Introduction to Android Development

Android is one of the most popular operating systms with over 88% of phones running android.

XML & Java Code

An XML file is used to build layouts in Android. Layouts are static pages (screens) which can be manipulated using Java Code (programmatically)
Declaring UIs in XML enables us to better separate the presentation of our application from the code that controls its behaviour.

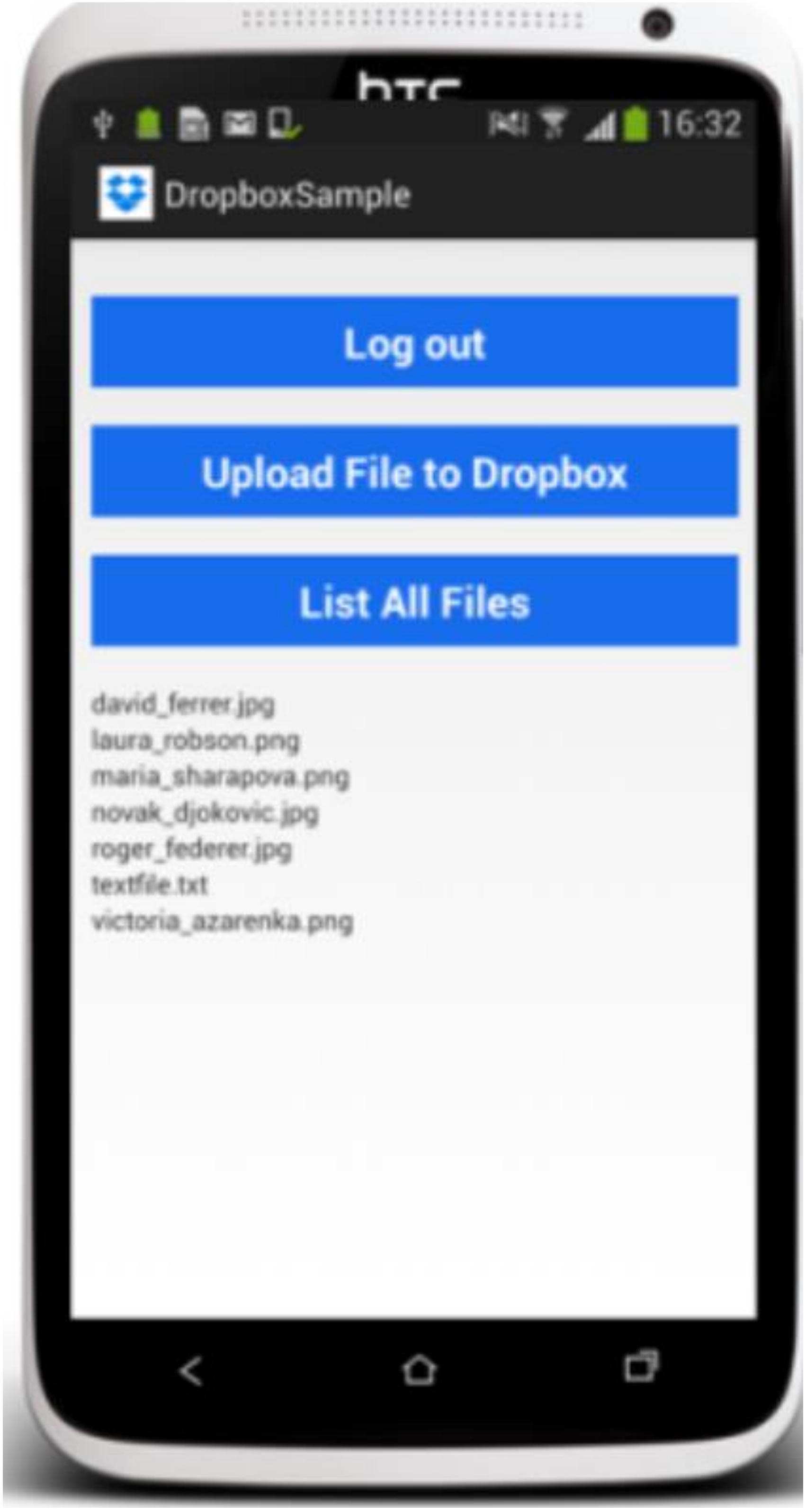
Installing Android Studio

Android studio is an IDE that makes it easy for us to write & build android applications very conveniently.
We can create emulators (virtual android phones), see previews and build UI layouts using drag & drop features

You can go to https://developer.android.com/studio to download android studio.

The Layout Editor

The layout editor is used to quickly build layouts by dragging UI elements which is easier to write XML by hand.
We can setup different attributes easily using the design mode in layout editor.



david_ferrer.jpg
laura_robson.png
maria_sharapova.png
novak_djokovic.jpg
roger_federer.jpg
textfile.txt
victoria_azarenka.png

Chapter 1 - Creating our first App

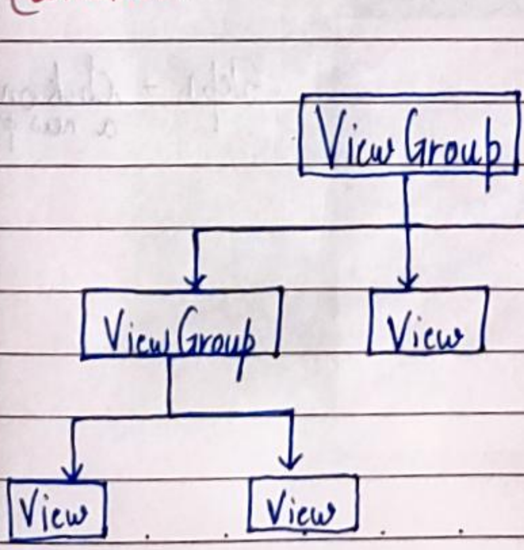
In this chapter we will create our first android app. I dont expect you to know anything but will walk you through the steps to build your first Android App!

What is an APK?
An APK is a collection of different files (like code, audio, video, etc.) compiled and bundled into a single file.

What is an AVD?
AVD stands for Android Virtual Device
AVD is an emulator configuration that simulates a physical Android device.

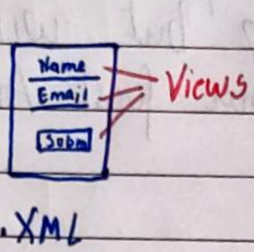
Android UI Layouts
View are the base class for widgets → Like buttons, text fields etc.
View = Basic building blocks

View Group holds View and View Group. → Just like a box can hold objects and more boxes
↓
(Container)



XML vs Java in Android

XML is the skeleton code which describes the UI layout
Java Drives this XML

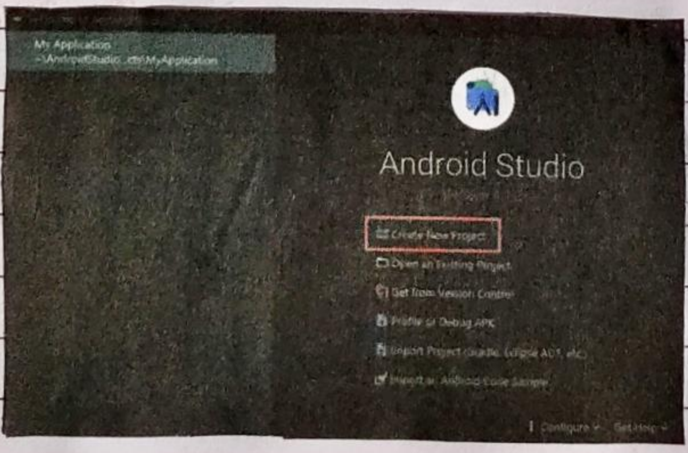


```
When Submit is clicked {
    Change the screen + Store the data
}
                        . Java
```

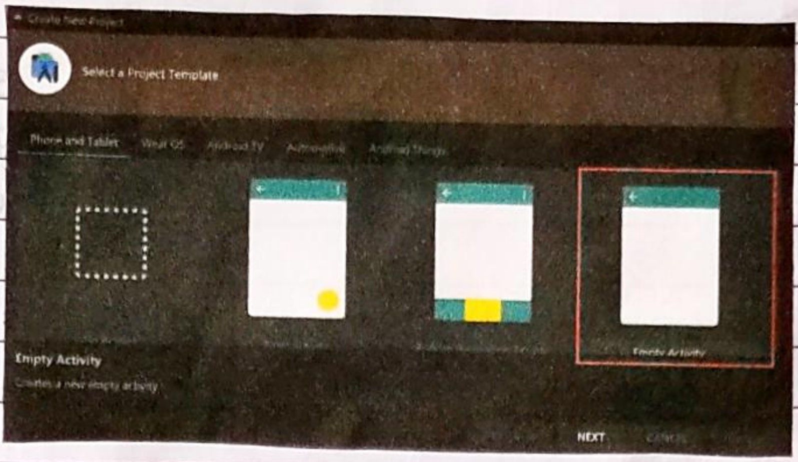
Important Notes

- Android Studio is a resource hungry program. You need to have patience while using it!
- Sometimes Android Studio might download files from the internet, so keep your wifi/ Hotspot ready
- In very rare cases, your firewall might block Android Studio. In that case, you will need to
- If your computer is slow, use USB debugging to use your phone as an AVD replacement
- If you are using an old PC, make sure that the virtualisation is turned on

Creating our Unit Converter App.



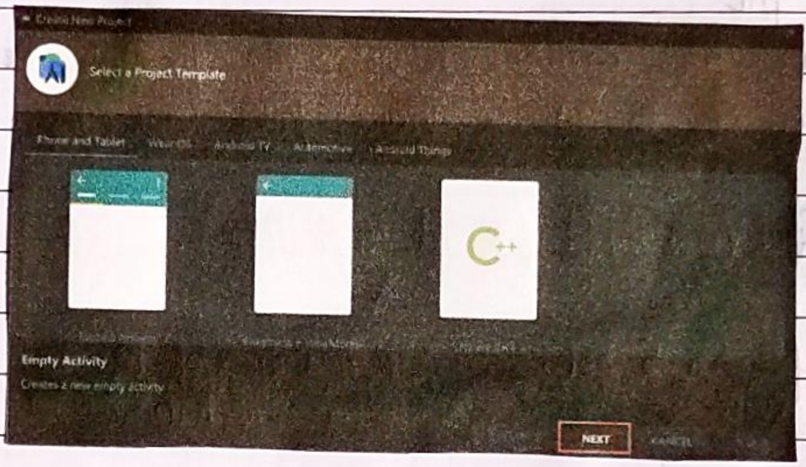
Step 1 → click on create a new project



Empty Activity

Creates a new empty activity

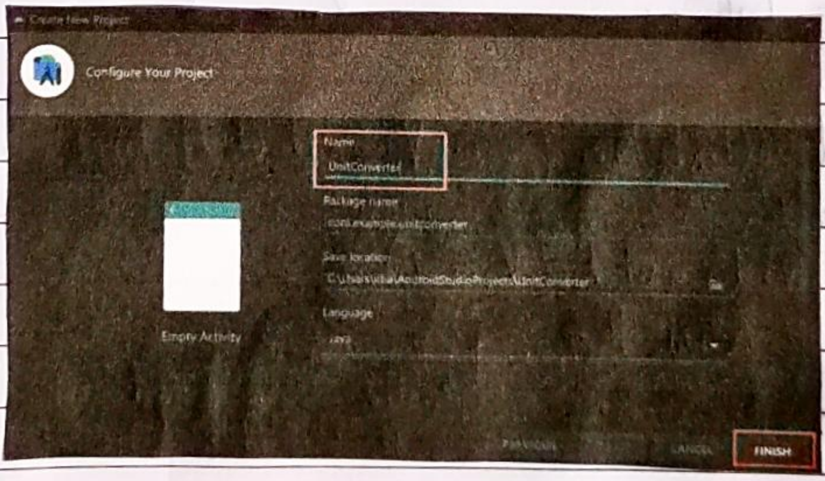
Step 2→ Click on Empty activity



Empty Activity

Creates a new empty activity

Step 3 → Click Next



Name: UnitConverter

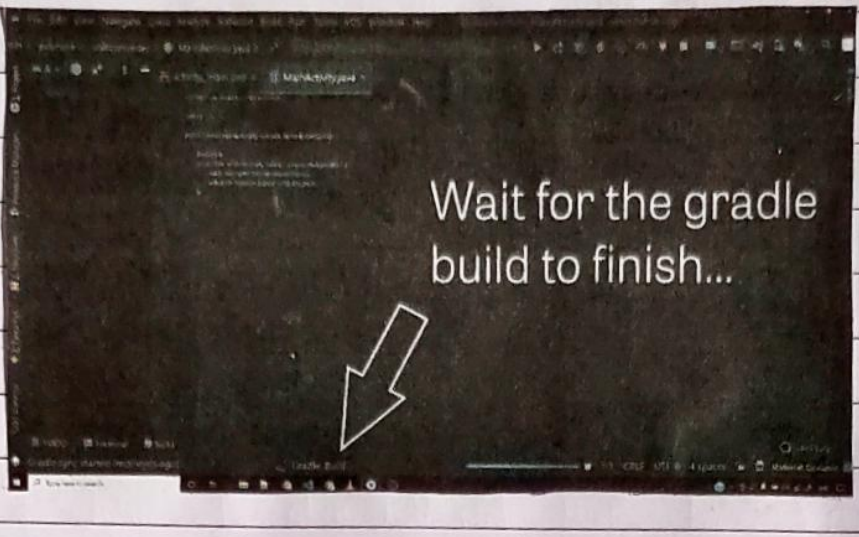
Package name: com.example.unitconverter

Save location: C:\Users\...\AndroidStudioProjects\UnitConverter

Language: Java

Step 4 → Type the name of the app. & click finish

→ you can chang App location from here



Wait for the gradle build to finish...

Step 5 → Wait for the gradle build to finish.

The R.Java file

Android R.java file contains resource IDs for all the resources We can use it to access views from our java file.

```
button = findViewById(R.id.mybutton);
```

function to get views

button in xml has an id of "mybutton"

Adding Event Listeners

We can add add click listeners by using setOnClickListener method as follows:

```
button.setOnClickLiskner(new View.OnClickListener() {
  @Override
  public void onClick(View v) {
        // Action Here
     }
});
```

This is performed when the button is clicked!

android : onClick attribute

The onClick attribute can be set for the button element in XML layout.

```
android : onClick = "sendMessage"        → In XML

public void sendMessage (View view) {    → In Java
        // code here
    }
```

Chapter 1 - Practice Set

1. Create an Android app which is capable of display "Good morning" to the user

2. Create an App which is capable of adding two numbers entered by the user

3. Create an App which displays the multiplication table of a given number.

Chapter 2 - Java Refresher

Java is an amazing Object oriented programming language. We will use Java to create android apps.

The main method

The Java program starts executing from here

```
public static void main (String[] args) {
        // Code
}
```

Printing to the console

The following code prints "Hello World" to the console:

```
System.out.println ("Hello World");
```

Variables in Java

Variables are buckets in memory

```
String actionNow; → String is used to store seq of characters
int marks;        → int is used to store numbers
int value = 7;
↙      ↓      ↘ value
type   name
```

Comments

```
// Comments are used to write text which doesnt executes
// This is a comment
/* This is a
   multiline comment. */
```

Strings in Java

String = Sequence of characters

```
String name = " Harry";
```

↳ Strings are immutable & cannot be changed

Printing Strings

We can concatenate String like this:

```
System.out.println(" Hello, " + name);
```

String methods

```
                01234
String name = " Harry";
```

```
name.length()
name.toLowerCase()
name.trim()
```

Other data types to store numbers

We can store numbers using:

byte → -128 to 127

short → $-(2^{16}/2)$ to $2^{16}/2 - 1$

int → $-(2^{32}/2)$ to $(2^{32}/2 - 1)$

float → used to store decimal values (4 bytes) [ex. 10.1f]

long → $-(2^{64}/2)$ to $(2^{64}/2 - 1)$

double → decimal values of 8 bytes [ex 7.88d]

Booleans

true or false values

boolean isGood = true;

Operators in Java

These are the types of operators in Java:

1. Arithmetic operators → a+b, a*b, a/b, a%b
2. Assignment operators → a=3, a+=3
3. Relational Operators → a<b, a≥3
4. Logical Operators → (a>3) && (b<7)
5. Unary Operators → a++, b--
6. Bitwise Operators → ~, <<, &, |

If - else Conditionals

We can use If-else to execute instructions when a Condition is true

```
if (a>3) {
      // code
   }
else if (a>1) {
      // code
   }
else {
     //code
  }
```

We can use if inside an if, if inside an else and booleans inside if (as conditions)

Loops in Java

① for loop : The Syntax of a for loop looks like this :

```
for ( initialize ; check_bool_exp ; update) {
        // code ;
    }
```

② while loop : The syntax looks like this :

```
while ( boolean ) {
      // Code
    }
```

↳ Stops when boolean becomes false

③ do while loop : do-while loop is guaranteed to execute atleast once .

```
do {
  // code
  } while (condition);
```

↳ Note the Semicolon

Functions in Java

We can use functions to separate logic like this :

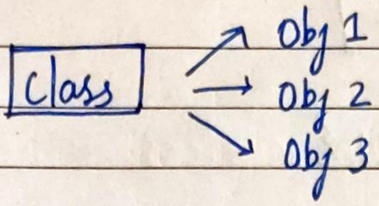
```
public static void harrysMethod ( int a) {
        // Code
      }
```

This method can be called like this :

```
harrysMethod (7);
```

Object Oriented Programming

In OOPs, class is a blueprint for creating objects.



Syntax :

```
        public class Harry {
                public static void thisMethod () {
                        // code
                    }
                }
```

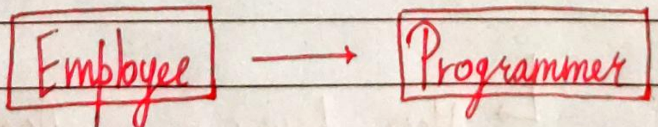
The objects can be created like this :

```
    Harry h = new Harry();
```

Inheritance in Java

In Java, we can create classes from another class like this :

```
      public class Programmer extends Employee {
              private String language;
              // code
          }
```



Arrays in Java

We can store collection of similar items in an Array

```
  0    1    2    3    4
[ 7,  10 , 11 , 21 , 88 ]
```

```
int[] harry = { 1, 5, 9, 21 };

System.out.println(harry[0]);
```

Java Collections framework

The collections framework in Java allows us to enjoy features like resizable arrays.

Arraylist is a class inside collections framework for creating resizable arrays.

```
Arraylist harry = new Arraylist();
```

For Arraylist & other collection methods, visit the java docs.

Iterating through ArrayLists

We can iterate through Arraylists like this:

```
for (object o : harry) {
    System.out.println("object : " + o);
}
```

↳ Here harry is an ArrayList

How to view Java Docs

Java has a very beautiful documentation where all the details from the API are listd.

You can navigate to Google and Search for the docs where you can further search for the Java API you are interested in.

Chapter 2 - Practice Set

1 Write a Java program to print multiplication table of a given number.

2 Write a Java program to add two numbers.

3 Write a Java program to find out day of the week given the number.

4 Write a Java program to calculate income tax on a given income considering Indian laws.

5 Write a Java program to sum first n even numbers using for loops.

6 Write a program to print the following pattern:

```
* * * * *
  * * * *
    * * *
      * *
        *
```

Chapter 3 - Activities & Layouts

What is an Activity?

A single, focused thing that the user can do.
In layman's terms ⇒ Activity = Screen

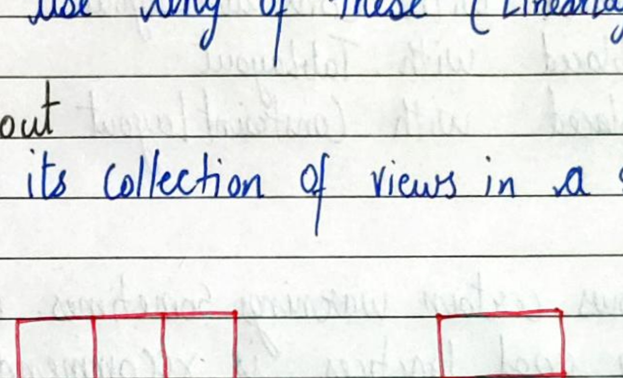
Activity has layouts
↳ Defines how Views are displayed
↙ Button ↘ TextView

Types of Layouts in Android

If you go to the palette, you will find a lot of layouts
We can use any of these (LinearLayout, ConstraintLayout etc)

Linear Layout

Arranges its collection of views in a straight horizontal or vertical row.



⇒ gravity attribute can be used for alignment

Required attributes of a LinearLayout

→ Layout width ↘ Can be match-parent / wrap-content / some value dp
→ Layout height ↗
→ Orientation → Can be horizontal or vertical

Note → Never close ur Emulator on every run when you change the app
Emulator is a resource hungy program & will take time to launch.

RelativeLayout

→ Elements are aligned relative to each other

→ Attributes like android:layout_alignParentTop are used to declare positions of views.

The RelativeLayout is available in legacy tab in Palette

Legacy tab in Palette

Some View Layouts in Android Studio are replaced with better Counterparts.

ListView is replaced with RecyclerView
GridView is replaced with Constraintlayout
TabHost is replaced with TabLayout
RelativeLayout is replaced with Constraint Layout

Important Notes

↗ Component view shows certain warnings sometimes. Correcting these by following good practices is recommended.

↗ You can resize the preview as per the device of your liking in Design view itself.

↗ Android Studio uses Gradle as the build system.

↗ Project structure of Android is very simple & straightforward

↗ You dont have to remember all the attributes of every View

strings.xml file

This file contains string resources in XML format

```
<string name = "app" > Harry </string>
```

identifier value

We can use <b> bold </b> and <i> Italic </i> tags inside the text in strings.xml. Other HTML Tags are ignored. Escape sequence characters like '\n' are also allowed.

ScrollView

ScrollView is a ViewGroup used to create Scrollable Views. It contains just one child which can be greater than the Screen height and can be scrolled.

Scrollview offers many attributes which is used to customize it

Horizontal ScrollView

It is very similar to ScrollView but instead of vertical scrolling, it provides functionality for horizontal scrolling

Logging in Android

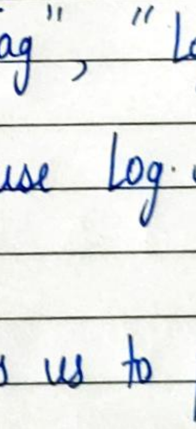
We can log a message to the console using :

```
Log.d("Tag", "Log this message");
```

Similarly we can use Log.i for info, Log.e for error etc.

Constraint Layout

Constraint Layout allows us to position widgets by applying constraints



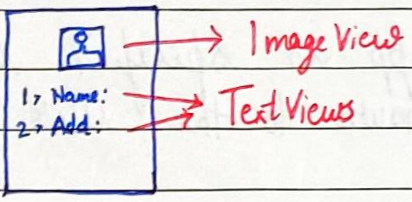
Constraints work exactly Like a Spring!

Corners can be used to resize the widget

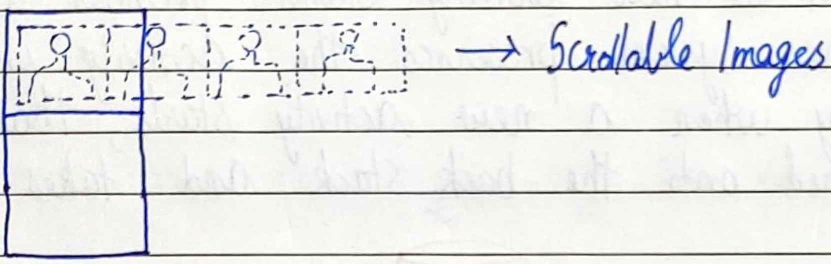
We can add a baseline constraint on widgets inside the Constraint layout by right clicking > Show Baseline & finally adding the baseline constraints.

Chapter 3 - Practice Set

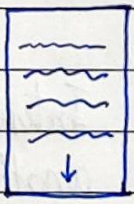
1. Create a layout which looks like this :



2. Create a layout which looks like this :



3. Create a layout which shows a bulk text scrollable vertically.



4. Create a layout which looks like a contact us page of a company.

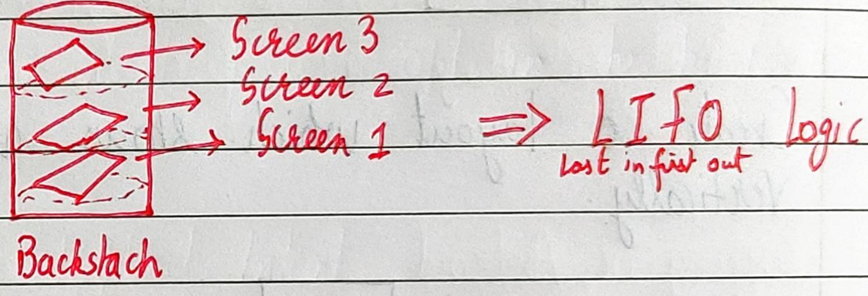
Chapter 4 - MultiScreen Apps

An Activity = Screen

One activity in an app is specified as the "main" activity which is shown to the user when the app is launched.

Intent

Whenever a new activity starts, previous activity is stopped but the system preserves the activity in a stack. This way when a new activity starts, that new activity is pushed onto the back stack and takes user focus



An activity is started with an Intent. An intent is a message from one activity to another activity. We can pass information from one activity to another using intents.

Types of Intents

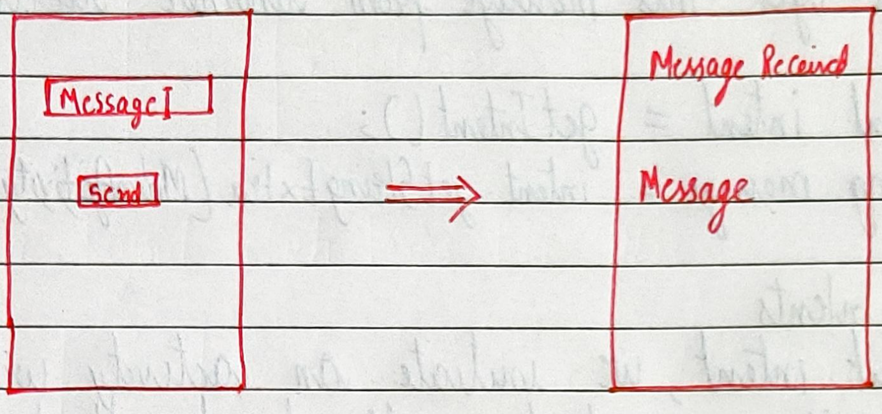
An Intent can be of two types:

1. Implicit Intent :→ Target component not known.
   → We have a general action to perform

2. Explicit Intent : → Target of the intent is known
   → Fully classified classname of a specific activity known.

Our first MultiScreen App

We will now create an app which has an EditText on the first activity. User enters a message and clicks a button to send this message to second activity



We will now create this App using the following steps:

1> Create a new app
2> Design the layout for the first app
3> Create button click listeners
4> Create the second activity
5> Add proper links & metadata in manifest.xml
6> Add an Intent using the following code:

```
Intent intent = new Intent(this, SecondActivity.class);
StartActivity(intent);
```

This is an explicit Intent

Sending data cross activities

We can send data cross activities using intent extras.
Intent extras are key/value pairs in a Bundle.
A Bundle is a collection of data stored as key/value pairs

Syntax for Intent putExtra looks like this :

```
intent.putExtra ("key", "value");
```

We can get this message from another activity using:

```
Intent intent = getIntent();
String message = intent.getStringExtra("key");
```

Implicit Intents

In implicit intent, we initiate an activity without knowing which app or activity will handle the task.

Ex: Take a photo, open this URL etc.

Activities with matching intent filters opt in to perform the action.

Creating an App with Implicit Intent

following code starts an activity to open a URL

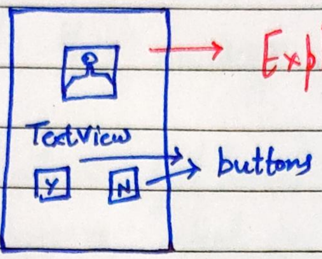
```
                         eg https://codewithharry.com
String url = " Some_URL"
Intent mint= new Intent (Intent.ACTION_VIEW, webpage);

if (intent.resolveActivity(getPackageManager()) != null) {
        startActivity(intent);
   }
else {
     // Cannot handle intent
     }
 }
```

Similarly we can handle intents with other actions.
For eg: open a location, Share text etc.
See android docs for more.

Chapter 4 - Practice Set

1. Create a layout in Android which looks like this



Explore how to get this full screen theme

buttons

2. Create an android app capable of opening your favorite websites on a single click

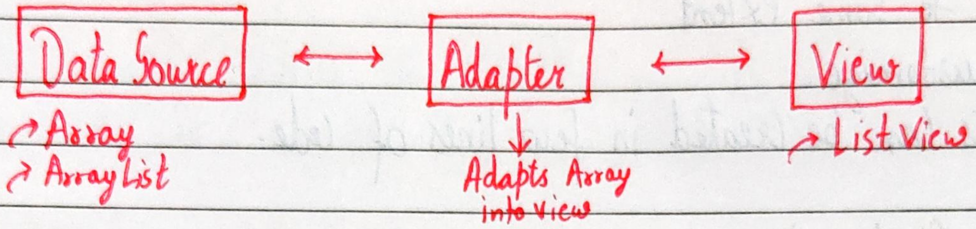
3. Create a quiz app using the layout in ①

4. Create an App capable of sending Email to the user. The app should take Email, subject and message as input.

Chapter 5 - ListViews & RecyclerView

In Android, a scrollable list of items is implemented using a ListView. The data is populated into the list using an Adapter.

Adapter converts an Array/Arraylist into view items.



ArrayAdapter

ArrayAdapter is used to display a set of items in a ListView

```
ArrayAdapter <String> ad = new ArrayAdapter (this, R.layout.list_item,
                                              sArr)
```

Context

layout (TextView)

String Array

```
listView.setAdapter(ad);
```

This sets the content of sArr to list View

Custom Array Adapter

We can create custom Array Adapters by creating a model and a class (eg. MyAdapter) which extends ArrayAdapter

We can pass our string array to MyAdapter like this:

```
MyAdapter ad = new MyAdapter(this, sArr);
listView.setAdapter(ad)
```

Why use ListViews

It will be very hectic to create a scrollable view where data is coming from a DataSource. Just imagine how hectic would it be to otherwise populate data into a View to show it to the user.

Hence Listviews are used due to the following reasons:

- User & Developer Friendly
- Optimized to some extent
- Easy to customize
- Simple Lists can be created in few lines of code.

Adding OnClick listener to items

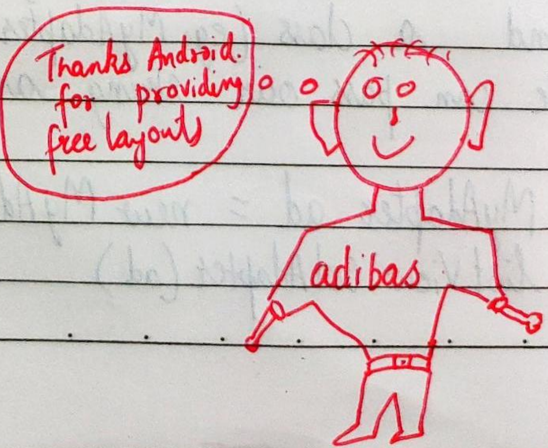
We can override onItemClick method to add click listeners as shown below:

```
listView.setOnItemClickListener(new OnItemClickListener(){
        ...
  }
```

Built-in XML layouts

Android provides you a list of built-in layouts to be used within list Views.

Ex: android.R.layout.simple_list_item_1
android.R.layout.simple_list_item_2
... etc.



RecyclerView

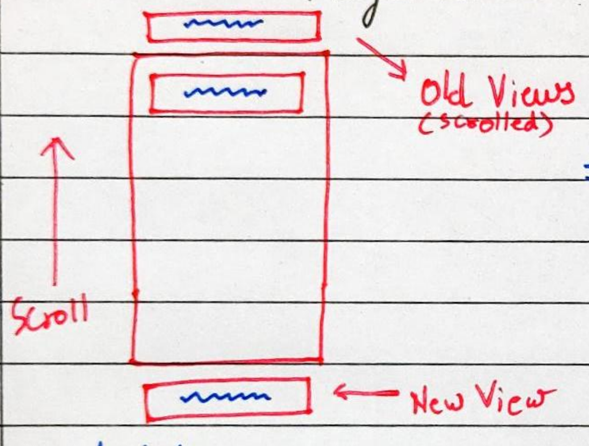
Its simply a better version of list Views

In ListViews → Memory is directly propotional to the number of items

RecyclerView solves this problem by recycling the existing views hence saving up on memory

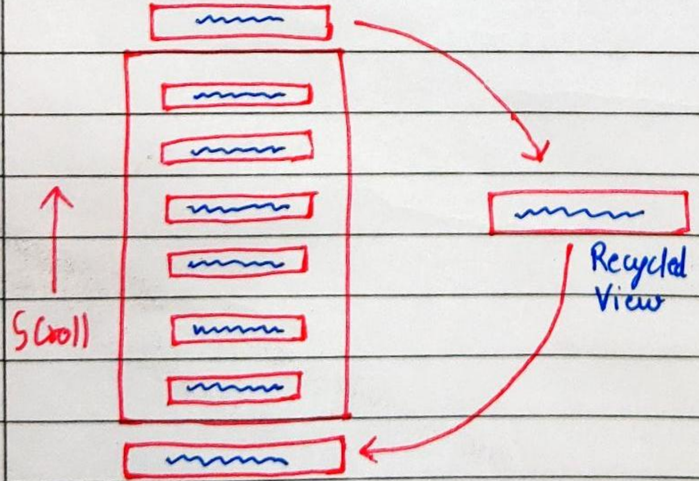
We simply update the Adapter in RecyclerView to an Adapter which is capable of Recycling the Views

ListViews Vs RecyclerViews



⇒ User keeps scrolling which adds Views & hence more memory is Consumed

ListView



⇒ Views are recycled when a user scrolls resulting into Performance boost

How to Implement a RecyclerView

A RecyclerView can be implemented just like ListViews using an Adapter. All the major changes are done to the Adapter. Android Docs has a page which can be used as a starter template for implementing RecyclerViews.

Chapter 5 - Practice Set

1. Create an app using ListView to display the contents of an string array with onClick listeners

2. Create an app using Recyclerview from ①

3. Create an app using RecyclerView to display contents of the "Contact" array which looks like this:

```
public class Contact {
        private int Sno;
        private String phoneNo;
        private String name;
    }
```

Chapter 6 - Media Player

Media is a Crucial Component of Android.

Media = Audio + Video + Images

The MediaPlayer class

This class provides APIs for playing variety of Media types.
We can simply create an instance, add a music & play it.

Adding music to the android "raw" directory

We can add an mp3 file to our res/raw folder. If the raw folder is not present, you need to create one.

Playing our first music

We can create an instance of MediaPlayer and play our first music by adding followring lines inside onCreate

```
mediaPlayer = MediaPlayer.create(this, R.raw.music);
media Player. start()
```

↓ plays music.mp3

Similarly we can use mediaPlayer.pause() to pause the music from the mediaplayer

Playing music from the web

We can play music from the web using the setDataSource method of media player.
The following steps plays music from the web

Step 1: Create a new mediaPlayer instance

```
mediaPlayer = new MediaPlayer();
```

Step 2 : Set the datasource

```
mediaPlayer.setDataSource("https://audio.source.com")
```

→ Use mp3/m[illegible] URL

Step 3 : Add android.permission.INTERNET to manifest

Step 4 : Add android:usesCleartextTraffic="true" in the application tag of manifest (AndroidManifest.xml)

Step 5 : Add Onprepared listener to the mediaPlayer & override required methods.

Step 6 : Run mediaPlayer.prepareAsync(); method to start preparing the mediaplayer.

Adding SeekBar

Android SDK provides a SeekBar widget which allows developers to add a progress bar for media Execution.
Further we can add OnSeekBarChangeListener() to take actions when the seekbar is changed.
This can be done like this :

```
SeekBar.setMax(mediaPlayer.getDuration());
SeekBar.setOnSeekBarChangeListener(new SeekBar.OnSeek...
```

↳ Use autocomplete & override methods

Playing Videos

We can use the Same MediaPlayer class to play videos in Android.

In order to display Videos we use a SurfaceView like this:

```
mediaPlayer = MediaPlayer.Create(this, R.raw.vid)
SurfaceHolder h= SurfaceView.getHolder();
h.addCallback( new SurfaceHolder.Callback() {
    ooo  //override methods here
  });
```

Chapter 6 - Practice Set

1 Create an Android App which plays your favorite song on loop

2 Add a seekbar in 1 for you to seek to a specific part in your favorite song.

3 Create an Android app which plays three favorite files of a user from web server.

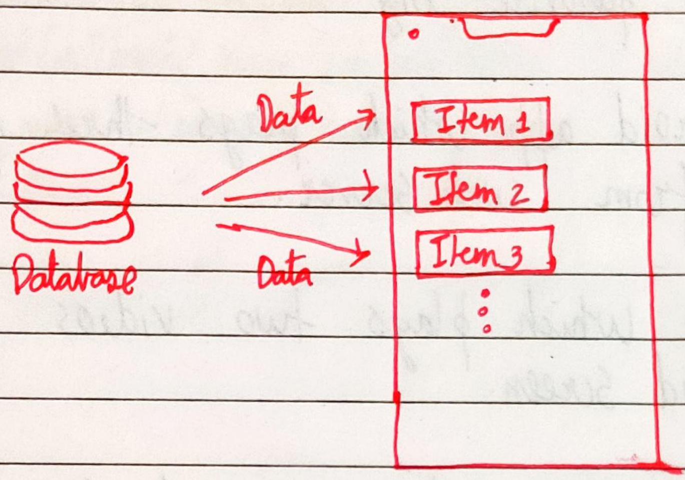
4 Create an App which plays two videos simultaneously on one Android Screen.

5 Stop one when another Video is played from your app in 4

Chapter 7 - Storing Data

Saving data makes apps more livly

Data persistence = Storing & saving the data



In android, we can save data using these common ways:

→ Text File → Not Efficient

→ Shared Preferences → Somewhat efficent

→ Database → Highly Efficient

Shared Preferences

Shared Preferences allow us to save and retrieve data in the form of key, value pair

We can access Shared preferences like this:

```
SharedPreferences sP = getSharedPreferences(MESSAGE, MODE_PRIVATE)
   SharedPreferences.Editor ed = sP.edit();
  ed.putString("text", "This is me");
  ed.apply();
```

⇘ Storing Data

```
SP. getString ("text", "default Value");
```

⇘ Retreive Data

Working with Database

We can use SQLite database to work with databases in Android.

We can create a class extending from SQLiteOpenHelper and use it for CRUD operations

Chapter 7 - Practice Set

1 Store the HiScore of a game using Shared Preferences an fetch it into a TextView

2 Create a database to store data of Employees using SQLiteOpenHelper class.

3 Add an Entry to the database created in 2

4 Fetch an Entry from the database created in 2

Project - Music Player

Create a music player iSangeet and add pause/play functionality to it. Your music player should be capable of reading the SD card and fetch all the Songs into a View such that user can play the song of their choice