# MODUL 2
# Building User Screen Flows

## THEME DESCRIPTION

This module covers the Android activity lifecycle and explains how the Android system interacts with your app.

## WEEKLY LEARNING OUTCOME (SUB-LEARNING OUTCOME)

Students will have learned how to build user journeys through different screens. You'll also be able to use activity tasks and launch modes, save and restore the state of your activity, use logs to report on your application, and share data between screens.

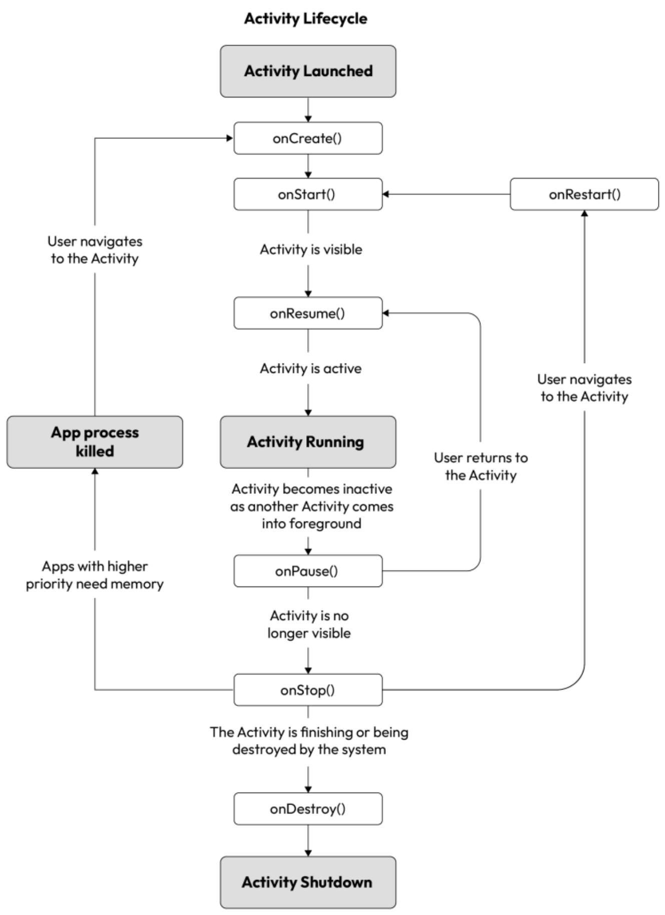
## TOOLS/SOFTWARE USED

- Android Studio

## CONCEPTS

### Activity Lifecycle

Activity lifecycle is a **series of steps/processes** that correspond with your application being hidden, backgrounded, and then destroyed. For every one of these steps, there is a **callback** that your Activity can use to perform actions such as creating and changing the display and saving data when your app has been put into the background and then restoring that data after your app comes back into the foreground.



Activity Lifecycle
Activity Launched
onCreate()
onStart()
onRestart()
User navigates to the Activity
Activity is visible
onResume()
Activity is active
User navigates to the Activity
App process killed
Activity Running
User returns to the Activity
Activity becomes inactive as another Activity comes into foreground
Apps with higher priority need memory
onPause()
Activity is no longer visible
onStop()
The Activity is finishing or being destroyed by the system
onDestroy()
Activity Shutdown

- **On Create**

```
override fun onCreate(savedInstanceState: Bundle?)
```

- **On Start**

```
override fun onStart()
```

- **On Restart**

```
override fun onRestart()
```

- **On Resume**

```
override fun onResume()
```

- **On Pause**

```
override fun onPause()
```

- **On Stop**

```
override fun onStop()
```

- **On Destroy**

```
override fun onDestroy()
```

### Intent

An **intent** in Android is a communication mechanism between components. Within your own app, a lot of the time, you will want **another specific Activity** to start when some action happens in the current activity. There are 2 types of intent:

- **Explicit intent**
  Specifies which activity or component will start. Example: Other activity in the same app.
- **Implicit intent**
  Doesn't specify which component will start. Example: Camera.

### Launch Modes

**Launch mode** controls the behavior of calling an activity into the screen. There are 5 modes currently available, but only 2 are often used:

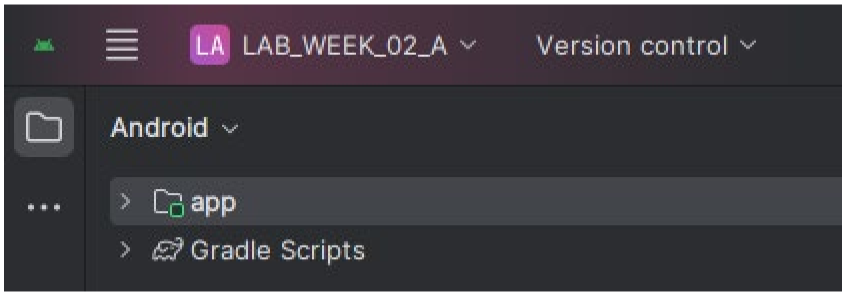
- **Standard Mode**
  This is the **default** mode and doesn't need specifying in the Activity element of AndroidManifest.xml. When you open the app from the launcher with **standard mode**, it creates its **own Task**, and each Activity you create is added to a **back stack**, so when you open three Activities one after the other as part of your user's journey, pressing the back button three times will move the user back through the previous screens/Activities and then go back to the device's home screen, while still keeping the app open.
- **Single Top Mode**
  This is an **alternative** to the default behavior. If a **singleTop** Activity is the most recently added, when the same **singleTop** Activity is launched again, then instead of creating a **new Activity**, it uses the **same Activity** and runs the **onNewIntent** callback. In this callback, you receive an intent, and you can then process this intent as you have done previously in onCreate.

## PRACTICAL STEPS

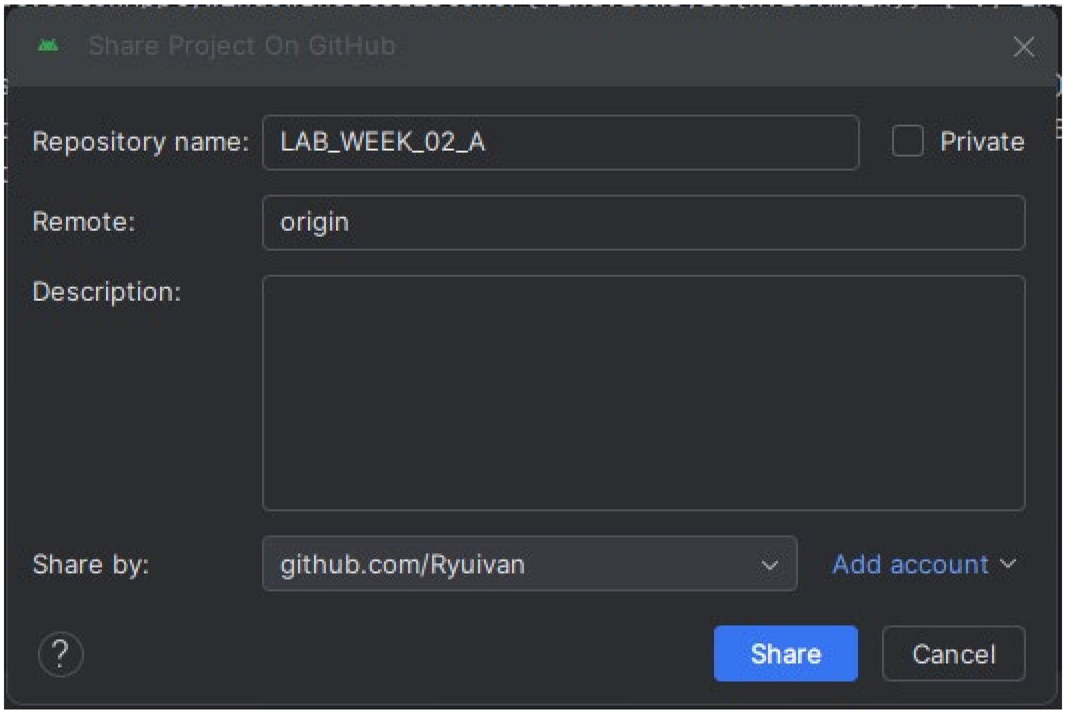
### Part 1 - Activity & Life Cycle

1. Open Android Studio and click **New Project.**
2. Choose the **Empty Views Activity** to start with.
3. Name your project **"LAB_WEEK_02_A"**.
4. Set the minimum SDK to **"API 24: Android 7.0 (Nougat)"**.
5. Click **Finish**, and let your android application build itself.

6. Create GitHub repository by select **“Version Control > Share Project On > GitHub”** on the top left.



7. Don’t forget to link your **GitHub** account with Android Studio.

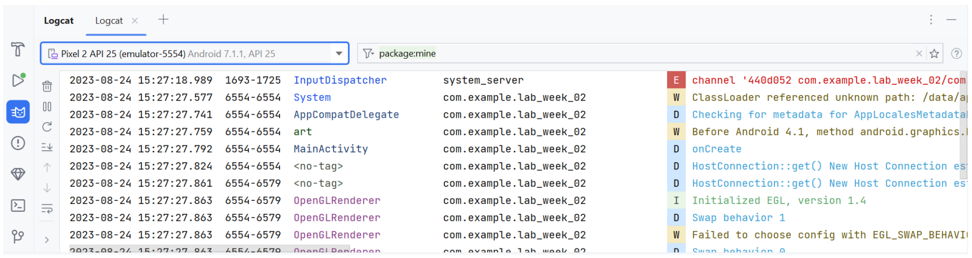


Repository name: LAB_WEEK_02_A ☐ Private
Remote: origin
Description:
Share by: github.com/Ryuivan Add account

8. Select **Share** and type **“Initial commit”** as the first commit to your branch. Then select **Add**.
9. In this part, we will be focusing on how the **activity lifecycle** works in Android. Update your **MainActivity.kt** to the code below.

```
class MainActivity : AppCompatActivity() {
    companion object {
        private const val TAG = "MainActivity"
    }

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)
        Log.d(TAG, "onCreate")
    }
}
```

10. In order to know how they work, we need to know when and how they are called while our application is running. In this case, we use the help of **Log.d** which prints out debug logs into our **Logcat** window.
11. Run your application, and click on the **Logcat** button at the bottom left of your window.



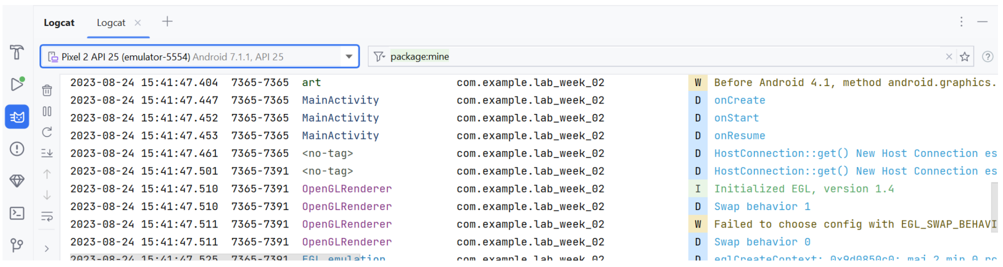
```
2023-08-24 15:27:18.989  1693-1725  InputDispatcher      system_server             E  channel '440d052 com.example.lab_week_02/com
2023-08-24 15:27:27.577  6554-6554  System               com.example.lab_week_02   W  ClassLoader referenced unknown path: /data/a
2023-08-24 15:27:27.741  6554-6554  AppCompatDelegate    com.example.lab_week_02   D  Checking for metadata for AppLocalesMetadata
2023-08-24 15:27:27.759  6554-6554  art                  com.example.lab_week_02   W  Before Android 4.1, method android.graphics.
2023-08-24 15:27:27.792  6554-6554  MainActivity         com.example.lab_week_02   D  onCreate
2023-08-24 15:27:27.824  6554-6554  <no-tag>             com.example.lab_week_02   D  HostConnection::get() New Host Connection es
2023-08-24 15:27:27.861  6554-6579  <no-tag>             com.example.lab_week_02   D  HostConnection::get() New Host Connection es
2023-08-24 15:27:27.863  6554-6579  OpenGLRenderer       com.example.lab_week_02   I  Initialized EGL, version 1.4
2023-08-24 15:27:27.863  6554-6579  OpenGLRenderer       com.example.lab_week_02   D  Swap behavior 1
2023-08-24 15:27:27.863  6554-6579  OpenGLRenderer       com.example.lab_week_02   W  Failed to choose config with EGL_SWAP_BEHAVI
2023-08-24 15:27:27.863  6554-6579  OpenGLRenderer       com.example.lab_week_02   D  Swap behavior 0
```

12. You can see our **Log.d** prints out **"onCreate"** into the **Logcat** window on the fifth line. This shows that our **onCreate** callback was successfully called.
13. Now try the above step for the other life cycles. Update your **MainActivity.kt** to the code below.

```
class MainActivity : AppCompatActivity() {
   companion object {
       private const val TAG = "MainActivity"
   }

   override fun onCreate(savedInstanceState: Bundle?) {
       super.onCreate(savedInstanceState)
       setContentView(R.layout.activity_main)
       Log.d(TAG, "onCreate")
   }
   override fun onRestart() {
       super.onRestart()
       Log.d(TAG, "onRestart")
   }
   override fun onStart() {
       super.onStart()
       Log.d(TAG, "onStart")
   }
```

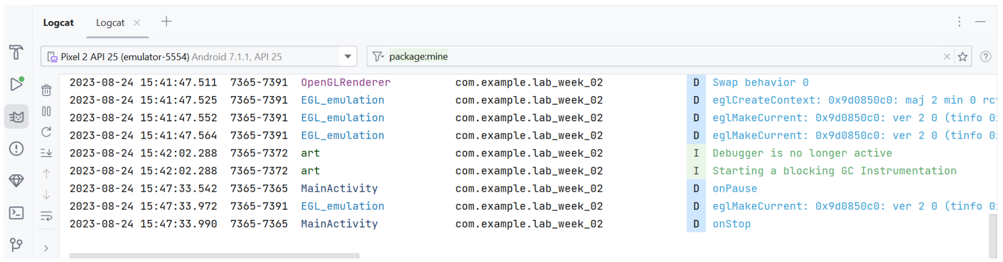
```
    override fun onResume() {
        super.onResume()
        Log.d(TAG, "onResume")
    }
    override fun onPause() {
        super.onPause()
        Log.d(TAG, "onPause")
    }
    override fun onStop() {
        super.onStop()
        Log.d(TAG, "onStop")
    }
    override fun onDestroy() {
        super.onDestroy()
        Log.d(TAG, "onDestroy")
    }
}
```

**14.** Now run your application again and your **Logcat** should print out **onCreate**, **onStart**, **onResume** in order.



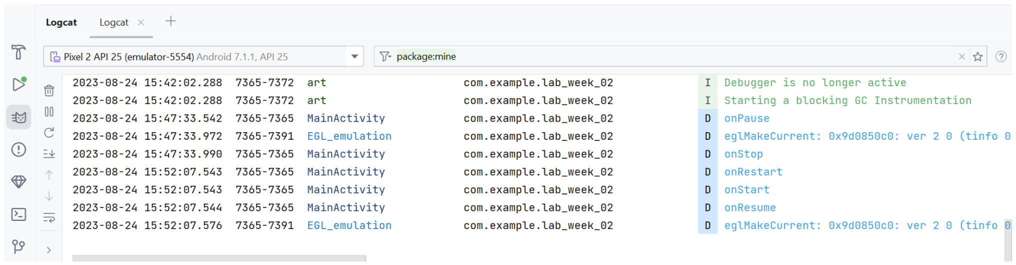
```
2023-08-24 15:41:47.404  7365-7365  art                 com.example.lab_week_02     W  Before Android 4.1, method android.graphics.
2023-08-24 15:41:47.447  7365-7365  MainActivity        com.example.lab_week_02     D  onCreate
2023-08-24 15:41:47.452  7365-7365  MainActivity        com.example.lab_week_02     D  onStart
2023-08-24 15:41:47.453  7365-7365  MainActivity        com.example.lab_week_02     D  onResume
2023-08-24 15:41:47.461  7365-7365  <no-tag>            com.example.lab_week_02     D  HostConnection::get() New Host Connection es
2023-08-24 15:41:47.501  7365-7391  <no-tag>            com.example.lab_week_02     D  HostConnection::get() New Host Connection es
2023-08-24 15:41:47.510  7365-7391  OpenGLRenderer      com.example.lab_week_02     I  Initialized EGL, version 1.4
2023-08-24 15:41:47.510  7365-7391  OpenGLRenderer      com.example.lab_week_02     D  Swap behavior 1
2023-08-24 15:41:47.511  7365-7391  OpenGLRenderer      com.example.lab_week_02     W  Failed to choose config with EGL_SWAP_BEHAVI
2023-08-24 15:41:47.511  7365-7391  OpenGLRenderer      com.example.lab_week_02     D  Swap behavior 0
```

**15.** Now press the **Home** button on your device and your **Logcat** should print out **onPause**, **onStop** in order.



```
2023-08-24 15:41:47.511  7365-7391  OpenGLRenderer      com.example.lab_week_02     D  Swap behavior 0
2023-08-24 15:41:47.525  7365-7391  EGL_emulation       com.example.lab_week_02     D  eglCreateContext: 0x9d0850c0: maj 2 min 0 rc
2023-08-24 15:41:47.552  7365-7391  EGL_emulation       com.example.lab_week_02     D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
2023-08-24 15:41:47.564  7365-7391  EGL_emulation       com.example.lab_week_02     D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
2023-08-24 15:42:02.288  7365-7372  art                 com.example.lab_week_02     I  Debugger is no longer active
2023-08-24 15:42:02.288  7365-7372  art                 com.example.lab_week_02     I  Starting a blocking GC Instrumentation
2023-08-24 15:47:33.542  7365-7365  MainActivity        com.example.lab_week_02     D  onPause
2023-08-24 15:47:33.972  7365-7391  EGL_emulation       com.example.lab_week_02     D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
2023-08-24 15:47:33.990  7365-7365  MainActivity        com.example.lab_week_02     D  onStop
```

**16.** Now press the **Recent** square button on your device and bring the app back into the foreground. Your **Logcat** should print out **onRestart**, **onStart, onResume** in order.

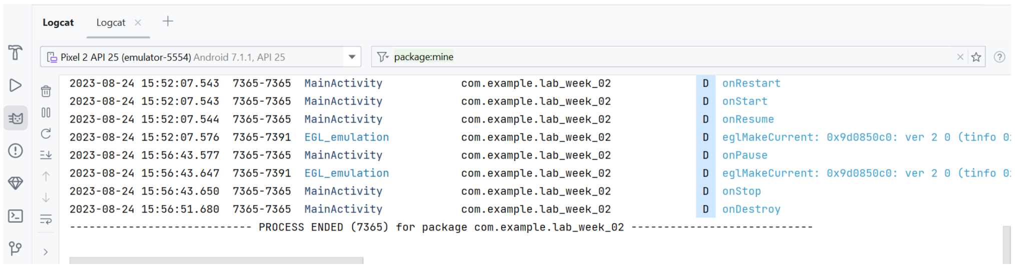


Logcat | Logcat

Pixel 2 API 25 (emulator-5554) Android 7.1.1, API 25 | package:mine

```
2023-08-24 15:42:02.288  7365-7372  art                  com.example.lab_week_02   I  Debugger is no longer active
2023-08-24 15:42:02.288  7365-7372  art                  com.example.lab_week_02   I  Starting a blocking GC Instrumentation
2023-08-24 15:47:33.542  7365-7365  MainActivity         com.example.lab_week_02   D  onPause
2023-08-24 15:47:33.972  7365-7391  EGL_emulation        com.example.lab_week_02   D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
2023-08-24 15:47:33.990  7365-7365  MainActivity         com.example.lab_week_02   D  onStop
2023-08-24 15:52:07.543  7365-7365  MainActivity         com.example.lab_week_02   D  onRestart
2023-08-24 15:52:07.543  7365-7365  MainActivity         com.example.lab_week_02   D  onStart
2023-08-24 15:52:07.544  7365-7365  MainActivity         com.example.lab_week_02   D  onResume
2023-08-24 15:52:07.576  7365-7391  EGL_emulation        com.example.lab_week_02   D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
```

**17.** Press the **Recent** square button again and swipe the app away to kill the activity. Your **Logcat** should print out **onPause**, **onStop**, **onDestroy** in order.

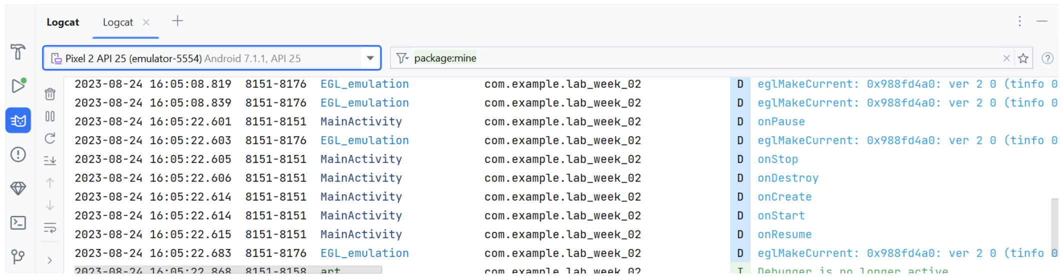


Logcat | Logcat

Pixel 2 API 25 (emulator-5554) Android 7.1.1, API 25 | package:mine

```
2023-08-24 15:52:07.543  7365-7365  MainActivity         com.example.lab_week_02   D  onRestart
2023-08-24 15:52:07.543  7365-7365  MainActivity         com.example.lab_week_02   D  onStart
2023-08-24 15:52:07.544  7365-7365  MainActivity         com.example.lab_week_02   D  onResume
2023-08-24 15:52:07.576  7365-7391  EGL_emulation        com.example.lab_week_02   D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0:
2023-08-24 15:56:43.577  7365-7365  MainActivity         com.example.lab_week_02   D  onPause
2023-08-24 15:56:43.647  7365-7391  EGL_emulation        com.example.lab_week_02   D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0:
2023-08-24 15:56:43.650  7365-7365  MainActivity         com.example.lab_week_02   D  onStop
2023-08-24 15:56:51.680  7365-7365  MainActivity         com.example.lab_week_02   D  onDestroy
-------------------------- PROCESS ENDED (7365) for package com.example.lab_week_02 --------------------------
```

**18.** Lastly, you need to know that rotating the device also counts as recreating the activity. Try rotating your device and your **Logcat** should print out **onPause, onStop, onDestroy, onCreate, onStart, onResume** in order.



Logcat | Logcat

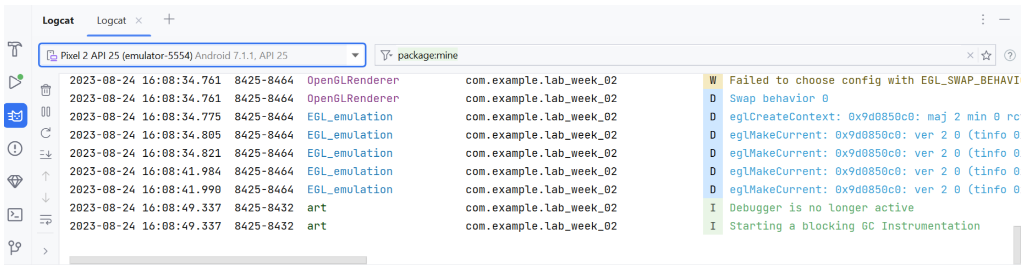
Pixel 2 API 25 (emulator-5554) Android 7.1.1, API 25 | package:mine

```
2023-08-24 16:05:08.819  8151-8176  EGL_emulation        com.example.lab_week_02   D  eglMakeCurrent: 0x988fd4a0: ver 2 0 (tinfo 0
2023-08-24 16:05:08.839  8151-8176  EGL_emulation        com.example.lab_week_02   D  eglMakeCurrent: 0x988fd4a0: ver 2 0 (tinfo 0
2023-08-24 16:05:22.601  8151-8151  MainActivity         com.example.lab_week_02   D  onPause
2023-08-24 16:05:22.603  8151-8176  EGL_emulation        com.example.lab_week_02   D  eglMakeCurrent: 0x988fd4a0: ver 2 0 (tinfo 0
2023-08-24 16:05:22.605  8151-8151  MainActivity         com.example.lab_week_02   D  onStop
2023-08-24 16:05:22.606  8151-8151  MainActivity         com.example.lab_week_02   D  onDestroy
2023-08-24 16:05:22.614  8151-8151  MainActivity         com.example.lab_week_02   D  onCreate
2023-08-24 16:05:22.614  8151-8151  MainActivity         com.example.lab_week_02   D  onStart
2023-08-24 16:05:22.615  8151-8151  MainActivity         com.example.lab_week_02   D  onResume
2023-08-24 16:05:22.683  8151-8176  EGL_emulation        com.example.lab_week_02   D  eglMakeCurrent: 0x988fd4a0: ver 2 0 (tinfo 0
2023-08-24 16:05:22.868  8151-8158  art                  com.example.lab_week_02   I  Debugger is no longer active
```

**19.** To prevent the activity recreation, update your **MainActivity** in your **AndroidManifest.xml** file to the code below.

```
<activity
   android:name=".MainActivity"
   android:exported="true"
   android:configChanges="orientation|screenSize|screenLayout">
   <intent-filter>
       <action android:name="android.intent.action.MAIN" />
       <category android:name="android.intent.category.LAUNCHER" />
   </intent-filter>
</activity>
```

**20.** Now try rotating your device again, and no lifecycle logs should appear in your **Logcat**.



```
2023-08-24 16:08:34.761  8425-8464  OpenGLRenderer        com.example.lab_week_02            W  Failed to choose config with EGL_SWAP_BEHAVI
2023-08-24 16:08:34.761  8425-8464  OpenGLRenderer        com.example.lab_week_02            D  Swap behavior 0
2023-08-24 16:08:34.775  8425-8464  EGL_emulation         com.example.lab_week_02            D  eglCreateContext: 0x9d0850c0: maj 2 min 0 rc
2023-08-24 16:08:34.805  8425-8464  EGL_emulation         com.example.lab_week_02            D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
2023-08-24 16:08:34.821  8425-8464  EGL_emulation         com.example.lab_week_02            D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
2023-08-24 16:08:41.984  8425-8464  EGL_emulation         com.example.lab_week_02            D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
2023-08-24 16:08:41.990  8425-8464  EGL_emulation         com.example.lab_week_02            D  eglMakeCurrent: 0x9d0850c0: ver 2 0 (tinfo 0
2023-08-24 16:08:49.337  8425-8432  art                   com.example.lab_week_02            I  Debugger is no longer active
2023-08-24 16:08:49.337  8425-8432  art                   com.example.lab_week_02            I  Starting a blocking GC Instrumentation
```

**21. Commit** your changes to **GitHub** at this point. **Commit Message: “Commit No.1 – Activity lifecycle”**.

## Part 2 - Intent

1. Create a **New Project.**
2. Choose the **Empty Views Activity** to start with.
3. Name your project **“LAB_WEEK_02_B”**.
4. Set the minimum SDK to **“API 24: Android 7.0 (Nougat)”**.
5. Click **Finish**, and let your android application build itself.
6. Create new **GitHub** repository for this project and commit.
7. In this part, we will be focusing on how **intent** works in Android. We will be making a color code picker app. Update your **activity_main.xml** to the code below.

```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"
   style="@style/screen_margin">

   <LinearLayout
       android:layout_width="match_parent"
       android:layout_height="wrap_content"
       android:layout_marginTop="16dp"
       android:orientation="vertical"
       app:layout_constraintTop_toTopOf="parent">

       <TextView
           android:id="@+id/welcome_message"
```

```
            android:layout_width="match_parent"
            android:layout_height="match_parent"
            style="@style/text_display"
            android:text="@string/welcome_message" />
        <com.google.android.material.textfield.TextInputLayout
            android:id="@+id/color_code_input_wraper"
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            style="@style/text_input"
            android:hint="@string/color_code_input_message">
            <com.google.android.material.textfield.TextInputEditText
                android:id="@+id/color_code_input_field"
                android:layout_width="match_parent"
                android:layout_height="wrap_content"
                android:inputType="text"
                android:maxLength="6" />
        </com.google.android.material.textfield.TextInputLayout>
        <Button
            android:id="@+id/submit_button"
            android:layout_width="200dp"
            android:layout_height="wrap_content"
            style="@style/button"
            android:text="@string/submit_button"/>
    </LinearLayout>

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

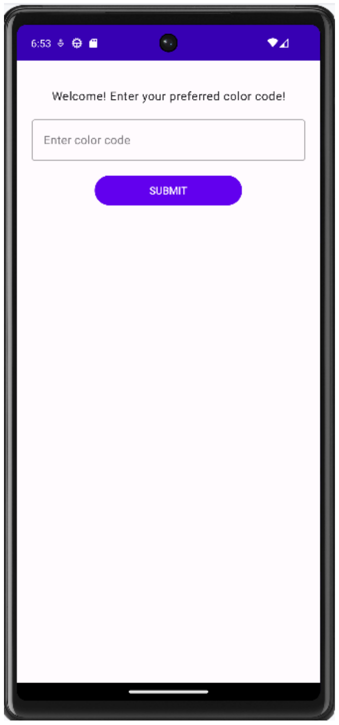
8. Now update your **strings.xml** to the code below.

```
<resources>
   <string name="app_name">LAB_WEEK_02</string>
   <string name="welcome_message">Welcome! Enter your preferred color
code!</string>
   <string name="color_code_input_message">Enter color code</string>
   <string name="color_code_input_empty">Color code field is empty!</string>
   <string name="color_code_input_wrong_length">Color code has to be 6
digits!</string>
   <string name="color_code_result_message">Color code #%s is applied!</string>
   <string name="color_code_input_invalid">Color code is invalid!</string>
   <string name="submit_button">SUBMIT</string>
</resources>
```

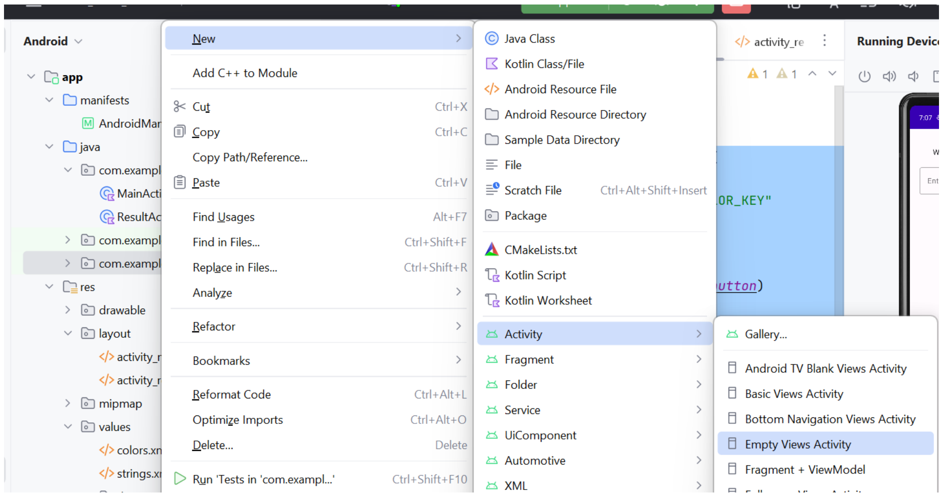
9. Next update your **themes.xml** to the code below.

```xml
<resources xmlns:tools="http://schemas.android.com/tools">
   <!-- Base application theme. -->
   <style name="Base.Theme.LAB_WEEK_02"
parent="Theme.Material3.DayNight.NoActionBar">
       ...
   </style>

   <style name="Theme.LAB_WEEK_02" parent="Base.Theme.LAB_WEEK_02" />

   <!-- Your custom styles -->
   <style name="text_input"
parent="Widget.MaterialComponents.TextInputLayout.OutlinedBox">
       <item name="android:layout_margin">8dp</item>
   </style>
   <style name="button">
       <item name="android:layout_margin">8dp</item>
       <item name="android:layout_gravity">center</item>
   </style>
   <style name="text_display">
       <item name="android:layout_margin">8dp</item>
       <item name="android:gravity">center</item>
       <item name="android:layout_height">40dp</item>
   </style>
   <style name="screen_margin">
       <item name="android:layout_margin">12dp</item>
   </style>
</resources>
```

10. Your main activity layout should now look like this.



11. Our main layout is done, now let’s make another activity. **Right click** anywhere in the **files menu** and then choose **New > Activity > Empty Views Activity.** Name your new activity **Result Activity**.



12. Now edit the **activity_result.xml** file to the code below.

```
<?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=".ResultActivity"
    android:id="@+id/background_screen">
    <TextView
        android:id="@+id/color_code_result_message"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintBottom_toBottomOf="parent"
        style="@style/text_display"
        android:textColor="@color/white"/>
</androidx.constraintlayout.widget.ConstraintLayout>
```

13. Your **activity_result.xml** should show a blank activity for now.
14. We've set up all of the activity layouts, now we can focus on the logic behind it. Let's start with the **MainActivity.kt** file. Update it to the code below.

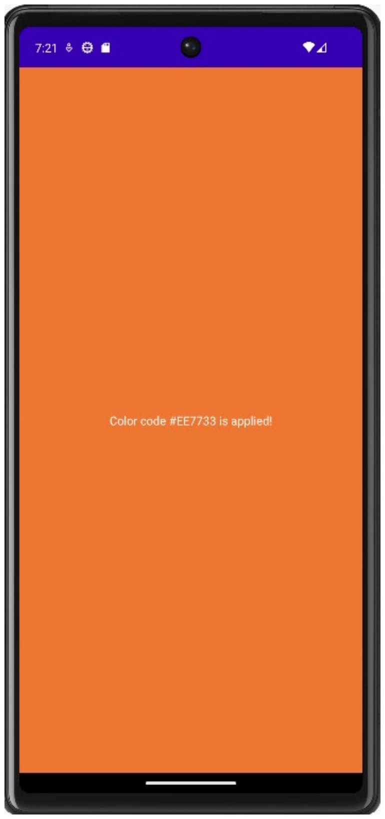
```
class MainActivity : AppCompatActivity() {
    companion object {
        private const val COLOR_KEY = "COLOR_KEY"
    }

    private val submitButton: Button
        get() = findViewById(R.id.submit_button)

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)

        submitButton.setOnClickListener{
            val colorCode =
findViewById<TextInputEditText>(R.id.color_code_input_field).text.toString()

            if(colorCode.isNotEmpty()){
                if (colorCode.length < 6){
                    Toast
                        .makeText(this,
getString(R.string.color_code_input_wrong_length), Toast.LENGTH_LONG)
                        .show()
                }
                else{
                    val ResultIntent = Intent(this, ResultActivity::class.java)
                    ResultIntent.putExtra(COLOR_KEY, colorCode)
                    startActivity(ResultIntent)
                }
            }
            else{
                Toast
                    .makeText(this, getString(R.string.color_code_input_empty),
Toast.LENGTH_LONG)
                    .show()
            }
        }
    }
}
```

15. To sum up, the above code accepts a color code input, which will be **passed** on to the **ResultActivity** through our **intent** (using extra). This color code will then be received and displayed as the background color of **ResultActivity**.
16. Next, let's set up our **ResultActivity.kt** as the receiver of the started intent. Update your **ResultActivity.kt** to the code below.

```
class ResultActivity : AppCompatActivity() {
   companion object {
       private const val COLOR_KEY = "COLOR_KEY"
   }

   override fun onCreate(savedInstanceState: Bundle?) {
       super.onCreate(savedInstanceState)
       setContentView(R.layout.activity_result)

       if(intent != null){
           val colorCode = intent.getStringExtra(COLOR_KEY)

           val backgroundScreen =
findViewById<ConstraintLayout>(R.id.background_screen)
           backgroundScreen.setBackgroundColor(Color.parseColor("#$colorCode"))
           val resultMessage =
findViewById<TextView>(R.id.color_code_result_message)
           resultMessage.text = getString(R.string.color_code_result_message,
colorCode?.uppercase())
       }
```

```
    }
}
```

17. To sum up, the above code **receives** an intent with the **passed** on color code through **extra**. The color code will then be displayed as the background color of the activity.
18. Now try running your application, and insert a random color code. An intent should be started and you will be moved to another activity with the background color set to your chosen color.



19. Congratulations, you've successfully made a simple intent-based application. Unfortunately, there's 1 problem with the current version of the app. Any **invalid** color code combination will result in the app being **crashed**.
20. **Commit** your changes to **GitHub** at this point. **Commit Message: "Commit No. 2 – Result activity"**.
21. In order to fix this, we need to retrieve an **error message** back from **ResultActivity** to **MainActivity**. We can do this by using **startActivityResult** instead of **startActivity.**
22. In **MainActivity.kt**, add the code below above your **onCreate** method.

```
private val startForResult =
registerForActivityResult(ActivityResultContracts.StartActivityForResult()){
   activityResult ->
   val data = activityResult.data
   val error = data?.getBooleanExtra(ERROR_KEY, false)
   if(error == true){
       Toast
           .makeText(this, getString(R.string.color_code_input_invalid),
Toast.LENGTH_LONG)
           .show()
   }
}

override fun onCreate(savedInstanceState: Bundle?) {
      ...
}
```

23. The above code accepts an optional response from **ResultActivity** (in this case an error confirmation) and displays it as a **toast** message in the **MainActivity**.
24. Because we're using a new key for our **getBooleanExtra**, update your companion object to the code below.

```
companion object {
   private const val COLOR_KEY = "COLOR_KEY"
   private const val ERROR_KEY = "ERROR_KEY"
}
```

25. Also update your input validation to the code below.

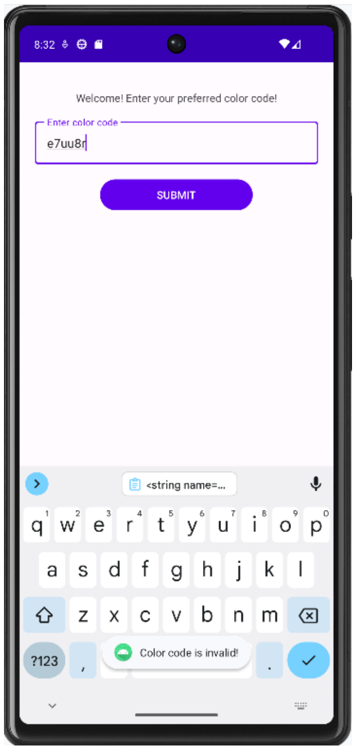
```
if(colorCode.isNotEmpty()){
   if (colorCode.length < 6){
       Toast
           .makeText(this, getString(R.string.color_code_input_wrong_length),
Toast.LENGTH_LONG)
           .show()
   }
   else{
       val ResultIntent = Intent(this, ResultActivity::class.java)
       ResultIntent.putExtra(COLOR_KEY, colorCode)
       //startActivity(ResultIntent)
       startForResult.launch(ResultIntent)
```

```
    }
}
```

26. Now instead of using **startActivity()**, we use **startForResult.lauch()**. With this, a **response** can be passed back from **ResultActivity** back to **MainActivity**.
27. Next, let’s update our **ResultActivity.kt** so it can pass back an error argument back to **MainActivity.kt**. Update your **ResultActivity.kt** to the code below.

```
class ResultActivity : AppCompatActivity() {
    companion object {
        private const val COLOR_KEY = "COLOR_KEY"
        private const val ERROR_KEY = "ERROR_KEY"
    }

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_result)

        if(intent != null){
            val colorCode = intent.getStringExtra(COLOR_KEY)

            val backgroundScreen =
findViewById<ConstraintLayout>(R.id.background_screen)
            try {
                backgroundScreen.setBackgroundColor(Color.parseColor("#$colorCode"))
            }
            catch (ex: IllegalArgumentException){
                Intent().let{
                    errorIntent ->
                    errorIntent.putExtra(ERROR_KEY, true)
                    setResult(Activity.RESULT_OK, errorIntent)
                    finish()
                }
            }
            val resultMessage =
findViewById<TextView>(R.id.color_code_result_message)
            resultMessage.text = getString(R.string.color_code_result_message,
colorCode?.uppercase())
        }
    }
}
```

28. Now our validation will send back an error response back to **MainActivity** if the color code is invalid.
29. Try running your application and input an invalid color code. An error message should be shown as a toast message in your **MainActivity**.



30. Congratulations, you've successfully made a fully functional intent-based application.
31. **Commit** your changes to **GitHub** at this point. **Commit Message: "Commit No. 3 – Fix application crash when user input wrong color code"**.

## Part 3 - Launch Modes

1. Create a **New Project.**
2. Choose the **Empty Views Activity** to start with.
3. Name your project **"LAB_WEEK_02_C"**.
4. Set the minimum SDK to **"API 24: Android 7.0 (Nougat)"**.
5. Click **Finish**, and let your android application build itself.
6. Create new **GitHub** repository for this project and commit.
7. In this part, we will be focusing on how **launch mode** works in Android. Update your **activity_main.xml** to the code below.

```
<?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">

    <include layout="@layout/activity_standard"
        android:id="@+id/layout_standard"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintBottom_toTopOf="@+id/layout_single_top"/>

    <include layout="@layout/activity_single_top"
        android:id="@+id/layout_single_top"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        app:layout_constraintTop_toBottomOf="@+id/layout_standard"
        app:layout_constraintBottom_toBottomOf="parent"/>

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

8. Next, create 2 new activities called **StandardActivity** and **SingleTopActivity**.
9. After creating your activities, always remember to add it to the **AndroidManifest.xml** file.

```
<activity
    android:name=".MainActivity"
    android:exported="true">
    <intent-filter>
        <action android:name="android.intent.action.MAIN" />

        <category android:name="android.intent.category.LAUNCHER" />
    </intent-filter>
</activity>
<activity
    android:name=".StandardActivity"
    android:launchMode="standard">
</activity>
<activity
    android:name=".SingleTopActivity"
    android:launchMode="singleTop">
</activity>
```

10. In **activity_standard.xml**, update the file to the code below.

```
<?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">

   <Button
       android:id="@+id/button_standard"
       android:layout_width="200dp"
       android:layout_height="wrap_content"
       android:text="@string/standard_button"
       android:padding="20dp"
       app:layout_constraintBottom_toBottomOf="parent"
       app:layout_constraintLeft_toLeftOf="parent"
       app:layout_constraintRight_toRightOf="parent"
       app:layout_constraintTop_toTopOf="parent" />

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

11. In **activity_single_top.xml**, update the file to the code below.

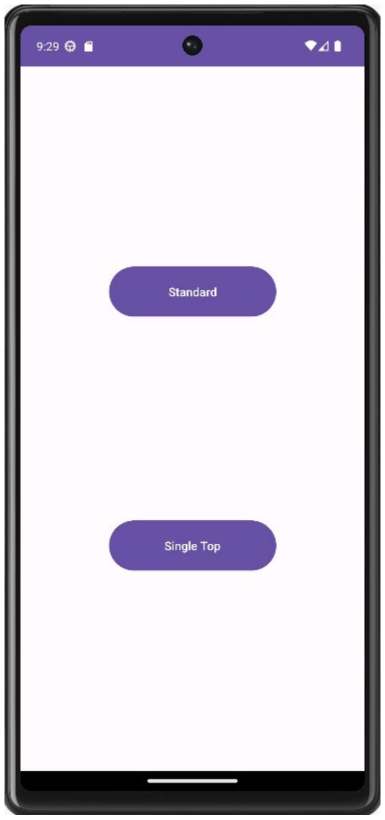
```
<?xml version="1.0" encoding="utf-8"?>
<androidx.constraintlayout.widget.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
   xmlns:app="http://schemas.android.com/apk/res-auto"
   xmlns:tools="http://schemas.android.com/tools"
   android:layout_width="match_parent"
   android:layout_height="match_parent"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

   <Button
       android:id="@+id/button_single_top"
       android:layout_width="200dp"
       android:layout_height="wrap_content"
       android:text="@string/single_top_button"
       android:padding="20dp"
       app:layout_constraintBottom_toBottomOf="parent"
       app:layout_constraintLeft_toLeftOf="parent"
```

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

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

12. Don’t forget to also update your **strings.xml** to the code below.

```
<resources>
   <string name="app_name">LAB_WEEK_02_C</string>
   <string name="standard_button">Standard</string>
   <string name="single_top_button">Single Top</string>
</resources>
```

13. Your layout should now look like this.



14. Our layouts are done, now update your **StandardActivity.kt** to the code below.

```
class StandardActivity : AppCompatActivity() {
    companion object{
        private const val DEBUG = "DEBUG"
    }

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_standard)
        Log.d(DEBUG, "onCreate")

        findViewById<Button>(R.id.button_standard).setOnClickListener{
            startActivity(
                Intent(this,
                    StandardActivity::class.java)
            )
        }
    }

    override fun onNewIntent(intent: Intent?) {
        super.onNewIntent(intent)
        Log.d(DEBUG, "onNewIntent")
    }
}
```

15. Next, update your **SingleTopActivity.kt** to the code below.

```
class SingleTopActivity : AppCompatActivity() {
    companion object{
        private const val DEBUG = "DEBUG"
    }

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_single_top)
        Log.d(DEBUG, "onCreate")

        findViewById<Button>(R.id.button_single_top).setOnClickListener{
            startActivity(
                Intent(this,
                    SingleTopActivity::class.java)
            )
        }
    }
```

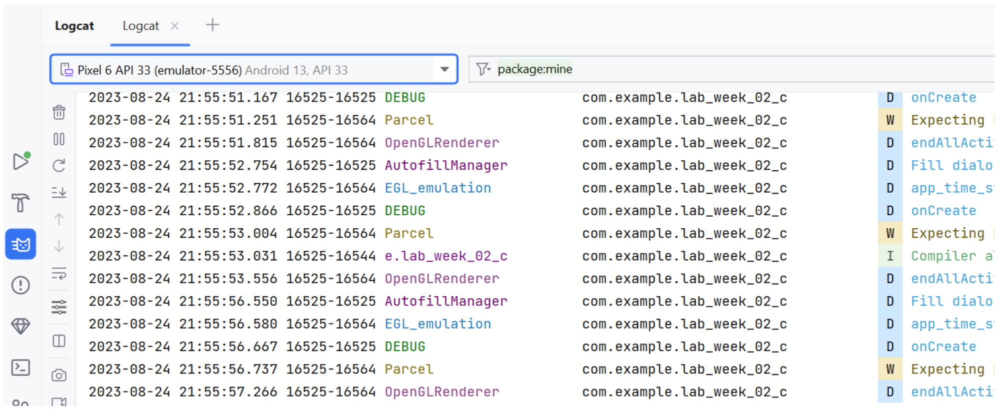
```
   override fun onNewIntent(intent: Intent?) {
       super.onNewIntent(intent)
       Log.d(DEBUG, "onNewIntent")
   }
}
```

16. Lastly, update your **MainActivity.kt** to the code below.

```
class MainActivity : AppCompatActivity() {
   companion object{
       private const val DEBUG = "DEBUG"
   }

   override fun onCreate(savedInstanceState: Bundle?) {
       super.onCreate(savedInstanceState)
       setContentView(R.layout.activity_main)
       Log.d(DEBUG, "onCreate")

       val buttonClickListener = View.OnClickListener { view ->
           when (view.id) {
               R.id.button_standard -> startActivity(
                   Intent(this,
                       StandardActivity::class.java)
               )
               R.id.button_single_top -> startActivity(
                   Intent(this,
                       SingleTopActivity::class.java)
               )
           }
       }


findViewById<Button>(R.id.button_standard).setOnClickListener(buttonClickListener)

findViewById<Button>(R.id.button_single_top).setOnClickListener(buttonClickListener
)
   }
}
```

17. Now try running your application and click the **standard button** repetitively.

18. Open your **Logcat** and the **onCreate** log should be shown as many times as you press the button.

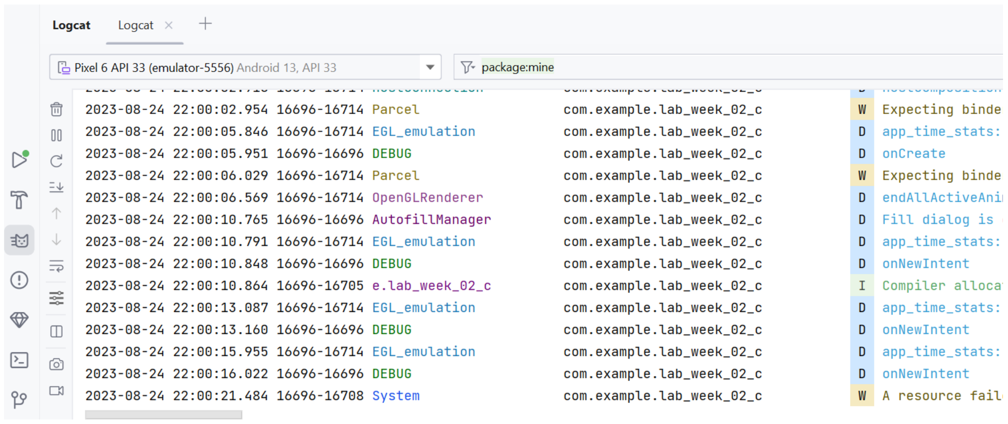


Logcat Logcat

Pixel 6 API 33 (emulator-5556) Android 13, API 33 package:mine

```
2023-08-24 21:55:51.167 16525-16525 DEBUG              com.example.lab_week_02_c    D  onCreate
2023-08-24 21:55:51.251 16525-16564 Parcel             com.example.lab_week_02_c    W  Expecting
2023-08-24 21:55:51.815 16525-16564 OpenGLRenderer     com.example.lab_week_02_c    D  endAllActi
2023-08-24 21:55:52.754 16525-16525 AutofillManager    com.example.lab_week_02_c    D  Fill dialo
2023-08-24 21:55:52.772 16525-16564 EGL_emulation      com.example.lab_week_02_c    D  app_time_s
2023-08-24 21:55:52.866 16525-16525 DEBUG              com.example.lab_week_02_c    D  onCreate
2023-08-24 21:55:53.004 16525-16564 Parcel             com.example.lab_week_02_c    W  Expecting
2023-08-24 21:55:53.031 16525-16544 e.lab_week_02_c    com.example.lab_week_02_c    I  Compiler a
2023-08-24 21:55:53.556 16525-16564 OpenGLRenderer     com.example.lab_week_02_c    D  endAllActi
2023-08-24 21:55:56.550 16525-16525 AutofillManager    com.example.lab_week_02_c    D  Fill dialo
2023-08-24 21:55:56.580 16525-16564 EGL_emulation      com.example.lab_week_02_c    D  app_time_s
2023-08-24 21:55:56.667 16525-16525 DEBUG              com.example.lab_week_02_c    D  onCreate
2023-08-24 21:55:56.737 16525-16564 Parcel             com.example.lab_week_02_c    W  Expecting
2023-08-24 21:55:57.266 16525-16564 OpenGLRenderer     com.example.lab_week_02_c    D  endAllActi
```

19. Now, try clicking the **Single Top Button** repetitively.
20. Open your **Logcat** and the **onCreate** log should only be shown once in the beginning. After that, the **onNewIntent** log will be shown every time the button is pressed again. This shows with **single top mode**, activity is not being recreated every time the same one is called.



Logcat Logcat

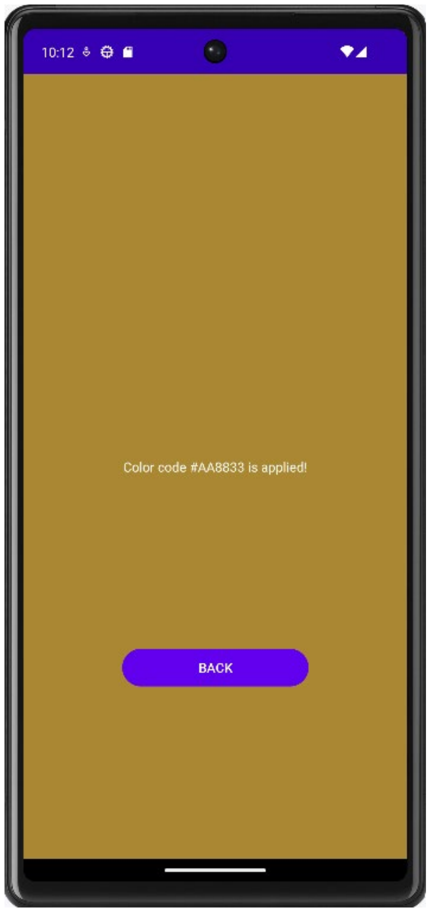
Pixel 6 API 33 (emulator-5556) Android 13, API 33 package:mine

```
2023-08-24 22:00:02.954 16696-16714 Parcel             com.example.lab_week_02_c    W  Expecting binde
2023-08-24 22:00:05.846 16696-16714 EGL_emulation      com.example.lab_week_02_c    D  app_time_stats:
2023-08-24 22:00:05.951 16696-16696 DEBUG              com.example.lab_week_02_c    D  onCreate
2023-08-24 22:00:06.029 16696-16714 Parcel             com.example.lab_week_02_c    W  Expecting binde
2023-08-24 22:00:06.569 16696-16714 OpenGLRenderer     com.example.lab_week_02_c    D  endAllActiveAni
2023-08-24 22:00:10.765 16696-16696 AutofillManager    com.example.lab_week_02_c    D  Fill dialog is
2023-08-24 22:00:10.791 16696-16714 EGL_emulation      com.example.lab_week_02_c    D  app_time_stats:
2023-08-24 22:00:10.848 16696-16696 DEBUG              com.example.lab_week_02_c    D  onNewIntent
2023-08-24 22:00:10.864 16696-16705 e.lab_week_02_c    com.example.lab_week_02_c    I  Compiler alloca
2023-08-24 22:00:13.087 16696-16714 EGL_emulation      com.example.lab_week_02_c    D  app_time_stats:
2023-08-24 22:00:13.160 16696-16696 DEBUG              com.example.lab_week_02_c    D  onNewIntent
2023-08-24 22:00:15.955 16696-16714 EGL_emulation      com.example.lab_week_02_c    D  app_time_stats:
2023-08-24 22:00:16.022 16696-16696 DEBUG              com.example.lab_week_02_c    D  onNewIntent
2023-08-24 22:00:21.484 16696-16708 System             com.example.lab_week_02_c    W  A resource fail
```

21. **Commit** your changes to **GitHub** at this point. **Commit Message: “Commit No. 4 – Standard activity and single top activity”**.

## ASSIGNMENT

Continue your **LAB_WEEK_02_B** project, and add a **back button** in **ResultActivity** so the user can submit another color code without rerunning the application.



Color code #AA8833 is applied!