Grow with Google Challenge Scholarship
Lesson 2 Notes

Are you ready?

This course assumes you are comfortable working in Java. In addition we assume that you have some basic familiarity with XML (or HTML), **GitHub**, networking and threading.

What do I do if I don't have these prerequisites?

Don't fret! We have other Android and Java related courses.

- **Android Development for Beginners**: This is the first course in a series of free courses about Android development. It assumes no programming knowledge and is perfect for the beginner student who wants to jump quickly into making an Android app. You'll learn Android in parallel to learning basic Java. After this course, you may wish to take our other beginner courses for **User Input**, **Multi-Screen Apps**, **Networking** and **Data Storage**.
- **Android Basics Nanodegree Program**: To add features and support on top of our free courses, sign up for the Android Basics Nanodegree Program to get access to ten projects, code reviews, personalized feedback, one-on-one appointments and moderated forums. If you'd like to build a portfolio of Android projects and have the support of Udacity mentors and staff, this option is for you.
- **Java Programming Basics**: If you'd like an introduction to pure Java programming, consider taking this course, a deep dive into the basics of Java.
- **Git and Github**: If you're not sure what GitHub is all about, take this course to help you manage your code and collaborate with other developers.
- **Android Development for Beginners - Lesson 1**: If you've never worked with a language like XML or HTML but you're familiar with Java, consider taking the first lesson of the Android Development for Beginners class. It is solely focused on XML layouts for Android.

A Brief Introduction to Android Studio

In this course we strongly recommend using **Android Studio** as your development environment. It is the defacto IDE for Android Development, and the environment we use in all videos in the course.
Android Studio is specifically made for creating Android Apps. It is actively supported and maintained by Google. It even contains an Android emulator so that you can start creating Android Apps without needing a real device. Jamal Eason will describe a few more features which will be helpful on your journey to becoming an Android Developer.

Check out developer.android.com for a **full feature list for Android studio**.

Installing Android Studio

You should install Android Studio now, and set it up to use either a physical Android device or an emulated phone. If you need guidance for installing Android Studio, there is a mini course with instructions for both Windows and Mac installations which will also go through how to setup an emulator and make your first Hello World app.

Go to the Android Studio Installation Mini Course

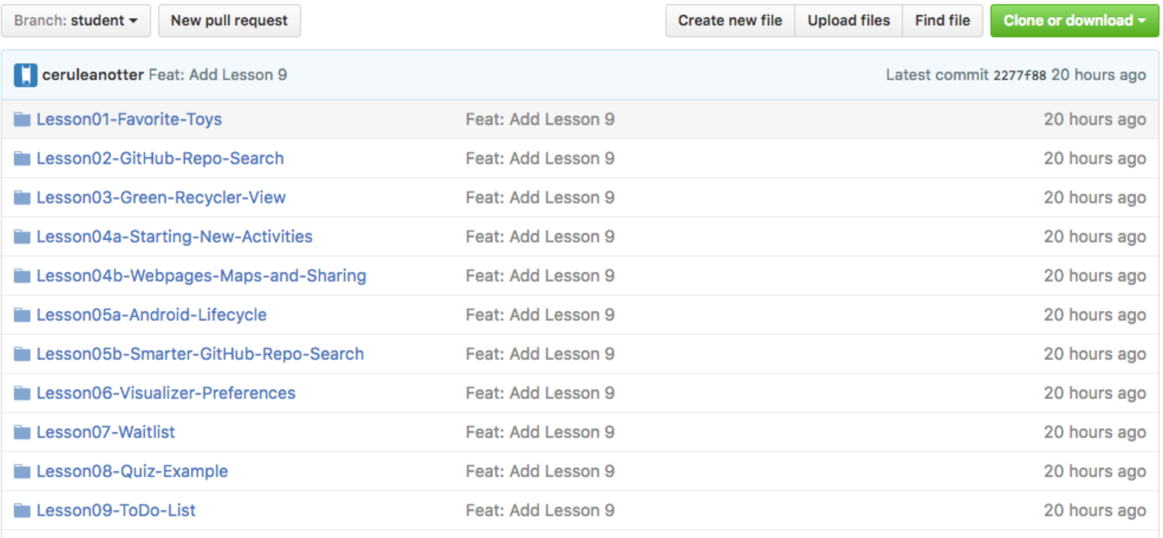
Code Repositories

One of the unique things about this class is we will go through over ten code examples with you, as well as the Sunshine app. The code for this course is found in two repositories:

- **Sunshine Code Repository** (**ZIP Download**)
- **Toy App Repository** (**ZIP Download**)

Code Steps

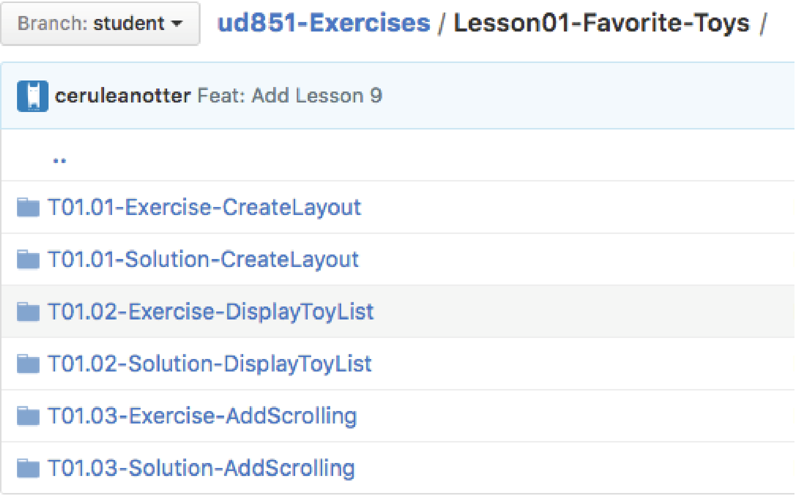
You should download both of the repositories above. As shown in the video, the example repository (also known as the toy app repository) contains folders for each app in the course:



ceruleanotter Feat: Add Lesson 9 — Latest commit 2277f88 20 hours ago

Lesson01-Favorite-Toys	Feat: Add Lesson 9	20 hours ago
Lesson02-GitHub-Repo-Search	Feat: Add Lesson 9	20 hours ago
Lesson03-Green-Recycler-View	Feat: Add Lesson 9	20 hours ago
Lesson04a-Starting-New-Activities	Feat: Add Lesson 9	20 hours ago
Lesson04b-Webpages-Maps-and-Sharing	Feat: Add Lesson 9	20 hours ago
Lesson05a-Android-Lifecycle	Feat: Add Lesson 9	20 hours ago
Lesson05b-Smarter-GitHub-Repo-Search	Feat: Add Lesson 9	20 hours ago
Lesson06-Visualizer-Preferences	Feat: Add Lesson 9	20 hours ago
Lesson07-Waitlist	Feat: Add Lesson 9	20 hours ago
Lesson08-Quiz-Example	Feat: Add Lesson 9	20 hours ago
Lesson09-ToDo-List	Feat: Add Lesson 9	20 hours ago

Inside of these folders there are exercises you can do. Each exercise has a starting folder and a solution folder, which contain versions of the app at the start of the exercise and after the exercise.



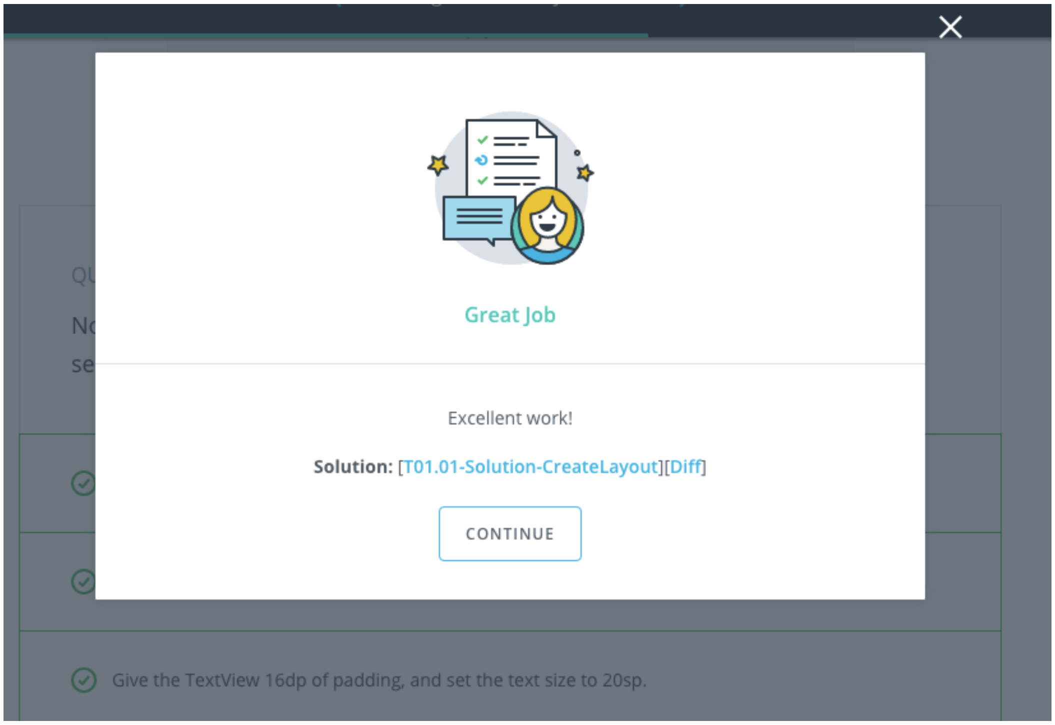
ud851-Exercises / Lesson01-Favorite-Toys /

ceruleanotter Feat: Add Lesson 9

..

- T01.01-Exercise-CreateLayout
- T01.01-Solution-CreateLayout
- T01.02-Exercise-DisplayToyList
- T01.02-Solution-DisplayToyList
- T01.03-Exercise-AddScrolling
- T01.03-Solution-AddScrolling

In addition, when you solve a code step, there are links to GitHub pages which show the code differences between the exercise and solution repositories.



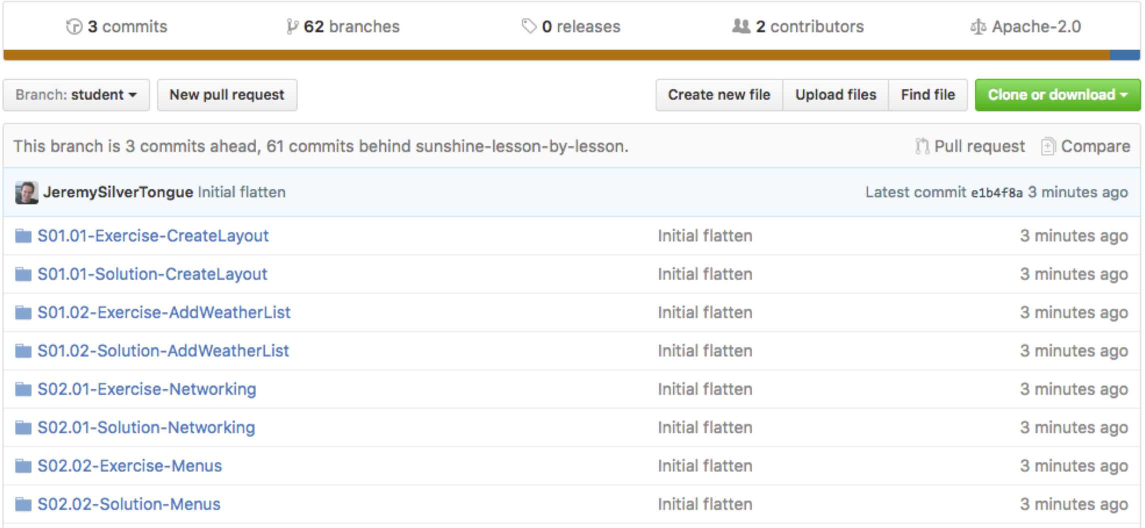
Great Job

Excellent work!

Solution: [T01.01-Solution-CreateLayout][Diff]

Give the TextView 16dp of padding, and set the text size to 20sp.

Sunshine is similarly divided up into code steps, with a solution and exercise folder.



This branch is 3 commits ahead, 61 commits behind sunshine-lesson-by-lesson.

JeremySilverTongue Initial flatten Latest commit e1b4f8a 3 minutes ago

S01.01-Exercise-CreateLayout	Initial flatten	3 minutes ago
S01.01-Solution-CreateLayout	Initial flatten	3 minutes ago
S01.02-Exercise-AddWeatherList	Initial flatten	3 minutes ago
S01.02-Solution-AddWeatherList	Initial flatten	3 minutes ago
S02.01-Exercise-Networking	Initial flatten	3 minutes ago
S02.01-Solution-Networking	Initial flatten	3 minutes ago
S02.02-Exercise-Menus	Initial flatten	3 minutes ago
S02.02-Solution-Menus	Initial flatten	3 minutes ago

Report Issues

Notice any issues with the repository? File a github issue in the **Sunshine repository** or in the **Toy App repository**.

If you notice a general course issue and want to report it to us, please do! This can include typos, confusing statements, video issues or suggestions. You can report problems by sending an email to android-support(AT)udacity.com. Make sure to have the subject of the email in the following format:

Developing Android Apps - (Lesson Name) - (Issue description)

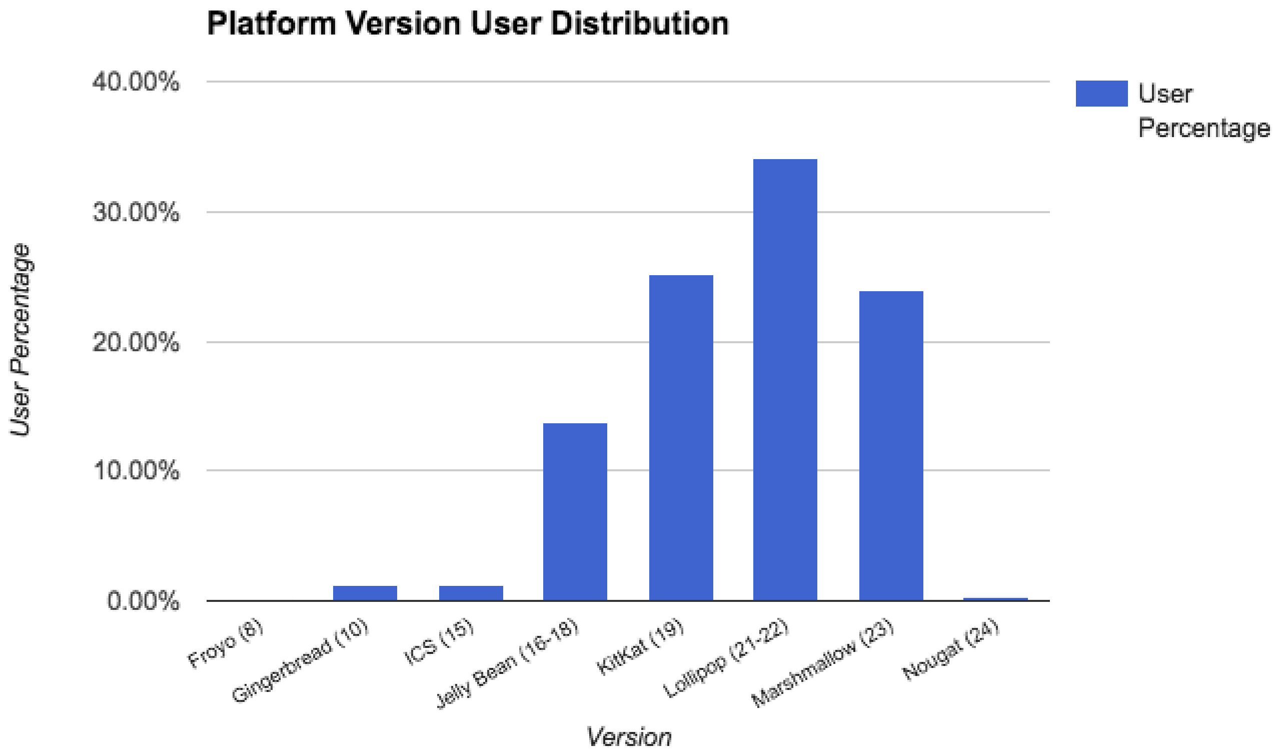
In the body of the email, please include a link to the page you're having trouble with. Taking a screenshot can also help us resolve the issue.

Android Min and Target Versions

Android 1.0 launched in 2008, and in just the 8 years since - there have been **13** new major platform releases. By convention, each release is named off of a sugary treat, and the releases are named alphabetically.

On the **Android Developer site**, we show the relative percentage of active Android devices running a given platform version, also presented in this cool pie chart. Because pie charts are awesome.

For our purposes though, you're really better off looking at it as a histogram.



If you squint, you can almost see a vaguely bell shaped curve, with the oldest releases on the left, their popularity dropping off as devices are upgraded or replaced. The largest proportion of devices are in the middle, representing devices about 2 years old. The newest platforms, which gain in popularity as new phones are released or updates go out, are on the right.

Setting minSDK

The minSDK is the lowest SDK level that your app can run on. You can choose what level of devices to support. Setting the minSDK acts as a filter -- Google Play won't show your app on devices running an Android platform version lower than your minimum SDK version.

So why not just set the minSDK to 1 and support everyone? Generally, you'll want to target as many users as you can, but there's a cost associated with supporting older versions - things like creating different execution paths around deprecated or updated APIs, or presenting a different UX to devices with different features. You need to balance the opportunity of expanding your audience, with the cost of supporting those users.

Also remember that each release introduced new APIs and hardware support, so it may not make sense to make your app available to devices that don't support your minimum feature set. Here are some examples of hardware support and features, tied to releases.

- Home screen widgets (Cupcake)
- Multiple finger tracking (Froyo)
- Tablet (Honeycomb)
- Android Beam (Jellybean)
- Android TV, Auto, Wear (Lollipop)
- Pro Audio (Marshmallow)

Setting targetSDK

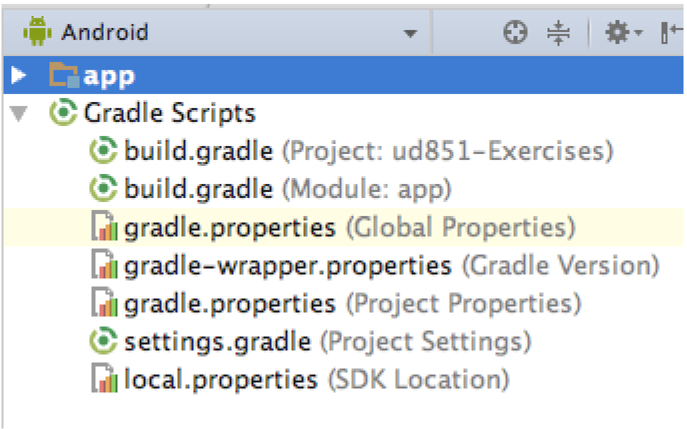
By comparison, the targetSDK is NOT a high pass filter -- it's used only to declare which platform version you've tested your app on. An app targeted to a certain API or Android version will continue to be forward compatible on future releases -- the platform uses the target SDK values in case a future release makes a significant change to expected behavior, ensuring your app doesn't break when a user's phone gets upgraded. `

Android Studio by-default targets the latest release. If you're developing a new app, there's really no reason to target anything but the latest Android version, and once your app has been released, make it a point to update your target SDK and test as soon as possible when new platform releases roll out, so your app can take advantage of every new platform optimization and improvement.

Advanced Build Options

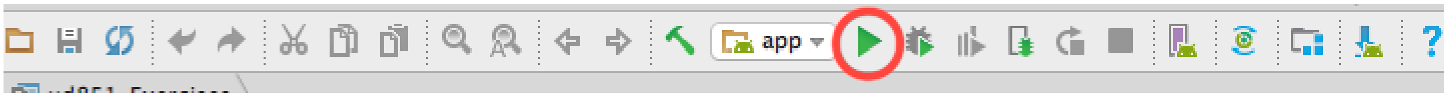
Gradle in Android Studio

Gradle is the build system of choice for Android Studio. Because of that, there's various functionality available within the platform. When you make a project, there are a few gradle build scripts automatically generated for you, shown below:

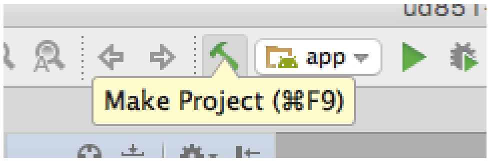


```
Android
▶ app
▼ Gradle Scripts
    build.gradle (Project: ud851-Exercises)
    build.gradle (Module: app)
    gradle.properties (Global Properties)
    gradle-wrapper.properties (Gradle Version)
    gradle.properties (Project Properties)
    settings.gradle (Project Settings)
    local.properties (SDK Location)
```

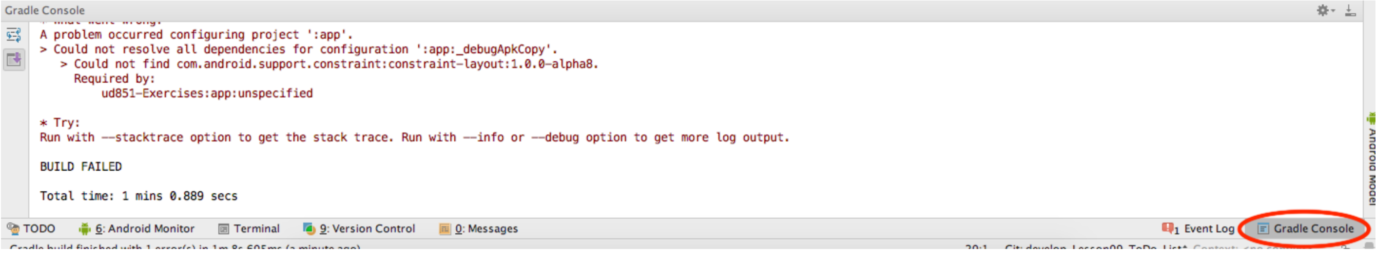
When you press the green **Run** button, if the project has changed, the build scripts will run.



To explicitly run the build scripts, you can press the **Make Project** button:



To observe logs and build errors for gradle, Android Studio includes a **Gradle Console**.



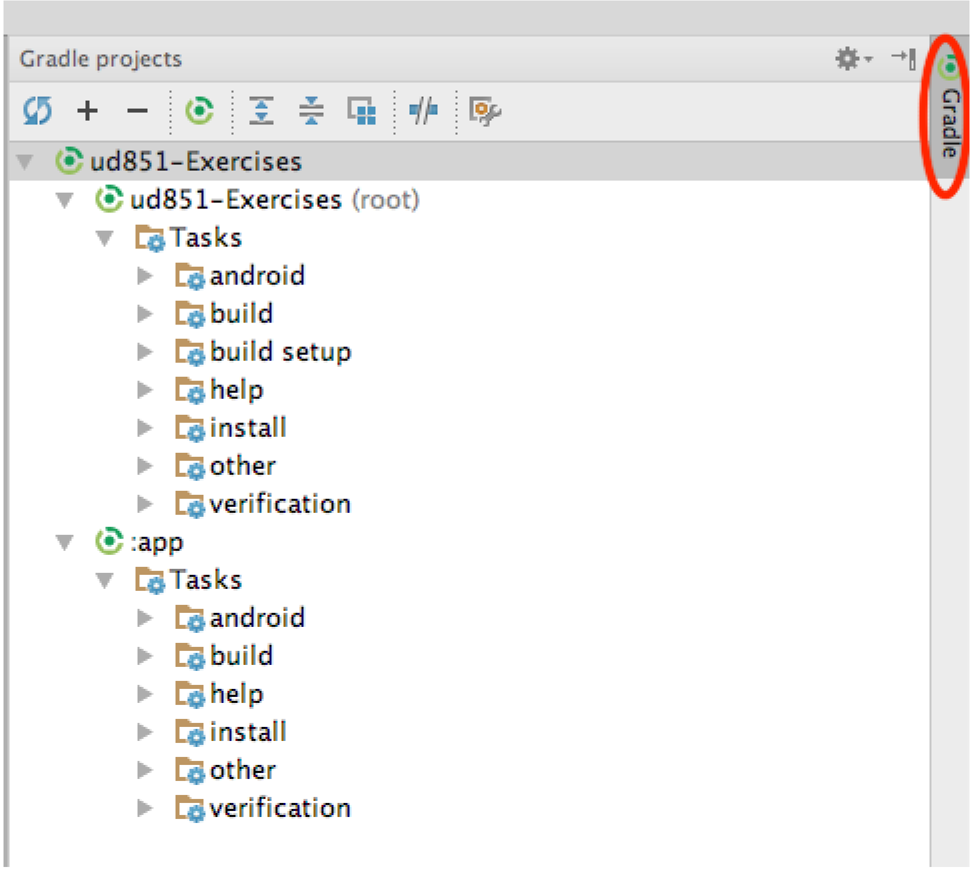
```
* What went wrong:
A problem occurred configuring project ':app'.
> Could not resolve all dependencies for configuration ':app:_debugApkCopy'.
   > Could not find com.android.support.constraint:constraint-layout:1.0.0-alpha8.
     Required by:
         ud851-Exercises:app:unspecified

* Try:
Run with --stacktrace option to get the stack trace. Run with --info or --debug option to get more log output.

BUILD FAILED

Total time: 1 mins 0.889 secs
```

A **gradle task** represents a single, atomic piece of work for a build. To see a list of tasks, you can open the tasks window in Android Studio by clicking on the gradle button on the far right. Clicking on the name of the task runs that task.



Gradle from the Command Line

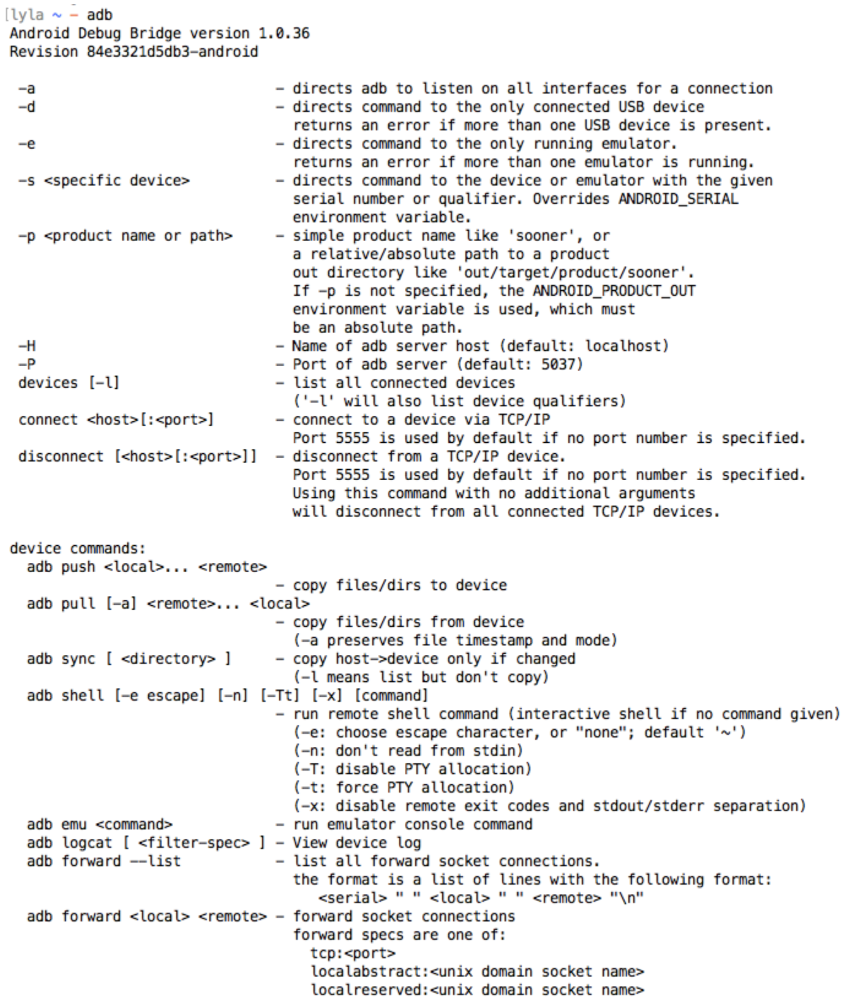
You can also run gradle build tasks from the command line if you prefer. To start, you should navigate to the root of your project folder. From there you can run:

```
./gradlew tasks
```

This will give you a full list of runnable tasks. You may need to run chmod +x on gradlew before you can run it. See this **link** for more detailed instructions. To learn more, you can check out **Udacity's Gradle course**.

Android Debug Bridge

The other tool that Dan mentioned is **adb** which is short for Android Debug Bridge. ADB is a command line utility included with Android's SDK. You do not need to use adb for this course, but if you enjoy using the command line, you can read up on **adb** and other command line tools. When you type **adb** into a terminal, you'll also get a helpful list of everything adb can do for you:



```
[lyla ~ - adb
Android Debug Bridge version 1.0.36
Revision 84e3321d5db3-android

 -a                              - directs adb to listen on all interfaces for a connection
 -d                              - directs command to the only connected USB device
                                   returns an error if more than one USB device is present.
 -e                              - directs command to the only running emulator.
                                   returns an error if more than one emulator is running.
 -s <specific device>            - directs command to the device or emulator with the given
                                   serial number or qualifier. Overrides ANDROID_SERIAL
                                   environment variable.
 -p <product name or path>       - simple product name like 'sooner', or
                                   a relative/absolute path to a product
                                   out directory like 'out/target/product/sooner'.
                                   If -p is not specified, the ANDROID_PRODUCT_OUT
                                   environment variable is used, which must
                                   be an absolute path.
 -H                              - Name of adb server host (default: localhost)
 -P                              - Port of adb server (default: 5037)
 devices [-l]                    - list all connected devices
                                   ('-l' will also list device qualifiers)
 connect <host>[:<port>]         - connect to a device via TCP/IP
                                   Port 5555 is used by default if no port number is specified.
 disconnect [<host>[:<port>]]    - disconnect from a TCP/IP device.
                                   Port 5555 is used by default if no port number is specified.
                                   Using this command with no additional arguments
                                   will disconnect from all connected TCP/IP devices.

device commands:
  adb push <local>... <remote>
                                 - copy files/dirs to device
  adb pull [-a] <remote>... <local>
                                 - copy files/dirs from device
                                   (-a preserves file timestamp and mode)
  adb sync [ <directory> ]       - copy host->device only if changed
                                   (-l means list but don't copy)
  adb shell [-e escape] [-n] [-Tt] [-x] [command]
                                 - run remote shell command (interactive shell if no command given)
                                   (-e: choose escape character, or "none"; default '~')
                                   (-n: don't read from stdin)
                                   (-T: disable PTY allocation)
                                   (-t: force PTY allocation)
                                   (-x: disable remote exit codes and stdout/stderr separation)
  adb emu <command>              - run emulator console command
  adb logcat [ <filter-spec> ]   - View device log
  adb forward --list             - list all forward socket connections.
                                   the format is a list of lines with the following format:
                                      <serial> " " <local> " " <remote> "\n"
  adb forward <local> <remote>   - forward socket connections
                                   forward specs are one of:
                                     tcp:<port>
                                     localabstract:<unix domain socket name>
                                     localreserved:<unix domain socket name>
```

For example, to start your android app from the command line, you could type:

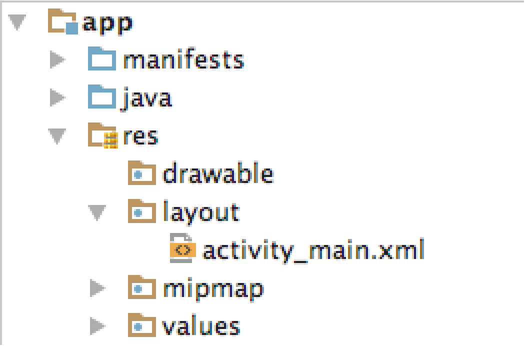
```
adb shell am start -n com.package.name/com.package.name.ActivityName
```

Android Layouts Primer

You've learned about a lot of new terms that have to do with the Android UI. Here is a quick reference of these important concepts and how they work together. If you have never worked with a language like XML or HTML before and feel confused, you should head over to the **Android Basics class on Android Layouts**class and take the first lesson.

Activities and Layouts

An **activity** is a single focused thing that the user can do. Activities are responsible for creating the window that your application uses to draw and receive events from the system. Activities are written in Java, extending from the Activity class.
An activity creates **views** to show the user information, and to let the user interact with the activity. Views are a class in the Android UI framework. They occupy a rectangular area on the screen and are responsible for drawing and handling events. An activity determines what views to create (and where to put them), by reading an XML layout file. These XML files, as Dan mentioned, are stored in the **res folder** inside the folder labeled **layouts**.



Layout XML

So what does this XML look like? Here's an example:

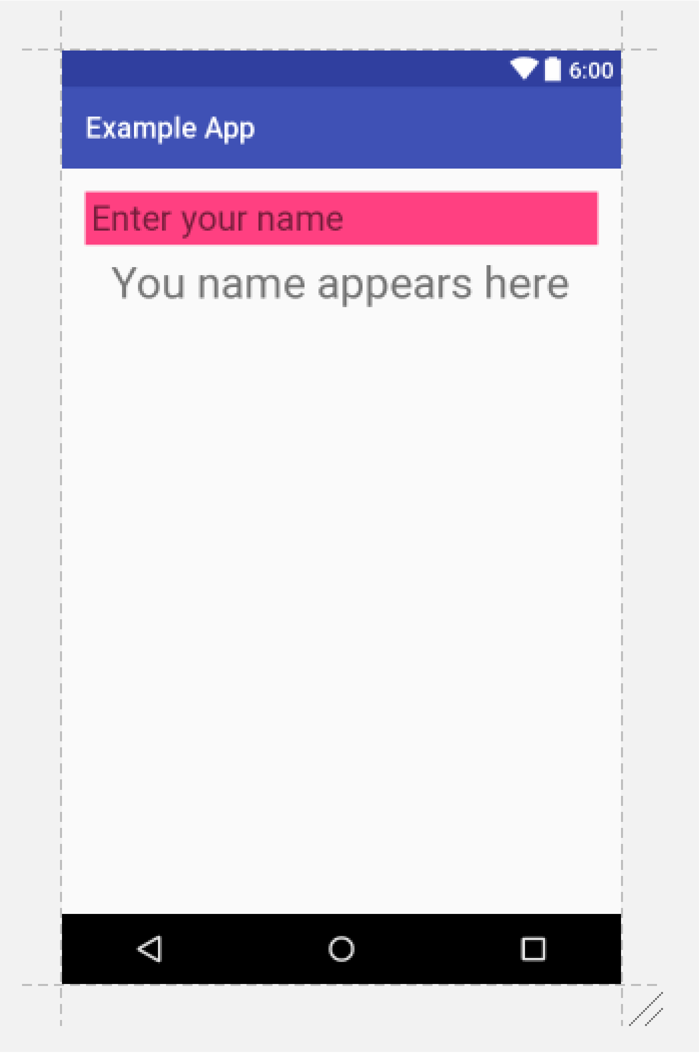
```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  xmlns:tools="http://schemas.android.com/tools"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:orientation="vertical"
  android:padding="16dp"
  tools:context="com.example.android.exampleapp.MainActivity">

     <EditText
     android:id="@+id/edit_text_name_input"
     android:layout_width="match_parent"
     android:layout_height="wrap_content"
```

```
    android:background="@color/colorAccent"
    android:hint="Enter your name"
    android:padding="4dp"
    android:textSize="24sp" />

     <TextView
    android:id="@+id/text_view_name_display"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_gravity="center"
    android:layout_marginTop="8dp"
    android:text="Your name appears here"
    android:textSize="30sp" />
</LinearLayout>
```

This looks like the following on a phone screen:



Oops! The subtitle should read "Your name appears here"

Type of View : UI Components

There are two major categories of views. The first type are UI components that are often interactive. Here are a few examples:

Class Name	Description
TextView	Creates text on the screen; generally non interactive text.
EditText	Creates a text input on the screen
ImageView	Creates an image on the screen
Button	Creates a button on the screen
Chronometer	Create a simple timer on screen

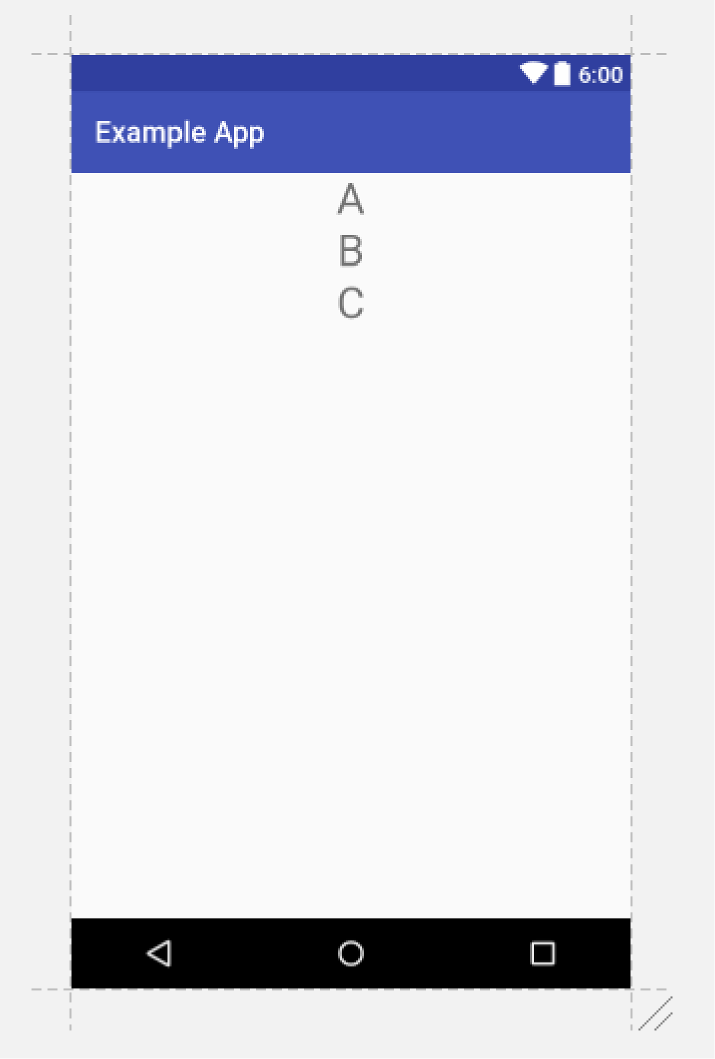
The **android.widget** package contains a list of *most* of the UI view classes available to you.

Type of View : Container View

The second are views called "Layout" or "Container" views. They extend from a class called **ViewGroup**. They are primarily responsible for containing a group of views and determining where they are on screen. What do I mean by "containing a group of views?". I mean that a view will be nested inside the tag of another view, like below:

```
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  xmlns:tools="http://schemas.android.com/tools"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:orientation="vertical"
  tools:context="com.example.android.exampleapp.MainActivity">
    <TextView
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_gravity="center"
    android:text="A"
    android:textSize="30sp" />
    <TextView
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_gravity="center"
    android:text="B"
    android:textSize="30sp" />
    <TextView
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_gravity="center"
    android:text="C"
    android:textSize="30sp" />
</LinearLayout>
```

This will look like:



A few examples of common container views are:

Class Name	Description
LinearLayout	Displays views in a single column or row.
RelativeLayout	Displays views positioned relative to each other and this view.

Class Name	Description
FrameLayout	A ViewGroup meant to contain a single child view.
ScrollView	A FrameLayout that is designed to let the user scroll through the content in the view.
ConstraintLayout	This is a newer viewgroup; it positions views in a flexible way. We'll be exploring constraint layout later in the lesson.

Note that layout views can be nested in one another, so you can nest a LinearLayout inside of a LinearLayout if you so choose.

XML Attributes

Views have attributes in XML which control the **properties** of the view. Here's an example from before:

```xml
<?xml version="1.0" encoding="utf-8"?>
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
  xmlns:tools="http://schemas.android.com/tools"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:orientation="vertical"
  android:padding="16dp"
  tools:context="com.example.android.exampleapp.MainActivity">


    <EditText
    android:id="@+id/edit_text_name_input"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:background="@color/colorAccent"
    android:hint="Enter your name"
    android:padding="4dp"
    android:textSize="24sp" />


    <TextView
    android:id="@+id/text_view_name_display"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_gravity="center"
    android:layout_marginTop="8dp"
    android:text="Your name appears here"
    android:textSize="30sp" />
</LinearLayout>
```

The properties are things like **textSize** and **padding**. Every view has a handful of properties associated with them, which can be found on their documentation pages. These properties can be set to different values. Properties determine the specifics of how a view looks and interacts. Let's look at a few examples of properties you'll be using shortly.

Text

The `android:text` attribute is an example of a very simple property that can be modified with the xml. In the code above, the portion that says
`android:text="Your name appears here"`
makes the TextView show the words:

You name appears here

Width and Height

Some of the most important properties are the width property and height property - those must be defined for every view. Remember that all views occupy a rectangular area on the screen - the width and height are the width and height of that area. You can define this in pixels, or better yet dp (stands for density-independent pixels, we'll talk a lot more about this in later lessons):

```
android:layout_width="200dp"
android:layout_height="300dp"
```

For the sake of having a layout be responsive and adjust to different devices, two common values are not numbers at all, but `wrap_content` and `match_parent` used as shown here:

```
android:layout_width="wrap_content"
android:layout_height="match_parent"
```

wrap_content will shrink the view to wrap whatever is displayed inside the view. For example, if the view is filled with the text "Hello world" then `wrap_content` for the width will set the width of the view to be the exact width that the text "Hello world" takes up on the screen. **match_parent** will expand the size of the view to be as large as the parent view which it is nested inside of.

Padding and Margin

`padding` and `layout_margin` are two very similar attributes. Both determine the space around a View. The difference is that `padding` determines space within the boundaries of the view, and `layout_margin`determines the space outside the boundaries of the view. For a thorough example, check out this video about **Padding and Margin**

How do the XML Layouts relate to the Java Activites?

After you create your XML Layout you need to associate it with your activity. This is done in the `onCreate`method of the `Activity` using the method `setContentView`. You pass a reference to the layout file as `R.layout.name_of_layout`. For example, if your layout were named **activity_main.xml** this would look like:

```
public  class MainActivity extends AppCompatActivity {
     @Override
     protected void onCreate(Bundle savedInstanceState) {
         super.onCreate(savedInstanceState);
         setContentView(R.layout.activity_main);
         // other code to setup the activity
     }
     // other code
}
```

At this point, you might have two questions, first, what is this R.layout business and second, what is setContentView actually doing?

The R Class

When your application is compiled the **R** class is generated. It creates constants that allow you to dynamically identify the various contents of the `res` folder, including layouts. To learn more, check out the documentation about **resources**.

setContentView

So what is the `setContentView` method doing? It **inflates the layout**. Essentially what happens is that Android reads your XML file and generates Java objects for each of the tags in your layout file. You can then edit these objects in the Java code by calling methods on the Java objects. We'll go over what these methods look like and how to access view in your layout files later in the course.

Additional resources

This was a very quick introduction to the basics of Android layouts. You'll be learning more about leveraging resources and responsive design in the course. If you'd like a more in-depth introduction to creating XML layouts in Android, check out the first lesson in **Android for Beginners**.

Update Sunshine Layout Solution

In this step, you modified some of the boiler plate code to create a new layout for Sunshine

Notes on Solution Code

Most of this step involved massaging the layout code to contain just a simple `FrameLayout` with a `ScrollView`, as seen below:

```
<FrameLayout xmlns:android="http://schemas.android.com/apk/res/android"
  android:layout_width="match_parent"
  android:layout_height="match_parent">
      <ScrollView
    android:layout_width="match_parent"
    android:layout_height="wrap_content">
            <TextView
      android:id="@+id/tv_weather_data"
      android:layout_width="wrap_content"
      android:layout_height="wrap_content"
      android:padding="16dp"
      android:textSize="20sp" />
      </ScrollView>
</FrameLayout>
```

After removing the `ConstraintLayout` from your code, it was also safe to remove this dependency:

```
compile 'com.android.support.constraint:constraint-layout:1.0.0-beta3'
```

Solution Code

Solution: [**S01.01-Solution-CreateLayout**][**Diff**]

Add Scrolling Weather Solution

In this exercise, you added a list of scrolling weather data.

Perhaps the trickiest part of this exercise was using `findViewById`. `findViewById` does exactly as the name implies: It gets a view from your XML layout by its ID, and stores it for you in a Java object, like this:

```
mWeatherTextView = (TextView) findViewById(R.id.tv_weather_data);
```

Once you have this view, you can add everything in your weather array using the **append** method of the `TextView` class.

Another method you can use is **setText**. The difference between `setText` and `append` is that `setText`overwrites what was in the `TextView`, while `append` simply adds text onto whatever text was already there. For the solution code and a full diff showing the before and after states, check out the links below.

Solution Code

Solution: [**S01.02-Solution-AddWeatherList**][**Diff**]