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Abstract

A document containing design decisions about Coinz. A map based game where players have to collect cryptocurrency coins. Features of the app, choice of programming language and the timescale are all included.

DESIGN

Informatics Large Practical

INDEX TO BE GENERATED

# Software Development Timetable

|  |  |
| --- | --- |
| **Week** | **Objectives** |
| 2 | * Create word document for the design part of the practical. * Setup private repository for Coinz implementation and include Professor Gilmore as a contributor. * Decide on programming language choice; Java vs Kotlin by Thursday. * List all objectives in the timetable by Friday. |
| 3 | * Complete list of features fundamental to the Coinz app by Tuesday. * Complete list of additional features to add to the Coinz app by Wednesday. * Finish watching half of the Firebase tutorial videos produced by TVAC Studios on Friday. |
| 4 | * Design document completed by Tuesday and submitted on Wednesday after a final check * Finish watching all the Firebase tutorial videos produced by TVAC Studio by Friday. https://www.youtube.com/playlist?list=PLGCjwl1RrtcTXrWuRTa59RyRmQ4OedWrt |
| 5 |  |
| 6 |  |
| 7 |  |
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| 12 |  |
| 13 |  |

Game summary:

* Players collect coins scattered around the central area
* App is considered a prototype that a team can further develop
* Location of coins are specified on map, they are collected by getting near to their location. (What if the player’s inventory is full? Drop/trade/bank)
* Each map has 50 coins
* A new map is released every day. (Do we generate the map or is the geo-json data given to us?)
* Four different coins: Penny (PENY), Dollar (DOLR), Shil (SHIL), Quid (QUID).
* Fluctuate relative to the value another currency just like real currencies do.
* That other currency is GOLD.
* What algorithm are we going to use to handle coin fluctuations ? Is it going to be a simulation or based on real data?
* Every coin on a map has a value > 0 but < 10 of its currency (relative to GOLD) E.g 5.72384765123 DOLR
* What happens to coins from an older map?

Project timescale from week 2 to week 13

* What have I done so far
* What still remains to be done
* Order in which you can complete a well-engineered, well-tested and well-documented project.

Justification and discussion on:

*Engineering*

* Programming language chosen
* API level chosen

*Game design*

* Extra features
* Features

Define extra features:

* Coin trading
* Exchange rate random walks
* *Backend game server. Firebase authentication, cloud functions programmed in Kotlin. Player updating and trading*

# Programming Language Discussion

In this section, I’m going to discuss the advantages and disadvantages of choosing Kotlin over Java or by choosing Java over Kotlin. I will weigh up the advantages and disadvantages of each choice and I will reach a conclusion based on which language maximizes benefits and minimizes costs.

As of the release of Android Studio 3.0 in October last year (\*REF), Google added Kotlin as an officially supported programming language for the Android SDK. When developing a specification for a project, this might cause analysts to ponder on which choice of language would be the best for a new Android app. There are many things to consider such as the supported libraries, the Java to Kotlin translator and the syntax and semantics. A conservative developer might want to stay with Java until Kotlin matures; whilst a more liberal developer would be open to going with Kotlin in its youth.

Since it is possible to use Java libraries in Kotlin and vice versa, simply looking at which language has better libraries is not a valid comparison. A more important factor is thinking about how *effective* the Java to Kotlin translator is. It seems to be fine at translating toy Java code to toy Kotlin code, but there are situations where it can struggle translating enterprise level code to Kotlin. For example, this stackoverflow question (https://stackoverflow.com/questions/43235423/converted-java-class-file-to-kotlin-makes-compilation-error) is about a developer using a Java CallbackWrapper in Kotlin that works fine; however, when the Java code is translated to Kotlin the compiler throws cryptic errors. The developer who answered the question noticed that the problem was caused by the fact Kotlin “doesn’t allow using lambdas to implement Kotlin functional interfaces, so your lambda isn’t going to work (*it does allow implementing Java functional interfaces, because Java doesn’t have proper function types*)” Unfortunately the Android Studio translator assumed that the Kotlin lambdas would work despite that Kotlin has real function types unlike Java. If I were to improve the Android Studio translator, I would add a heuristic that searches the entire code bases for usages of Kotlin lambdas to implement Java functional interfaces because it won’t work in Kotlin.

Ones of Kotlin’s biggest advantage over Java is its syntax; lots of developers complain about Java verbosity and this is absolutely not a problem in Kotlin because the signal to noise ratio is much lower. For example, in Java it would take multiple lines to populate an array with content.

String[] names = **new** String[3];  
names[0] = **"Raees"**;  
names[1] = **"John"**;  
names[2] = **"Elliott"**;

In Kotlin the same thing can be done using one line:

**val** names = *arrayOf*(**"Raees"**, **"John"**, **"Elliott"**)

Whether this is a good thing depends on who you speak to. Personally, I don’t like writing lots of noisy code but there are developers who would dispute whether the extra code is noise. Some would say it’s signal because the String[] in front of the declaration tells you that you are declaring an array of strings. In Python this is a common concern because sometimes it’s difficult to determine the type of variable without calling the type method to explicitly check. Fortunately, in Kotlin there’s a way around this, we can explicitly tell the developer the type by changing the array declaration to:

**val** names: Array<String> = *arrayOf*(**"Raees"**, **"John"**, **"Elliott"**)

So far there’s a fair tie between Java and Kotlin; Kotlin wins in the syntax department and Java wins in the compatibility department. But we need to make a decision now because if we choose the wrong language, it could lead to further problems down the line. For example, even though Google has an official page on migrating Java projects to Kotlin, there have been disputes about whether it’s an effective way to move to Kotlin because of the problems it introduces. For example, in the article (<https://blog.usejournal.com/how-to-fuck-up-java-to-kotlin-migration-in-your-existing-android-app-325b57c9ddbb)> Android Developer Paulina Sadowska talks about how following Google’s guidance will introduce problems if the Java project uses certain libraries. She talks about how using Java with Lombok to generate getters and setters causes errors in Kotlin because “when the Kotlin compiler runs it uses javac as well but with no annotation processing” Therefore, if we want to use Kotlin we must decide now because we will need to use different libraries than if we go with Java.

In conclusion, I have decided to program the Coinz app in Java. Java wins when we consider code migration and translation problems. Kotlin wins when we consider syntax. However, by using common dependencies like Google Guava we can reap the benefits of less noisy data structure instantiation by using its utility classes. Furthermore, I won’t be completing the Coinz app, I will just be making a prototype to pass onto a development team. There’s a significant time cost if 5 or 10 people have to spend a week learning the intricacies of Kotlin to understand good programming principles. We could just hire Kotlin developers but given the low supply and high demand, management will have to pay a higher salary.

Kotlin vs Java

Kotlin wins when it comes to programming features

* Lambda expressions
* Null-safety (billion dollar mistake)
* Smart casts
* String templates
* Extension functions
* Properties
* Primary constructors
* First-class delegation
* Type inference for variables
* Singletons
* Declaration-site variance
* Range expressions
* Operator overloading
* Companion objects
* Data classes
* Coroutines

https://kotlinlang.org/docs/reference/comparison-to-java.html

Java wins when it comes to # programmers available

But we could train Java developers to program in Kotlin.

But that would cost time + money

If the developer knows both Kotlin and Java to a similar level of competence, it will be quicker to build the app in Kotlin. If the app is passed onto another team, they will have to be equally as competent in Kotlin or they will need to learn Kotlin. If they don’t want to learn Kotlin or the resources aren’t available to teach them Kotlin, problems arise. We could translate the code but will it be readable and will it introduce bugs? Research this.