Kotlin Coroutines

Upon completion of this module, a student will be able to

- explain the advantage of Coroutines other Async patterns
- set up app to work with coroutines
- use annotations to ensure proper threading
- prepare methods to be run on coroutines
- spin up coroutine
- move coroutine execution from one thread to another

Assignment

- Task
  - Add coroutines to your recycler view app
- Repo
  - https://github.com/LambdaSchool/Android_KotlinCoroutines
- Submission
  - Fork on github and submit pull request

A Student Can

explain the advantage of Coroutines other Async patterns

Thread

- Threads
  - Lot of overhead (~ 2 MB per Thread)
  - Wastes a lot of resources waiting for something else to complete (network call)

https://www.youtube.com/watch?v=_hfBv0a09Jc

Callbacks

- Pros
  - Less waiting (code is executed
- Cons
  - Callback Hell
    - Multiple layers of chained callbacks

```
fs.readdir(source, function (err, files) {
  if (err) {
    console.log('Error finding files: ' + err)
  } else {
    files.forEach(function (filename, fileIndex) {
      console.log(filename)
      gm(source + filename).size(function (err, values) {
        if (err) {
          console.log('Error identifying file size: ' + err)
        } else {
          console.log(filename + ' : ' + values)
          aspect = (values.width / values.height)
          widths.forEach(function (width, widthIndex) {
            height = Math.round(width / aspect)
            console.log('resizing ' + filename + 'to ' + height + 'x' + height)
            this.resize(width, height).write(dest + 'w' + width + '_' + filename, function(err) {
              if (err) console.log('Error writing file: ' + err)
            })
          }.bind(this))
        }
      })
    })
  }
})
```

https://www.youtube.com/watch?v=_hfBv0a09Jc

Promise/Future

- A value which can be returned and run later

```
FutureTask<String> future =
       new FutureTask<String>(new Callable<String>() {
         public String call() {
           return searcher.search(target);
       }});
executor.execute(future);
```

https://www.youtube.com/watch?v=_hfBv0a09Jc

Coroutines

- Lightweight
  - Can run 10s of 1000s of coroutines
- Suspend
  - Waits without sleeping (fewer CPU cycles)

https://www.youtube.com/watch?v=_hfBv0a09Jc

A Student Can

set up app to work with coroutines

Dependencies

- Gradle Dependencies

```
dependencies {
    ...

    implementation 'org.jetbrains.kotlinx:kotlinx-coroutines-core:1.1.1'
    implementation 'org.jetbrains.kotlinx:kotlinx-coroutines-android:1.1.1'

    ...
}
```

https://codelabs.developers.google.com/codelabs/kotlin-coroutines/#1

A Student Can

use annotations to ensure proper threading

Thread Annotations

- Indicate which thread a function or class should run on
- Causes an error if run on incorrect thread

```
@UiThread
fun onMainViewClicked() {
    ...
}

@WorkerThread
fun onSnackbarShown() {
    ...
}
```

https://developer.android.com/studio/write/annotations.html#thread-annotations

A Student Can

prepare methods to be run on coroutines

Suspend Keyword

- Makes function available to coroutine
- Can only be called from coroutine or another suspend function

```
@WorkerThread
suspend fun getCharactersSuspend(
    offset: Int = 0,
    limit: Int = 10): List<Character> {
    val result = NetworkAdapter.httpGetRequestCoroutine(
        "$CHARACTERS_URL&limit=$limit&offset=$offset")
    val characterList = Json.parse(CharacterList.serializer(), result)

    return characterList.results ?: listOf()
}
```

https://codelabs.developers.google.com/codelabs/kotlin-coroutines/#3

A Student Can

spin up coroutine

CoroutineScope

- Manages Coroutines
- Dispatcher determines which thread the routine starts on
- Can cancel all coroutines in scope through job
  - If a CoroutineScope doesn't have a job, it will run until the app terminates

```
private val dataJob = Job()
private val workerScope = CoroutineScope(Dispatchers.Main + dataJob)


override fun onDetachedFromRecyclerView(recyclerView: RecyclerView) {
    dataJob.cancel()
    ...
}
```

https://codelabs.developers.google.com/codelabs/kotlin-coroutines/#4

Launch

- Coroutine Builder
- CoroutineScope.launch
- Starts coroutine in designated scope with associated job

```
workerScope.launch {
    ...
}
```

https://codelabs.developers.google.com/codelabs/kotlin-coroutines/#4

A Student Can

move coroutine execution from one thread to another

Switch Threads

- withContext
  - Executes block on separate thread
  - runOnUiThread replacement

```
imageScope.launch {
    var image: Bitmap? = null
    withContext(Dispatchers.IO) {
        ComicDao.getCharacterImage(element.image)?.let { image = it }
    }
    image.let {
        if (characterHolder.characterNameView.text == element.name) {
            characterHolder.characterImageView.setImageBitmap(it)
        }
    }
}
```

https://codelabs.developers.google.com/codelabs/kotlin-coroutines/#8