ViewModel LiveData Java Thread - In class Lab and Project

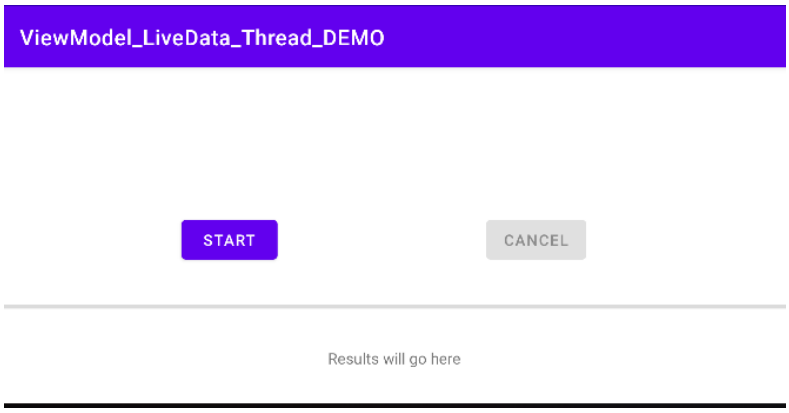
Create Empty activity project

Copy the following code into activity_main.xml in layout folder

```
<?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/bStart"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginStart="8dp"
        android:layout_marginTop="8dp"
        android:layout_marginEnd="8dp"
        android:layout_marginBottom="8dp"
        android:onClick="doStart"
        android:text="Start"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.254"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintVertical_bias="0.517" />

    <Button
        android:id="@+id/bCancel"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginStart="8dp"
        android:layout_marginTop="8dp"
        android:layout_marginEnd="8dp"
        android:layout_marginBottom="8dp"
        android:onClick="doCancel"
        android:text="Cancel"
        android:enabled="false"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.713"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintVertical_bias="0.517" />

    <ProgressBar
        android:id="@+id/progressBar1"
```

```
        style="?android:attr/progressBarStyleHorizontal"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        app:layout_constraintBottom_toTopOf="@+id/textView2"
        app:layout_constraintTop_toBottomOf="@+id/bCancel" />

    <TextView
        android:id="@+id/textView2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginBottom="32dp"
        android:layout_marginEnd="8dp"
        android:layout_marginStart="8dp"
        android:text="Results will go here"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent" />


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

Your UI should look like this



Next hover over doStart and doCancel and add those methods in MainActivity.java

Next, add a DataViewModel class
be sure to update imports for ViewModel

```
public class DataVM extends ViewModel {
}
```

Add a thread to DataVM, dont make it static, we dont care about implicit references anymore since we are decoupling the thread from the activity

```
public class MyThread extends Thread {

    //used to ask thread to stop
    public boolean stopRequested=false;
    private int NUMBER_TICKS=100;

    public void run() {
        for (int i=0;i<NUMBER_TICKS;i++){
            //if MainACtivity has asked us to stop then break
            if(stopRequested)
                break;

            //need to notify Mainactivity of progress

            //sleep for 1/2 sec
            try {
                Thread.sleep(50);
            } catch (InterruptedException e) {
                e.printStackTrace();
            }
        }

        //need to notify mainactivity that we are done
        //so it can enable/disable buttons

    }
}
```

also add a constructor and MyThread mt member variable to DataVM

```
public class DataVM extends ViewModel {

    private MyThread mt;
    public DataVM() {}
```

We want the DataVM to be able to run 1 thread at a time and be able to stop that thread as well, so add a couple of methods to DataVM

```
public void startThread(){
   //if I have not started a thread
   //or if I have and its finished
   //then start another
   if(mt==null || !mt.isAlive()) {
      mt = new MyThread();
      mt.start();
   }
}

public void stopThread(){
   //if null we are done
   if(mt==null)
      return;

   //ask for it to stop
   mt.stopRequested=true;

   try {
      //wait until its done
      //this is risky, it may take a while
      //your thread has to be designed to
      //handle this
      mt.join();
   } catch (InterruptedException e) {
      e.printStackTrace();
   }
   mt=null;  //GC this thread
}
```

Next in MainActivity.java
add some member variables

```
private TextView    tv;
private Button      bStart;
private Button      bCancel;
private ProgressBar pBar;
//persists accross config changes
DataVM myVM;
```

And get a reference to them in onCreate

```
tv = findViewById(R.id.textView2);
bStart= findViewById(R.id.bStart);
bCancel = findViewById(R.id.bCancel);
pBar = findViewById(R.id.progressBar1);
```

now get a reference to the DataVM, add the following to onCreate

```
// Create a ViewModel the first time the system calls an activity's
// onCreate() method.  Re-created activities receive the same
// MyViewModel instance created by the first activity.
myVM = new ViewModelProvider(this).get(DataVM.class);
```

now flesh out do start and doStop to start and stop a thread

```
public void doStart(View view) {
   myVM.startThread();
       pBar.setProgress(0);

}

public void doCancel(View view) {
   myVM.stopThread();
}
```

Notice we have done nothing about enabling/disabling buttons, or updating the progressbar, but doStart starts a thread. We cannot check doStop yet as it's grayed out.

Go over Why use ViewModel and LiveData lecture
Enter LiveData – An observer pattern where all the data is kept in the ViewModel and the Activity is notified when the data changes, the framework correctly manages all the lifecycle events for you.

In ViewModel (DataVM)

Add MutableLiveData listeners and initialize in DataVM's constructor, anytime we want to change the data we use setValue (from main thread) or postValue from a new thread, DataVM now looks like this with new bits in light gray

```
public class DataVM extends ViewModel {
   //lets add some livedata
   private MutableLiveData<Integer> progress ;
   public MutableLiveData<Integer> getCurrentProgress() {
      return progress;
   }

   //if any observer wants to react to a running thread
   // (for instance if an activity wants to configure its start and stop buttons)
   private MutableLiveData<Boolean> isThreadRunning;
   public MutableLiveData<Boolean> getThreadState() {
      return isThreadRunning;
   }

  :
   public DataVM() {
        super();

        //initialize as appropriate
        progress = new MutableLiveData<Integer>();
        progress.setValue(0);    //initialize

        //a tough one is the thread running or not
        isThreadRunning = new MutableLiveData<Boolean>();
        isThreadRunning.setValue(false);
   }

  public void startThread(){
   //if I have not started a thread
   //or if I have and its finished
```

```
    //then start another
    if(mt==null || !mt.isAlive()) {
        mt = new MyThread();
        mt.start();
        isThreadRunning.setValue(true);
    }
}

public void stopThread(){
    //if null we are done
    if(mt==null)
        return;

    //ask for it to stop
    mt.stopRequested=true;

    try {
        //wait until its done
        //this is risky, it may take a while
        //your thread has to be designed to
        //handle this
        mt.join();
    } catch (InterruptedException e) {
        e.printStackTrace();
    }
    mt=null;  //GC this thread

    isThreadRunning.setValue(false);
}
```

```
public class MyThread extends Thread {

    //used to ask thread to stop
    public boolean stopRequested=false;
    private int NUMBER_TICKS=100;

    public void run() {
       for (int i=0;i<NUMBER_TICKS;i++){
          //if MainACtivity has asked us to stop then break
          if(stopRequested)
             break;

          //need to notify Mainactivity of progress
          //can only postValue from background thread cannot use setValue
          progress.postValue(i);
          //sleep for 1/2 sec
          try {
             Thread.sleep(50);
          } catch (InterruptedException e) {
             e.printStackTrace();
          }
       }

       //need to notify mainactivity that we are done
       //so it can enable/disable buttons
       //if we are done then say so
       isThreadRunning.postValue(false);
    }
  }

}
```

And finally, In MainActivity, Add observers in OnCreate

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

    tv = findViewById(R.id.textView2);
    bStart= findViewById(R.id.bStart);
    bCancel = findViewById(R.id.bCancel);
    pBar = findViewById(R.id.progressBar1);

    myVM = new ViewModelProvider(this).get(DataVM.class);

    // Create the observer which updates the UI.
    final Observer<Integer> cntrObserver = new Observer<Integer>() {
        @Override
        public void onChanged(@Nullable final Integer newInt) {
            // Update the UI, in this case, a TextView.
            tv.setText("The new cnt=" +Integer.toString(newInt));
            pBar.setProgress(newInt);
        }
    };
    //now observe
    myVM.getCurrentProgress().observe(this,cntrObserver);

    final Observer<Boolean> isThreadRunningObserver = new Observer<Boolean>() {
        @Override
        public void onChanged(Boolean aBoolean) {
            bStart.setEnabled(!aBoolean);
            bCancel.setEnabled(aBoolean);
            pBar.setProgress(0);
        }
    };
    //now observe
    myVM.getThreadState().observe(this,isThreadRunningObserver);
}
```

You are mostly done.

What about that stopThread method in ViewModel, the indeterminate wait part?

```
public void stopThread(){
        //if null we are done
        if(mt==null)
            return;

        //ask for it to stop
        mt.stopRequested=true;

            //why wait for thread to exit?
            //doesnt the above line handle what we need?
            //it finishes, and its no longer alive

            //if we do this however, will the GC collect the thread before
            //the run method finishes?  (must execute  isThreadRunning.postValue(false); line)
            //Nope; A new thread that has been started becomes a garbage collection "root".
            //It won't be garbage collected until (after) it finishes.

        mt=null;  //GC this thread
    }
```

See ViewModel_LiveData_Thread project.