    android:layout_marginTop="84dp"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toTopOf="parent"
    app:srcCompat="?attr/actionModeCloseDrawable" />
    <!-- Add other UI elements here if needed -->
</androidx.constraintlayout.widget.ConstraintLayout>

```

MainActivity.java

```

package com.example.abex3;

import androidx.appcompat.app.AppCompatActivity;
import android.animation.ObjectAnimator;
import android.os.Bundle;
import android.os.Handler;

```

```

import android.view.View;
import android.view.animation.AccelerateDecelerateInterpolator;
import android.widget.Button;
import android.widget.ImageView;
public class MainActivity extends AppCompatActivity {
    private ImageView carImageView;
    private ImageView sunImageView;
    private Button forwardButton;
    private Button backwardButton;
    private Button sunFlipButton;
    private int carXPosition = 0;
    private final int endpoint = 800;
    private final int startpoint = 0;
    boolean isClicked=false;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);
        carImageView = findViewById(R.id.carImageView);
        sunImageView = findViewById(R.id.sunId);
        forwardButton = findViewById(R.id.forwardButton);
        backwardButton = findViewById(R.id.backwardButton);
        sunFlipButton = findViewById(R.id.sunFlipId);
        forwardButton.setOnClickListener(new View.OnClickListener() {
            boolean isOperationInProgress = false;
            @Override

            public void onClick(View v) {
                if (!isOperationInProgress) {
                    isOperationInProgress = true;
                    backwardButton.setEnabled(false);
                    forwardButton.setEnabled(false);
                    final Handler handler = new Handler();
                    final Runnable carMovement = new Runnable() {
                        @Override
                        public void run() {
                            carXPosition += 10;
                            if (carXPosition <= endpoint) {
                                carImageView.setX(carXPosition);
                                handler.postDelayed(this, 100); // 100
milliseconds delay
                            } else {
                                isOperationInProgress = false;
                                backwardButton.setEnabled(true);
                                forwardButton.setEnabled(true);
                            }
                        }
                    };
                    handler.post(carMovement);
                }
            }
        });
    }
}

```



```

        }
    }
});
backwardButton.setOnClickListener(new View.OnClickListener() {
    boolean isOperationInProgress = false;
    private boolean isCarFlipped = false;
    @Override
    public void onClick(View v) {
        if (!isOperationInProgress) {
            isOperationInProgress = true;
            backwardButton.setEnabled(false);
            forwardButton.setEnabled(false);
            flipCar();
            final Handler handler = new Handler();
            final Runnable carMovement = new Runnable() {
                @Override
                public void run() {
                    carXPosition -= 10;
                    if (carXPosition >= startpoint) {
                        carImageView.setX(carXPosition);
                        handler.postDelayed(this, 100); // 100
milliseconds delay
                    } else {
                        isOperationInProgress = false;
                        backwardButton.setEnabled(true);
                        forwardButton.setEnabled(true);
                        flipCar();
                    }
                }
            };
            handler.post(carMovement);
        }
    }
    private void flipCar() {
        ObjectAnimator flipAnimator;
        if (isCarFlipped) {
            flipAnimator = ObjectAnimator.ofFloat(carImageView,
"rotationY", 180f, 0f);
            isCarFlipped = false;
        } else {
            flipAnimator = ObjectAnimator.ofFloat(carImageView,
"rotationY", 0f, 180f);
            isCarFlipped = true;
        }
        flipAnimator.setDuration(500);
        flipAnimator.setInterpolator(new
AccelerateDecelerateInterpolator());
        flipAnimator.start();
    }
}

```

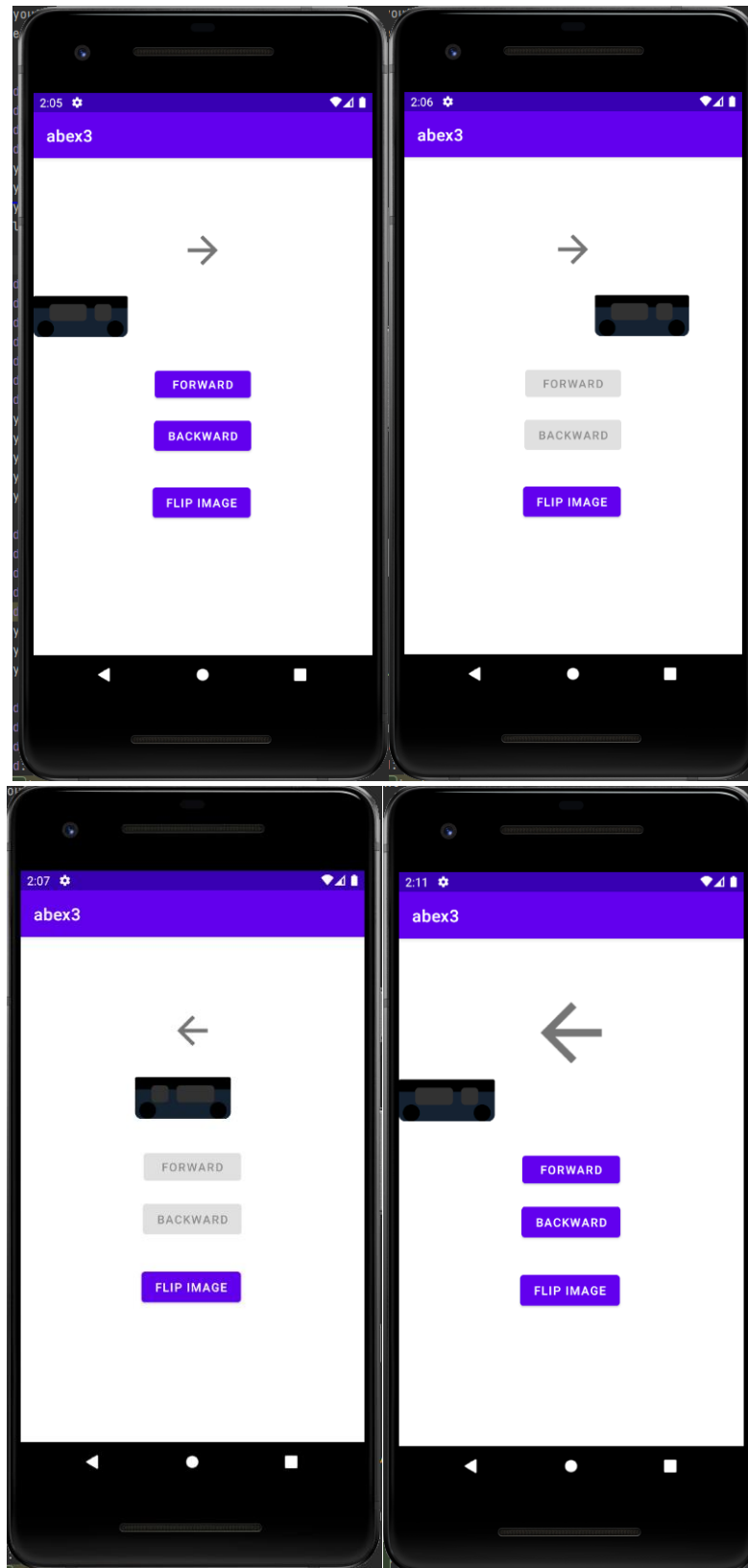
```

    }
});
sunImageView.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        if(!isClicked){
            sunImageView.setScaleX(2);
            sunImageView.setScaleY(2);
            isClicked=true;
        }
        else{
            sunImageView.setScaleX(1);
            sunImageView.setScaleY(1);
            isClicked=false;
        }
    }
});
sunFlipButton.setOnClickListener(new View.OnClickListener() {
    private boolean isArrowFlipped = false;
    @Override
    public void onClick(View v) {
        ObjectAnimator flipAnimator;
        if (isArrowFlipped) {
            flipAnimator = ObjectAnimator.ofFloat(sunImageView,
"rotationY", 180f, 0f);
            isArrowFlipped = false;
        } else {
            flipAnimator = ObjectAnimator.ofFloat(sunImageView,
"rotationY", 0f, 180f);
            isArrowFlipped = true;
        }
        flipAnimator.setDuration(500);
        flipAnimator.setInterpolator(new
AccelerateDecelerateInterpolator());

        flipAnimator.start();
    }
});
}
}

```

Output



Learning outcomes

- Proficient in creating user interfaces using shape drawables and relevant shapes.
- Implemented event listeners for user interaction and learned to navigate between activities.

- Successfully added animations, improving user engagement with tap-to-zoom and card flipping features.

Ex. No. 4 Android Application Development using Database

Aim: Develop a Product information application in Android that enables to perform CRUD operations on data stored in SQLite Database.

Layout Used: Linear Layout, Table Layout

Intents: Insert, Retrieve, Retrieve All, Update, Delete and Main

Code:

MainActivity.java:

```
package com.example.ex4;
import androidx.appcompat.app.AppCompatActivity;import
android.content.Intent;
import android.os.Bundle; import
android.view.View; import
android.widget.Button;
public class MainActivity extends AppCompatActivity {
```

```
@Override
```

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

    final Database[] db = new Database[1]; Button create
    = findViewById(R.id.create);
```

```
create.setOnClickListener(new View.OnClickListener() {@Override
    public void onClick(View v) {
        db[0] = new Database(MainActivity.this);
    }
});
```

```
Button insert = findViewById(R.id.insert);
insert.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Intent intent = new Intent(MainActivity.this, Insert.class);startActivity(intent);
    }
});
```

```
Button delete = findViewById(R.id.delete); delete.setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Intent intent = new Intent(MainActivity.this,Delete.class);startActivity(intent);
    }
});
```

```
Button retrieve = findViewById(R.id.read); retrieve.setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Intent intent = new Intent(MainActivity.this,Retrieve.class);startActivity(intent);
    }
});
```

```

        Button retrieveAll = findViewById(R.id.read_all); retrieveAll.setOnClickListener(new
        View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent intent = new Intent(MainActivity.this, RetrieveAll.class); startActivity(intent);
            }
        });

        Button update = findViewById(R.id.update); update.setOnClickListener(new
        View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent intent = new Intent(MainActivity.this, Update.class); startActivity(intent);
            }
        });

    }
}

```

Database.java:

```

package com.example.ex4;

import android.content.ContentValues;
import android.content.Context; import
android.database.Cursor;
import android.database.sqlite.SQLiteDatabase; import
android.database.sqlite.SQLiteOpenHelper;

public class Database extends SQLiteOpenHelper {private static

    final String DB_NAME = "product";

```

```

private static final int DB_VERSION = 3;

private static final String TABLE_NAME = "prod";private static

final String ID_COL = "id";

private static final String NAME_COL = "name"; private static

final String BRAND_COL = "brand";private static final String

DESC_COL = "desc"; private static final String PRICE_COL =

"price";

public Database(Context context) {
    super(context, DB_NAME, null, DB_VERSION);
}

@Override
public void onCreate(SQLiteDatabase db) {

    String query = "CREATE TABLE " + TABLE_NAME + " ("
        + ID_COL + " INTEGER PRIMARY KEY, "
        + NAME_COL + " TEXT,"
        + BRAND_COL + " TEXT,"
        + DESC_COL + " TEXT,"
        + PRICE_COL + " TEXT)";

    // at last we are calling a exec sql
    // method to execute above sql querydb.execSQL(query);
}

// this method is use to add new course to our sqlite database.

```

```

public void addProduct(String id,String name,String brand, String desc,String price) {

    // on below line we are creating a variable for
    // our sqlite database and calling writable method
    // as we are writing data in our database. SQLiteDatabase db =
    this.getWritableDatabase();

    // on below line we are creating a
    // variable for content values.
    ContentValues values = new ContentValues();

    // on below line we are passing all values
    // along with its key and value pair.
    values.put(ID_COL,id); values.put(NAME_COL,
    name); values.put(BRAND_COL,brand);
    values.put(DESC_COL, desc);
    values.put(PRICE_COL, price);

    // after adding all values we are passing
    // content values to our table. db.insert(TABLE_NAME, null,
    values);

    // at last we are closing our
    // database after adding database.db.close();
}

public void deleteProduct(String id){ SQLiteDatabase db =
    this.getWritableDatabase();
    db.delete(TABLE_NAME,ID_COL+"=?",new String[]{id});
}

public void updateProduct(String id,String price){

```



```

        SQLiteDatabase db = this.getWritableDatabase(); ContentValues
        values = new ContentValues(); values.put(PRICE_COL, price);
        db.update(TABLE_NAME, values, ID_COL + "=?", new
String[]{String.valueOf(id)});
    }

    public Cursor retrieveAll(){
        SQLiteDatabase db = this.getReadableDatabase();
        return db.query(TABLE_NAME, null, null, null, null, null, null);
    }

    public Cursor retrieve(String id){
        SQLiteDatabase db = this.getReadableDatabase();String[] projection =
        {
            NAME_COL,
            BRAND_COL,
            DESC_COL,
            PRICE_COL
        };

        // Define the condition for retrieval (e.g., where id = ?)String selection =
        ID_COL + " = ?";
        String[] selectionArgs = { id };

        // Execute the query Cursor
        cursor = db.query(
            TABLE_NAME,          // Table name projection,
                                // Columns to return selection,
                                // Selection (WHERE clause)
            selectionArgs,        // Selection arguments null,
                                // Group bynull,    // Having
            null                   // Order by
        );
    }

```

```

        // The cursor now contains the retrieved row(s) return cursor;
    }

    @Override
    public void onUpgrade(SQLiteDatabase db, int oldVersion, int newVersion) {
        // this method is called to check if the table exists already. db.execSQL("DROP TABLE IF
        EXISTS " + TABLE_NAME);
        onCreate(db);
    }
}

```

Insert.java:

```

package com.example.ex4;

import android.content.Intent; import
android.os.Bundle; import
android.util.Log; import
android.view.View; import
android.widget.Button; import
android.widget.RadioButton;
import android.widget.RadioGroup; import
android.widget.TextView; import

androidx.appcompat.app.AppCompatActivity; public

class Insert extends AppCompatActivity {

    @Override

```

```
protected void onCreate(Bundle savedInstanceState){  
    super.onCreate(savedInstanceState); setContentView(R.layout.insert);
```

```

Button backi = findViewById(R.id.backi); backi.setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Intent intent = new Intent(Insert.this,MainActivity.class);startActivity(intent);
    }
});

```

```

Button submiti = findViewById(R.id.submiti); submiti.setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Database db = new Database(Insert.this);

        TextView textView = findViewById(R.id.idi);String id =
        textView.getText().toString(); textView =
        findViewById(R.id.namei); String name =
        textView.getText().toString();

        RadioGroup radioGroup = findViewById(R.id.radioGroup);int
        selectedRadioButtonId =
radioGroup.getCheckedRadioButtonId(); RadioButton
        selectedRadioButton =
findViewById(selectedRadioButtonId);
        String brand = selectedRadioButton.getText().toString();Log.d("Debug",brand);

        textView = findViewById(R.id.desci);String desc
        = textView.getText().toString();
        Log.d("Debug",desc);

        textView = findViewById(R.id.pricei);String price
        =

```

```
textView.getText().toString();
```

```

        db.addProduct(id,name,brand,desc,price);
    }
    });
}

```

Retrieve:

```

package com.example.ex4;

import android.content.Intent; import
android.database.Cursor;import
android.os.Bundle; import
android.view.View; import
android.widget.Button; import
android.widget.TextView;
import androidx.appcompat.app.AppCompatActivity;

public class Retrieve extends AppCompatActivity {

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

        Button backr = findViewById(R.id.backr);
        backr.setOnClickListener(new View.OnClickListener() {
            @Override
            public void onClick(View v) {
                Intent intent = new Intent(Retrieve.this,MainActivity.class);startActivity(intent);
            }
        });
    }
}

```

```
Button retrieve = findViewById(R.id.retrieve); retrieve.setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View v) {
        TextView textView = findViewById(R.id.idr);String id =
        textView.getText().toString();

        Database db = new Database(Retrieve.this);Cursor cursor =
        db.retrieve(id);
        String name="",brand="",desc="",price="";

        if (cursor.moveToFirst()) {

            do {
                // Retrieve values from 'column1' and 'column2' as stringsint columnIndex =
                cursor.getColumnIndex("name");
                if (columnIndex != -1) {
                    name = cursor.getString(columnIndex);
                }

                columnIndex = cursor.getColumnIndex("brand");
                if(columnIndex!=-1){
                    brand=cursor.getString(columnIndex);
                }

                columnIndex =
                cursor.getColumnIndex("desc");
                if(columnIndex!=-1){
                    desc=cursor.getString(columnIndex);
                }

                columnIndex =
                cursor.getColumnIndex("price");
                if(columnIndex!=-1){
                    price=cursor.getString(columnIndex);
                }
            } while (cursor.moveToNext());
        }
    }
});
```



```

        } while (cursor.moveToNext());
    }

    textView = findViewById(R.id.namer);
    textView.setText(name);

    textView = findViewById(R.id.brandr);
    textView.setText(brand);

    textView = findViewById(R.id.descr);
    textView.setText(desc);

    textView = findViewById(R.id.pricer);
    textView.setText(price);

    }
    });
}
}

```

Retrieve All:

```

package com.example.ex4;

import android.content.Context; import
android.content.Intent; import
android.database.Cursor;import
android.graphics.Color; import
android.os.Bundle; import
android.util.Log;
import android.view.View; import
android.view.ViewGroup;import
android.widget.Button;
import android.widget.TableLayout;import
android.widget.TableRow;

```

```

import android.widget.TextView;

import androidx.appcompat.app.AppCompatActivity; import
androidx.constraintlayout.widget.ConstraintLayout;import
androidx.constraintlayout.widget.ConstraintSet;

import org.w3c.dom.Text;
public class RetrieveAll extends AppCompatActivity {private TextView
    newTextView(String text){
        TextView tv = new TextView(RetrieveAll.this);

        tv.setText(text);
        tv.setPadding(4,4,4,4);
        tv.setTextSize(24);
        TableRow.LayoutParams layoutParams = new
TableRow.LayoutParams(
            TableRow.LayoutParams.WRAP_CONTENT, // Adjust width as
needed                TableRow.LayoutParams.WRAP_CONTENT
// Adjust height as
needed
        );

        layoutParams.rightMargin = 20;
        tv.setLayoutParams(layoutParams);

        return tv;
    }

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

        Database db = new Database(RetrieveAll.this);

```

```

        Cursor cursor = db.retrieveAll();

        ConstraintLayout parent = findViewById(R.id.parent);

// Create layout params for the TableLayout
//      ConstraintLayout.LayoutParams tableLayoutParams = new
ConstraintLayout.LayoutParams(
//          ConstraintLayout.LayoutParams.MATCH_PARENT,
//          ConstraintLayout.LayoutParams.MATCH_PARENT
//      );
//      tableLayoutParams.startToStart =
ConstraintLayout.LayoutParams.PARENT_ID
;
//      tableLayoutParams.endToEnd =
ConstraintLayout.LayoutParams.PARENT_ID
;
//      tableLayoutParams.topToTop =
ConstraintLayout.LayoutParams.PARENT_ID
;
//      tableLayoutParams.bottomToBottom =
ConstraintLayout.LayoutParams.PARENT_ID
;

        TableLayout tl = new TableLayout(RetrieveAll.this);

        TableRow trh = new TableRow(RetrieveAll.this); TextView tv0
        = new TextView("Id"); trh.addView(tv0);

        tv0 = new TextView("Name");
        trh.addView(tv0);

        tv0 = new TextView("Brand");trh.addView(tv0);

        tv0 = new TextView("Description");

```

```
trh.addView(tv0);
```

```
tv0 = new TextView("Price");
```

```
trh.addView(tv0);
```

```
tl.addView(trh);
```

```
String id="",name="",brand="",desc="",price="";if  
(cursor.moveToFirst()) {  
    do {  
        // Retrieve values from 'column1' and 'column2' as strings  
        sint columnIndex =  
        cursor.getColumnIndex("id");  
        if (columnIndex != -1) {  
            id = cursor.getString(columnIndex);  
        }  
  
        columnIndex =  
        cursor.getColumnIndex("name");  
        if(columnIndex!=-1){  
            name=cursor.getString(columnIndex);  
        }  
  
        columnIndex =  
        cursor.getColumnIndex("brand");  
        if(columnIndex!=-1){  
            brand=cursor.getString(columnIndex);  
        }  
  
        columnIndex =  
        cursor.getColumnIndex("desc");  
        if(columnIndex!=-1){  
            desc=cursor.getString(columnIndex);  
        }  
  
        columnIndex =  
        cursor.getColumnIndex("price");  
        if(columnIndex!=-1){  
            price=cursor.getString(columnIndex);  
        }  
    }  
}
```

```
Log.d("Debug",id+" "+name+" "+brand+" "+desc+" "+price);
```

```

        TableRow tr = new TableRow(RetrieveAll.this);

        TextView tv1 = new TextView(id); TextView tv2
        = new TextView(name); TextView tv3 =
        new TextView(brand); TextView tv4 =
        new TextView(desc); TextView tv5 =
        new TextView(price);

        tr.addView(tv1)
        ;
        tr.addView(tv2)
        ;
        tr.addView(tv3)
        ;
        tr.addView(tv4)
        ;
        tr.addView(tv5)
        ;

        tl.addView(tr);

    } while (cursor.moveToNext());
}

parent.addView(tl);

//      app:layout_constraintEnd_toEndOf="parent"
//      app:layout_constraintStart_toStartOf="parent"
//      app:layout_constraintTop_toTopOf="parent"

Button retrieveAll = findViewById(R.id.backra); retrieveAll.setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Intent intent = new Intent(RetrieveAll.this, MainActivity.class);

```

```
        startActivity(intent);
    }
});
```



```
}  
}
```

Update:

```
package com.example.ex4;
```

```
import android.content.Intent;import  
android.os.Bundle; import  
android.view.View; import  
android.widget.Button;import  
android.widget.TextView;  
import androidx.appcompat.app.AppCompatActivity;
```

```
public class Update extends AppCompatActivity {
```

```
    @Override
```

```
    protected void onCreate(Bundle savedInstanceState){
```

```
        super.onCreate(savedInstanceState);
```

```
        setContentView(R.layout.update);
```

```
        Button backu = findViewById(R.id.backu);
```

```
        backu.setOnClickListener(new View.OnClickListener() {
```

```
            @Override
```

```
            public void onClick(View v) {
```

```
                Intent intent = new Intent(Update.this,MainActivity.class);startActivity(intent);
```

```
            }
```

```
        });
```

```
        Button update = findViewById(R.id.update); update.setOnClickListener(new
```

```
        View.OnClickListener() {
```

@Override

```

        public void onClick(View v) {
            Database db = new Database(Update.this);
            TextView
            textView = findViewById(R.id.idu); String id =
            textView.getText().toString(); textView =
            findViewById(R.id.priceu); String price =
            textView.getText().toString();

            db.updateProduct(id,price);
        }
    });
}
}

```

Delete.java:

```

package com.example.ex4;

import android.content.Intent;import
import android.os.Bundle; import
import android.view.View; import
import android.widget.Button;import
import android.widget.TextView;
import androidx.appcompat.app.AppCompatActivity;

public class Delete extends AppCompatActivity {

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

        Button backd = findViewById(R.id.backd);
        backd.setOnClickListener(new View.OnClickListener() {

```

```
@Override  
public void onClick(View v) {
```

```

    }
    });

```

```

Intent intent = new
Intent(Delete.this,MainActivity.class);
startActivity(intent);

```

```

Button delete = findViewById(R.id.delete); delete.setOnClickListener(new
View.OnClickListener() {
    @Override
    public void onClick(View v) {
        Database db = new Database(Delete.this);

        TextView textView = findViewById(R.id.idd);String id =
        textView.getText().toString();

        db.deleteProduct(id);
    }
});
}
}

```

Activity main.xml:

```

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

    <RelativeLayout android:layout_width="match_parent"
        android:layout_height="match_parent">

```

```
<!-- Center the LinearLayout vertically -->
<LinearLayout android:id="@+id/verticalLayout"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_centerInParent="true"
    android:orientation="vertical">

    <!-- Add your UI elements within this LinearLayout -->

    <Button
        android:id="@+id/create"
        android:layout_width="177dp"
        android:layout_height="62dp"android:text="Create" />

    <Button
        android:id="@+id/insert"
        android:layout_width="177dp"
        android:layout_height="62dp"android:text="Insert" />

    <Button
        android:id="@+id/read"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Retrieve" />

    <Button
        android:id="@+id/read_all"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:text="Retrieve All" />

    <Button
```

```
    android:id="@+id/update"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Update" />
```

```
<Button
    android:id="@+id/delete"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Delete" />
```

```
<!-- Add more views here as needed -->
```

```
</LinearLayout>
</RelativeLayout>
```

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

Insert.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:layout_width="match_parent"
    android:layout_height="match_parent">

    <LinearLayout android:layout_width="409dp"
        android:layout_height="665dp"
        android:layout_marginTop="50dp"
        android:orientation="vertical"
        app:layout_constraintBottom_toBottomOf="parent"
```

```
app:layout_constraintStart_toStartOf="parent"app:layout_constraintTop_toTopOf="parent">
```

```
<LinearLayout android:layout_width="match_parent"  
    android:layout_height="87dp"  
    android:orientation="horizontal">
```

```
<TextView android:id="@+id/textView3"  
    android:layout_width="120dp"  
    android:layout_height="55dp"  
    android:layout_weight="1"  
    android:text="Product Id"  
    android:textSize="24sp" />
```

```
<EditText  
    android:id="@+id/idi"  
    android:layout_width="wrap_content"  
    android:layout_height="58dp"  
    android:layout_weight="1" android:ems="10"  
    android:inputType="textPersonName"  
    android:textSize="24sp" />
```

```
</LinearLayout>
```

```
<LinearLayout android:layout_width="match_parent"  
    android:layout_height="84dp"  
    android:orientation="horizontal">
```

```
<TextView android:id="@+id/textView5"  
    android:layout_width="131dp"  
    android:layout_height="58dp"
```



```
    android:layout_weight="1"
    android:text="Product Name"
    android:textSize="24sp" />
```

```
<EditText android:id="@+id/namei"
    android:layout_width="wrap_content"
    android:layout_height="59dp"
    android:layout_weight="1" android:ems="10"
    android:inputType="textPersonName"
    android:textSize="24sp" />
</LinearLayout>

<LinearLayout android:layout_width="match_parent"
    android:layout_height="94dp"
    android:orientation="horizontal">
```

```
    <TextView android:id="@+id/textView6"
        android:layout_width="198dp"
        android:layout_height="71dp"
        android:layout_weight="1"
        android:text="Brand"
        android:textSize="24sp" />
```

```
    <RadioGroup android:id="@+id/radioGroup"
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        android:layout_weight="1" >
```

```
        <RadioButton android:id="@+id/radio1"
```

```
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:textSize="24sp" android:text="A" />
```

```
    <RadioButton android:id="@+id/radio2"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:textSize="24sp" android:text="B" />
```

```
</RadioGroup>
```

```
</LinearLayout>
```

```
<LinearLayout android:layout_width="match_parent"
    android:layout_height="93dp"
    android:orientation="horizontal">
```

```
    <TextView android:id="@+id/textView7"
        android:layout_width="146dp"
        android:layout_height="73dp"
        android:layout_weight="1"
        android:text="Description"
        android:textSize="24sp" />
```

```
    <EditText android:id="@+id/desci"
        android:layout_width="wrap_content"
        android:layout_height="75dp"
        android:layout_weight="1" android:ems="10"
        android:inputType="textPersonName"
```

```

        android:textSize="24sp" />
</LinearLayout>

<LinearLayout android:layout_width="match_parent"
    android:layout_height="96dp"
    android:orientation="horizontal">

    <TextView android:id="@+id/textView8"
        android:layout_width="114dp"
        android:layout_height="79dp"
        android:layout_weight="1"
        android:text="Price"
        android:textSize="24sp" />

    <EditText android:id="@+id/pricei"
        android:layout_width="wrap_content"
        android:layout_height="82dp"
        android:layout_weight="1" android:ems="10"
        android:inputType="textPersonName"
        android:textSize="24sp" />
</LinearLayout>

<Button
    android:id="@+id/submiti"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Submit" />

<Button
    android:id="@+id/backi"
    android:layout_width="match_parent"

```

```

        android:layout_height="wrap_content"android:text="Back"
    />

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

```

Retrieve.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:layout_width="match_parent"
android:layout_height="match_parent">

    <LinearLayout android:id="@+id/linearLayout"
        android:layout_width="414dp"
        android:layout_height="203dp"
        android:orientation="vertical"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="1.0"
        app:layout_constraintStart_toStartOf="parent"
        tools:ignore="MissingConstraints"
        tools:layout_editor_absoluteY="-2dp">

        <LinearLayout android:layout_width="match_parent"
            android:layout_height="103dp"
            android:orientation="horizontal">

            <TextView android:id="@+id/textView"
                android:layout_width="144dp"

```

```
        android:layout_height="64dp"
        android:layout_weight="1" android:text="Product Id"
        android:textSize="24sp" />
```

```
<EditText
    android:id="@+id/idr"
    android:layout_width="wrap_content"
    android:layout_height="83dp"
    android:layout_weight="1" android:ems="10"
    android:inputType="textPersonName"
    android:textSize="24sp" />
```

```
</LinearLayout>
```

```
<Button
    android:id="@+id/retrieve"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Retrieve" />
```

```
<Button
    android:id="@+id/backr"
    android:layout_width="match_parent"
    android:layout_height="wrap_content" android:text="Back"
    />
```

```
</LinearLayout>
```

```
<LinearLayout android:layout_marginTop="50dp"
    android:layout_width="411dp"
    android:layout_height="459dp"
    android:orientation="vertical"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintStart_toStartOf="parent"
```

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

```
<LinearLayout android:layout_width="match_parent"  
    android:layout_height="84dp"  
    android:orientation="horizontal">
```

```
<TextView android:id="@+id/textView5"  
    android:layout_width="131dp"  
    android:layout_height="58dp"  
    android:layout_weight="1"  
    android:text="Product Name"  
    android:textSize="24sp" />
```

```
<TextView android:id="@+id/namer"  
    android:layout_width="146dp"  
    android:layout_height="73dp"  
    android:layout_weight="1"  
    android:text=""  
    android:textSize="24sp" />
```

```
</LinearLayout>
```

```
<LinearLayout android:layout_width="match_parent"  
    android:layout_height="94dp"  
    android:orientation="horizontal">
```

```
<TextView android:id="@+id/textView6"  
    android:layout_width="198dp"  
    android:layout_height="71dp"  
    android:layout_weight="1"  
    android:text="Brand"
```

```
        android:textSize="24sp" />

        <TextView android:id="@+id/brandr"
            android:layout_width="146dp"
            android:layout_height="73dp"
            android:layout_weight="1"
            android:text=""
            android:textSize="24sp" />

    </LinearLayout>

    <LinearLayout android:layout_width="match_parent"
        android:layout_height="93dp"
        android:orientation="horizontal">

        <TextView android:id="@+id/textView0"
            android:layout_width="146dp"
            android:layout_height="73dp"
            android:layout_weight="1"
            android:text="Description"
            android:textSize="24sp" />

        <TextView android:id="@+id/descr"
            android:layout_width="146dp"
            android:layout_height="73dp"
            android:layout_weight="1"
            android:text=""
            android:textSize="24sp" />

    </LinearLayout>

    <LinearLayout
```

```

        android:layout_width="match_parent"
        android:layout_height="96dp"
        android:orientation="horizontal">

        <TextView android:id="@+id/textView8"
            android:layout_width="114dp"
            android:layout_height="79dp"
            android:layout_weight="1"
            android:text="Price"
            android:textSize="24sp" />

        <TextView android:id="@+id/pricer"
            android:layout_width="146dp"
            android:layout_height="73dp"
            android:layout_weight="1"
            android:text=""
            android:textSize="24sp" />
    </LinearLayout>

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

```

Retrieve All:

```

<?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" android:id="@+id/parent">

```



```
<Button
    android:id="@+id/backra" android:layout_width="match_parent"
    android:layout_height="wrap_content" android:text="Back"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent" />
```

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

Update.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:layout_width="match_parent"
    android:layout_height="match_parent">

    <LinearLayout android:layout_width="412dp"
        android:layout_height="352dp"
        android:orientation="vertical"
        app:layout_constraintStart_toStartOf="parent" tools:layout_editor_absoluteY="186dp"
        tools:ignore="MissingConstraints">

        <LinearLayout android:layout_width="match_parent"
            android:layout_height="107dp"
```

```
        android:orientation="horizontal">

        <TextView android:id="@+id/textView2"
            android:layout_width="105dp"
            android:layout_height="80dp"
            android:layout_weight="1"
            android:textSize="24sp"
            android:text="Product Id" />

        <EditText android:id="@+id/idu"
            android:layout_width="wrap_content"
            android:layout_height="match_parent"
            android:layout_weight="1" android:ems="10"
            android:inputType="textPersonName"
            android:textSize="24sp" />
    </LinearLayout>

    <LinearLayout android:layout_width="match_parent"
        android:layout_height="97dp"
        android:orientation="horizontal">

        <TextView android:id="@+id/textView4"
            android:layout_width="108dp"
            android:layout_height="79dp"
            android:layout_weight="1"
            android:textSize="24sp"
            android:text="Price" />

        <EditText android:id="@+id/priceu"
```

```

        android:layout_width="wrap_content"
        android:layout_height="match_parent"
        android:layout_weight="1" android:ems="10"
        android:textSize="24sp"
        android:inputType="textPersonName" />
</LinearLayout>

<Button
    android:id="@+id/update"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Update" />

<Button
    android:id="@+id/backu"
    android:layout_width="match_parent"
    android:layout_height="wrap_content" android:text="Back"
    />
</LinearLayout>
</androidx.constraintlayout.widget.ConstraintLayout>

```

Delete.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:layout_width="match_parent"
    android:layout_height="match_parent">

    <LinearLayout android:layout_width="414dp"
        android:layout_height="475dp"

```

```
android:orientation="vertical" app:layout_constraintEnd_toEndOf="parent"
app:layout_constraintStart_toStartOf="parent"tools:layout_editor_absoluteY="101dp"
tools:ignore="MissingConstraints">
```

```
<LinearLayout android:layout_width="match_parent"
    android:layout_height="152dp"
    android:orientation="horizontal">
```

```
<TextView android:id="@+id/textView"
    android:layout_width="144dp"
    android:layout_height="89dp"
    android:layout_weight="1"
    android:textSize="24sp"
    android:text="Product Id" />
```

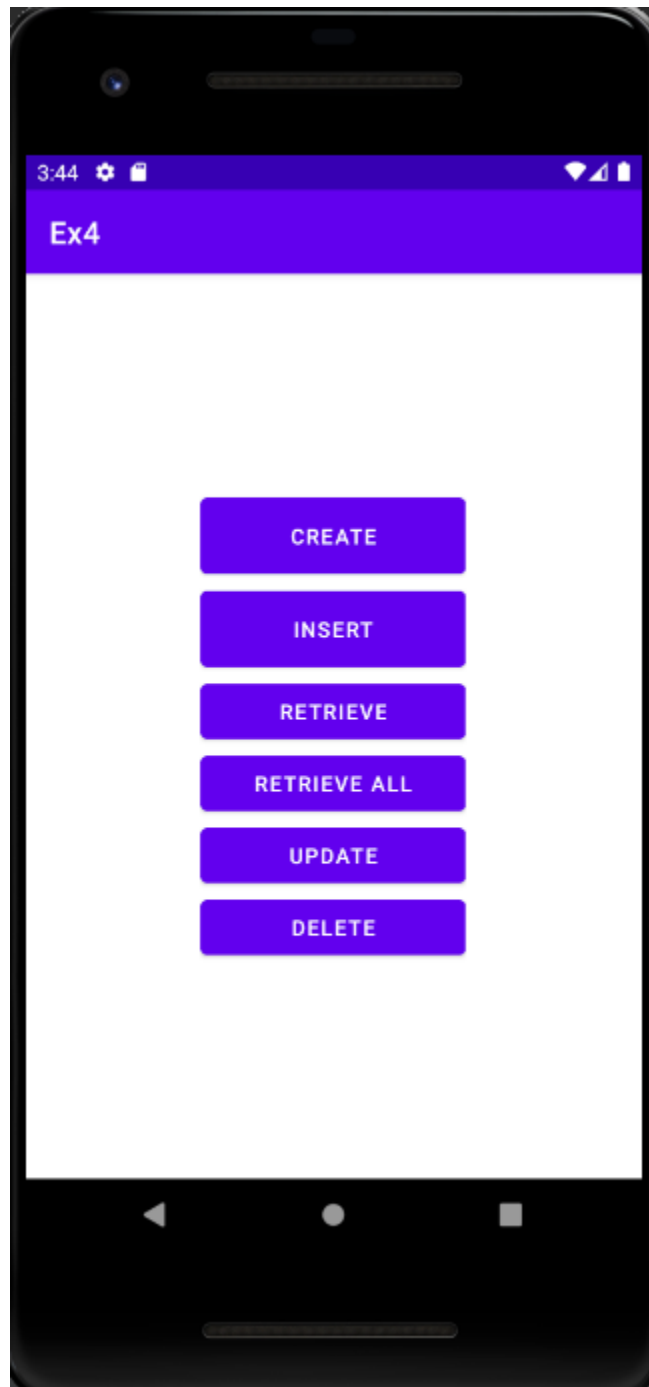
```
<EditText android:id="@+id/idd"
    android:layout_width="wrap_content"
    android:layout_height="match_parent"
    android:layout_weight="1" android:ems="10"
    android:inputType="textPersonName"
    android:textSize="24sp" />
```

```
</LinearLayout>
```

```
<Button
    android:id="@+id/delete"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:text="Delete" />
```

```
<Button
    android:id="@+id/backd"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"android:text="Back"
/>
</LinearLayout>
</androidx.constraintlayout.widget.ConstraintLayout>
```

Output:



3:44

Ex4

Product Id 4

Product Name zxcv

Brand ☒ A ☐ B

Description cool

Price 4567

SUBMIT

BACK

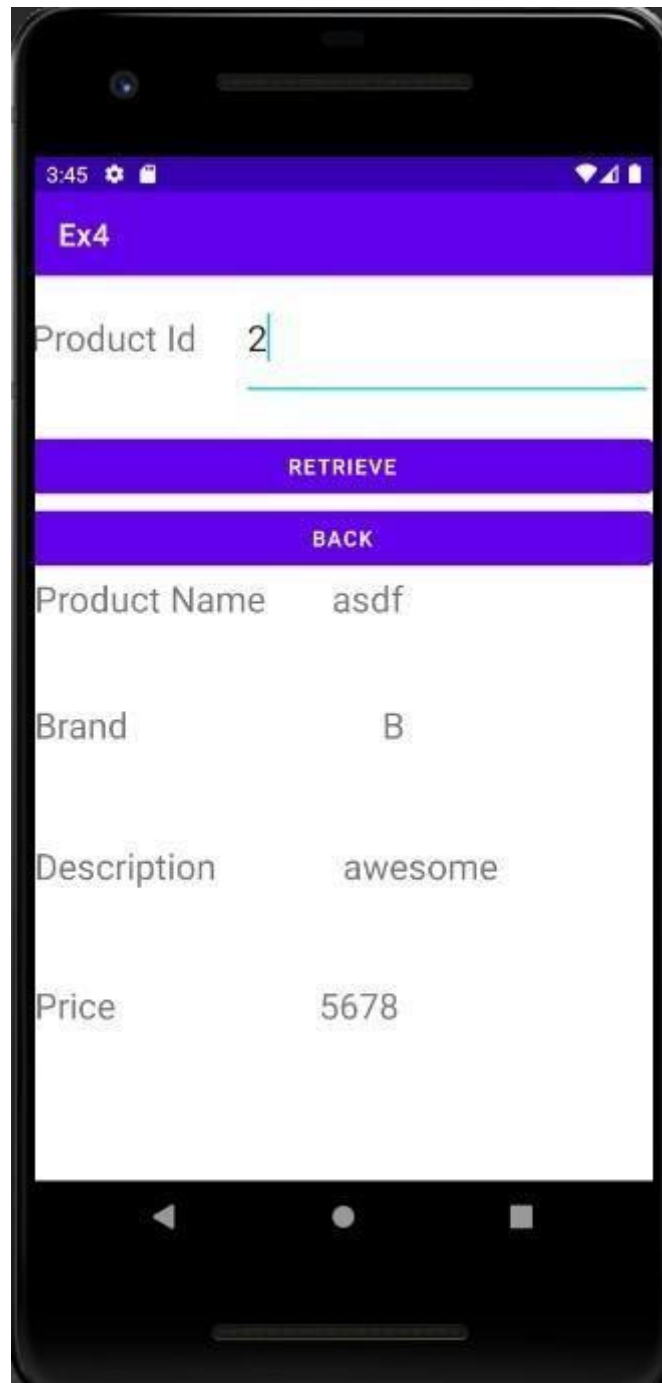
3:44

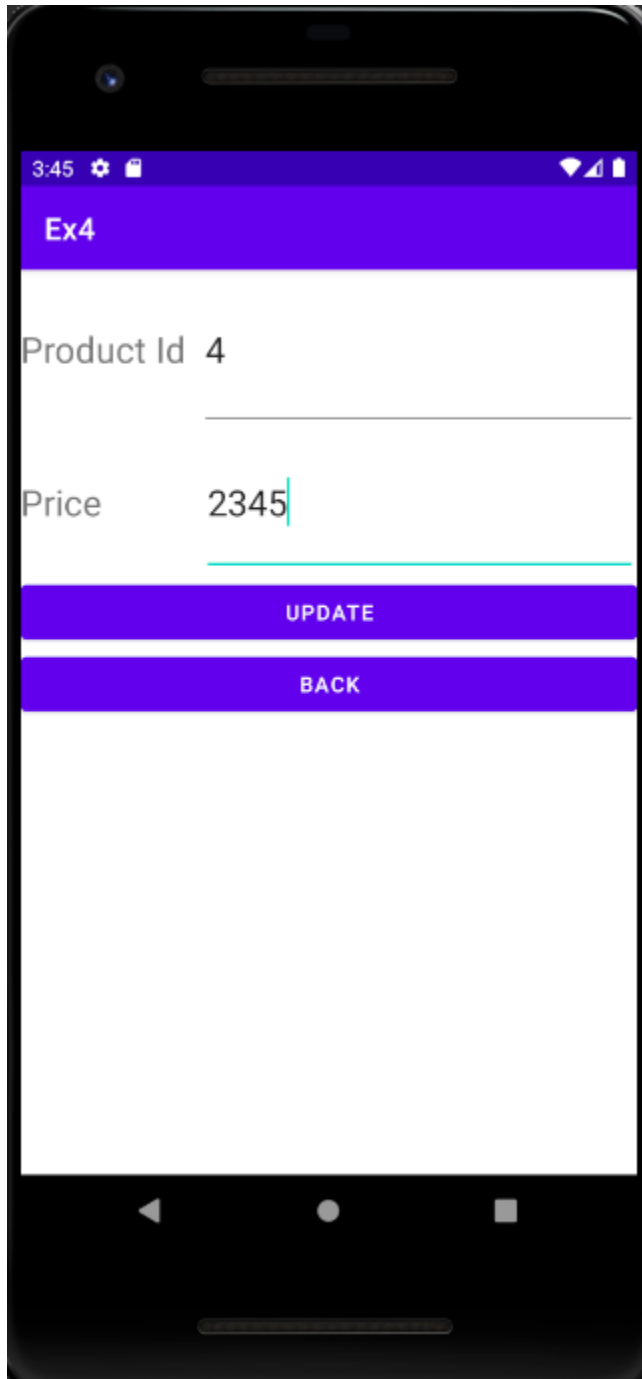


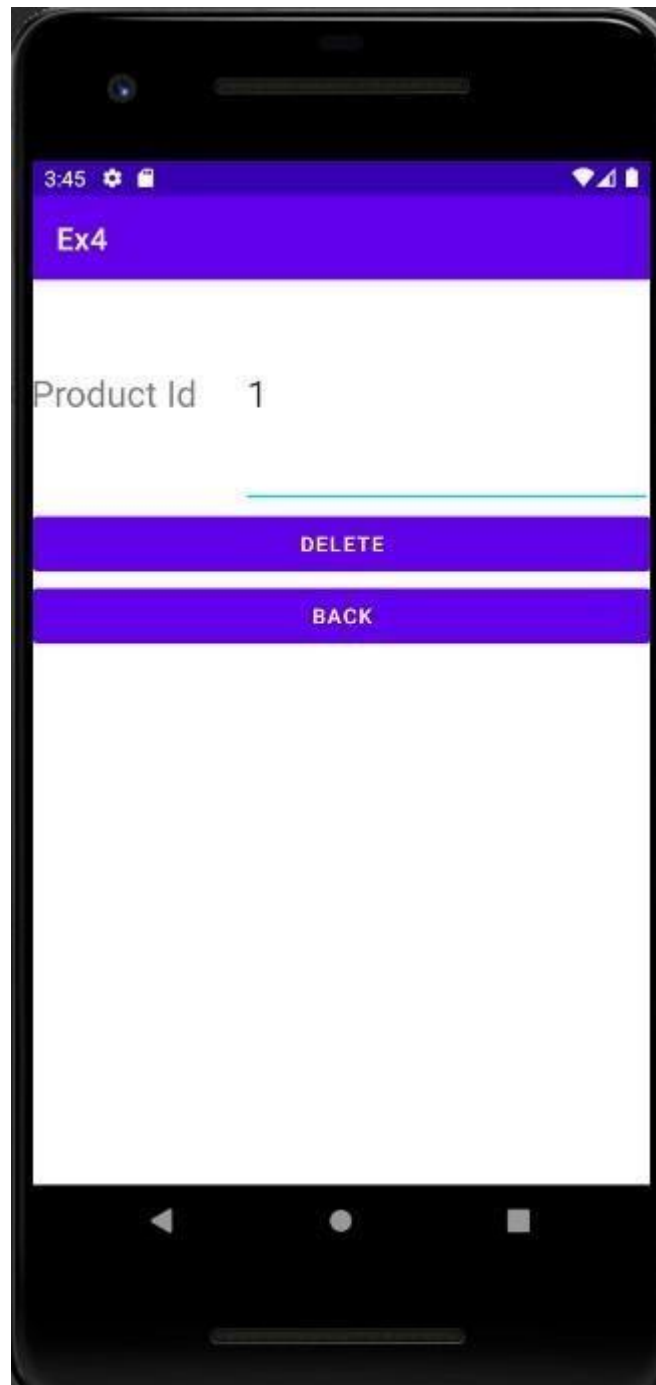
Ex4

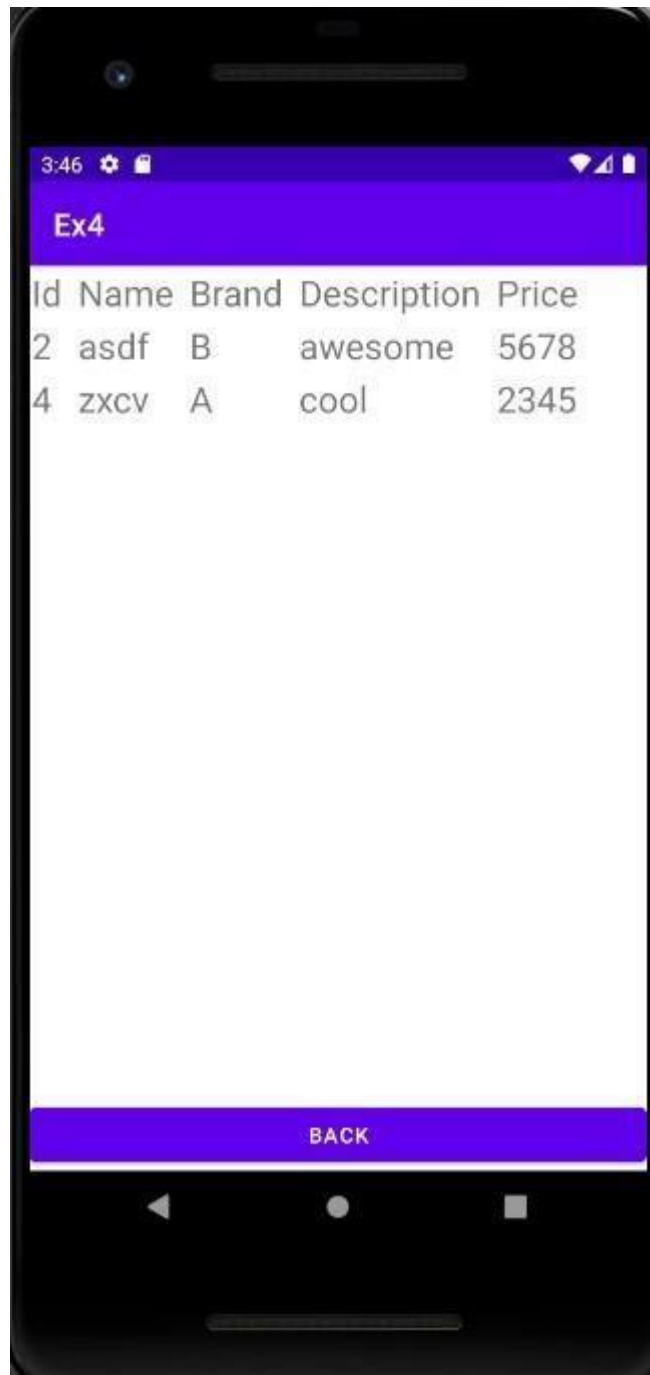
Id	Name	Brand	Description	Price
1	qwer	A	nice	1234
2	asdf	B	awesome	5678
4	zxcv	A	cool	4567

BACK









Best Practices:

- Used apt names for xml and java files.
- Set padding and margins for dynamically added elements

Learning Outcomes:

- Learnt to integrate sqlite3 in android studio
- Learnt to do CRUD operations

Ex. No. 5 Android Application using Multithreading**Aim:**

Develop an android application to perform multithreading. Define 3 threads to run concurrently when "start" button is clicked.

The first thread should change the color of the text indefinitely
The second thread should implement a moving banner

The third thread should display a counter starting from 0 to 1000
When the "Stop" button is pressed all the threads should be stopped

Layouts Used: None. Three textViews.

Code:

MainActivity.java:

```
package com.example.ex5;
```

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

```
import android.graphics.Color;import
```

```
android.os.Bundle;
```

```
import android.util.Log; import  
android.view.View;import  
android.widget.Button;  
import android.widget.TextView;
```

```
public class MainActivity extends AppCompatActivity {
```

```
    @Override
```

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

```
        TextView t1 = findViewById(R.id.t1);Thread1  
        th1 = new Thread1(t1);
```

```
        TextView t2 = findViewById(R.id.t2);Thread2  
        th2 = new Thread2(t2);
```

```
        TextView t3 = findViewById(R.id.t3);Thread3  
        th3 = new Thread3(t3);
```

```
final boolean[] init = {false};

Button start = findViewById(R.id.start); start.setOnClickListener(new
View.OnClickListener() {

    @Override

    public void onClick(View v) {if(!init[0]){

        th1.start();

        th2.start();

        th3.start();

        init[0] = true;

    }

    else{

        Log.d("debug","hello");

        th1.pause(false); th2.pause(false);

        th3.pause(false);

    }

}

});
```



```
Button stop = findViewById(R.id.stop); stop.setOnClickListener(new  
View.OnClickListener() {  
    @Override  
    public void onClick(View v) {  
        th1.pause(true); th2.pause(true);  
        th3.pause(true);  
    }  
});
```

```
}  
}
```

Thread1.java:

```
package com.example.ex5;  
  
import android.graphics.Color;import  
android.util.Log;  
import android.widget.TextView;
```

```

public class Thread1 extends Thread{TextView t;

    int red = 120; int
    green = 120;int blue
    = 120;

    boolean paused = false; Object
    lock = new Object();

    Thread1(TextView t){

        this.t=t;

    }

    public void pause(boolean paused){synchronized
        (lock){

            if(paused) this.paused
            = true;else{

                this.paused = false;

                lock.notifyAll();

            }

        }
    }

```

```
        Log.d("Debug", ""+paused);
    }

    public void run(){

        while(true) {try
        {
            int color = Color.rgb(red, green, blue);t.setTextColor(color);

            red = (red + 20) % 255; green =
            (green + 10) % 255;blue = (blue + 5)
            % 255;

            Thread.sleep(500);

            synchronized (lock){
                while(paused){
                    try{
                        lock.wait();
                    }catch(InterruptedException e){
```

```

        }
    }
}
} catch (InterruptedException e) {
    e.printStackTrace();
}
}

}
}

```

Thread2.java:

```

package com.example.ex5;

import android.util.Log;

import android.view.animation.TranslateAnimation;import
android.widget.TextView;

public class Thread2 extends Thread{TextView t;

```

```

int dir = 1;

int translationDistance = 300;boolean
paused=false; Object lock = new
Object(); Thread2(Textview t){
    this.t=t;
}

public void pause(boolean paused){synchronized
    (lock){
        if(paused)
            this.paused =
            true;
        else{
            this.paused = false;
            lock.notifyAll();
        }
    }
    Log.d("Debug",""+paused);
}

public void run(){

```

```

while (!paused) {try {
    TranslateAnimation animation;if (dir ==
    1) {
        animation = new TranslateAnimation(-translationDistance,translationDistance, 0,
0);
    } else {
        animation = new TranslateAnimation(translationDistance,
-translationDistance, 0, 0);
    }

    animation.setDuration(3000); // Keep the total duration the same
    animation.setFillAfter(true);
    t.startAnimation(animation);

    Thread.sleep(3000)
    ; dir = 1 - dir;

    synchronized (lock){
        while(paused){
            try{
                lock.wait();

```

```
        }catch(InterruptedException e){

        }

    }

}

} catch (InterruptedException e) {

    e.printStackTrace();

}

}

}

}
```

Thread3.java:

```
package com.example.ex5;

import android.util.Log;

import android.widget.TextView;
```

```

public class Thread3 extends Thread{TextView t;

    int ctr=0;

    boolean paused = false; Object

    lock = new Object();

    Thread3(TextView t){

        this.t=t;

    }

    public void pause(boolean paused){synchronized

        (lock){

            if(paused)

                this.paused =

                true;

            else{

                this.paused = false;

                lock.notifyAll();

            }

        }

        Log.d("Debug",""+paused);

    }

```



```
public void run(){
```

```
while (ctr < 3000 && !paused) {try {  
    Thread.sleep(1000)  
    ; ctr += 1;  
  
    // Update the TextView on the UI threadt.post(new  
    Runnable() {  
        @Override publicvoid  
        run() {  
            t.setText(Integer.toString(ctr));  
        }  
    });  
  
    synchronized (lock){  
        while(paused){  
            try{  
                lock.wait();  
            }catch(InterruptedException e){  
            }  
        }  
    }  
}
```

```

    }

    } catch (InterruptedException e) {paused =
        true; e.printStackTrace();
    }
}
}
}
}
}

```

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:layout_width="match_parent"
android:layout_height="match_parent" tools:context=".MainActivity"
tools:layout_editor_absoluteX="-1dp"
tools:layout_editor_absoluteY="-83dp">

<TextView

```

```
android:id="@+id/t1" android:layout_width="wrap_content"
android:layout_height="wrap_content" android:text="Hello
World!" android:textSize="24sp"
app:layout_constraintBottom_toBottomOf="parent"
app:layout_constraintHorizontal_bias="0.498"
app:layout_constraintLeft_toLeftOf="parent"
app:layout_constraintRight_toRightOf="parent"
app:layout_constraintTop_toTopOf="parent"
app:layout_constraintVertical_bias="0.383" />
```

```
<TextView android:id="@+id/t2"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content" android:text="Hello
World!" android:textSize="24sp"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintHorizontal_bias="0.501"
    app:layout_constraintLeft_toLeftOf="parent"
```

```
app:layout_constraintRight_toRightOf="parent"
app:layout_constraintTop_toTopOf="parent" app:layout_constraintVertical_bias="0.266"
/>
```

```
<TextView android:id="@+id/t3"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="0" android:textSize="24sp"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintHorizontal_bias="0.498"
    app:layout_constraintLeft_toLeftOf="parent"
    app:layout_constraintRight_toRightOf="parent"
    app:layout_constraintTop_toTopOf="parent" app:layout_constraintVertical_bias="0.155"
/>
```

```
<Button
    android:id="@+id/stop" android:layout_width="wrap_content"
    android:layout_height="wrap_content"
```

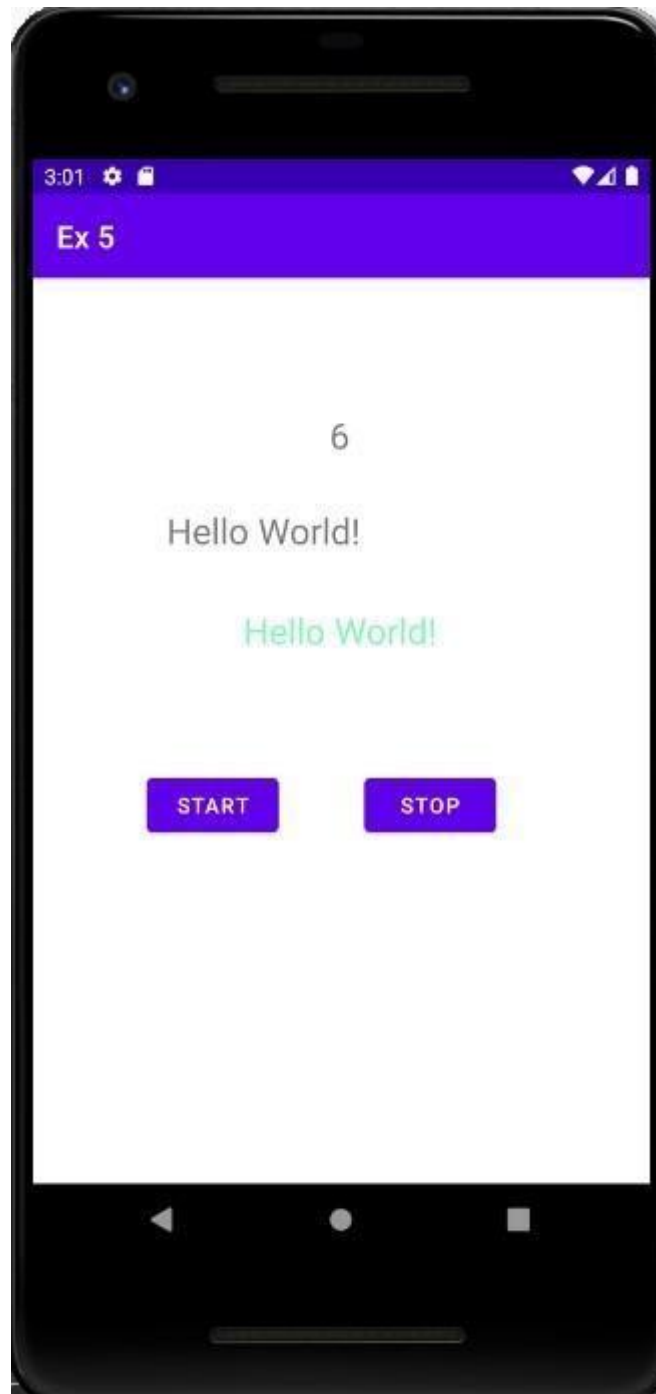
```
android:layout_marginTop="76dp" android:text="Stop"
app:layout_constraintEnd_toEndOf="parent"
app:layout_constraintHorizontal_bias="0.684"
app:layout_constraintStart_toStartOf="parent"
app:layout_constraintTop_toBottomOf="@+id/t1" />
```

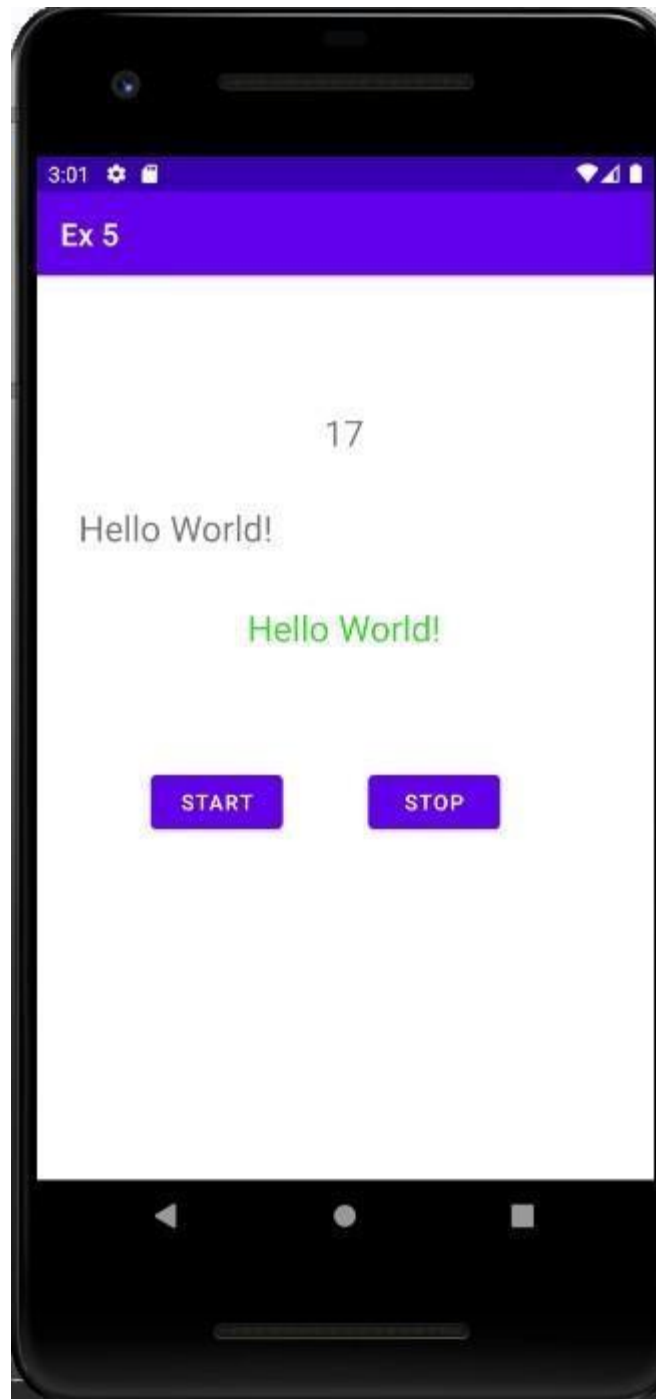
<Button

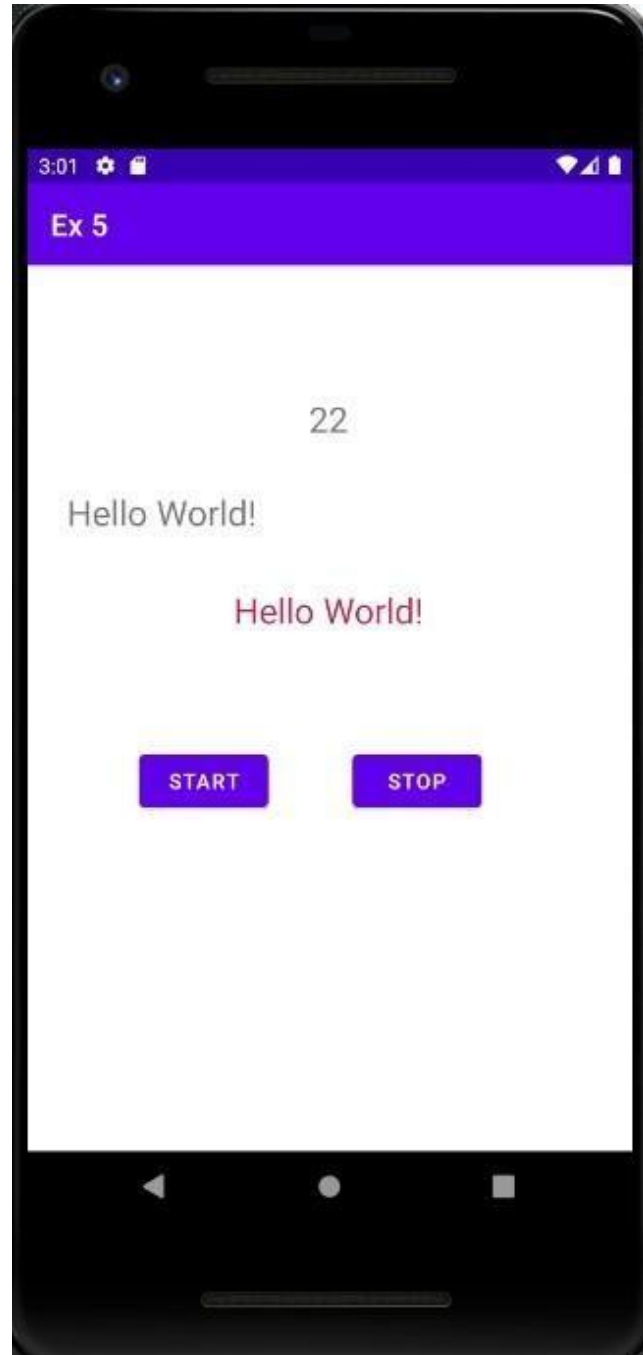
```
android:id="@+id/start" android:layout_width="wrap_content"
android:layout_height="wrap_content"
android:layout_marginTop="76dp" android:text="Start"
app:layout_constraintEnd_toEndOf="parent"
app:layout_constraintHorizontal_bias="0.236"
app:layout_constraintStart_toStartOf="parent"
app:layout_constraintTop_toBottomOf="@+id/t1" />
```

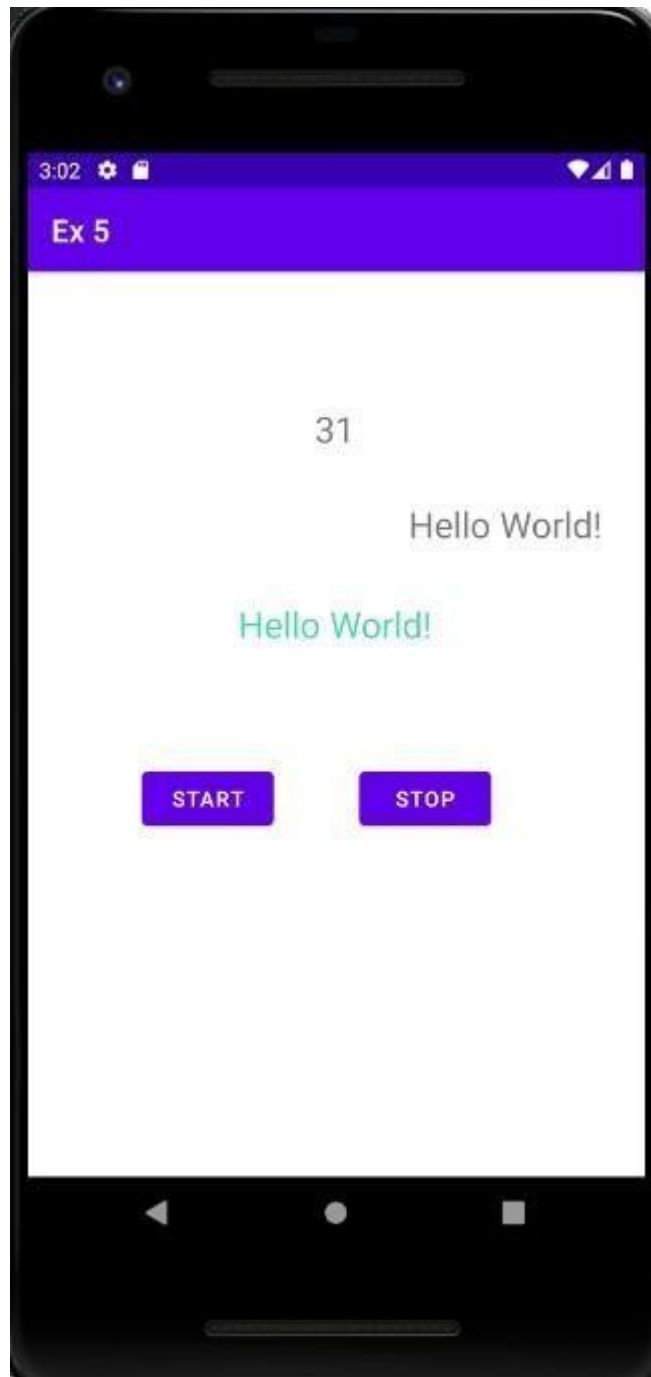
</androidx.constraintlayout.widget.ConstraintLayout>

Output:









Best Practices:

- Names for ids of buttons were set meaningfully
- Implemented pause and resume in a single function

- Handled exceptions

Learning Outcomes:

- Learnt to implement multithreading
- Learnt to start, stop and resume threads