Open-Source Coding (Introduction)
OPSC7311
Module Outline 2024
(First Edition: 2018)

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Introduction

Welcome to Open Source Coding (Introduction). In this module, we will be focussing on developing native apps for the Android Operating System (OS). We will make use of the Kotlin programming language.

In 2022, the Android OS has a market share of 70.97% of mobile devices (G., 2022). This means that the apps that we learn to develop here, will be able to run on most mobile devices out there right now.

In your previous programming modules, you have already learned object-oriented programming in Java or C#. Although the syntax of Kotlin is slightly different, you will find the concepts quite familiar.

Throughout this module, you will create several apps to master all the basic skills needed to build an Android app. It is important to get hands-on experience in any programming module, so it is essential that you complete all the activities provided on Learn.

We hope you will enjoy the module and take the opportunity to use the knowledge and experience gained in both future modules, and in your career.

Reference

G., N., 2022. *Android: Market Share & Other Stats for 2022*. [online] Available at: https://techjury.net/blog/android-market-share/ [Accessed 17 November 2022].

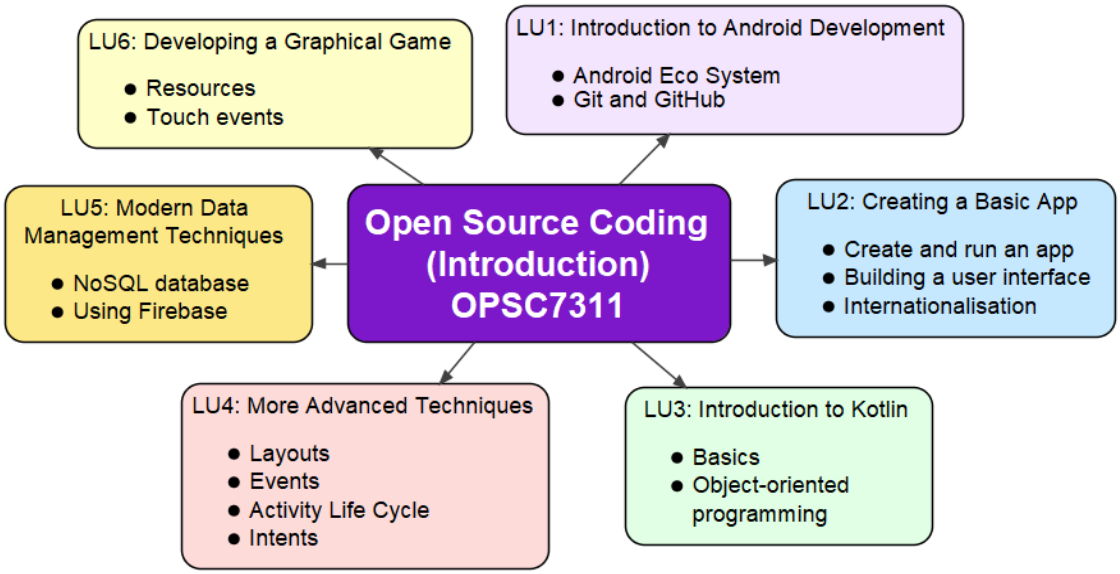

Figure 1. Module Structure

Using this Module Outline

A Module Outline is a brief summary of the module and is given to you to support your learning.

The content of this module is on Learn as well as in the prescribed material. You will not succeed in this module if you focus on this document alone.

To succeed in this module, you will need to:

- Attend lectures/online sessions;
- Go through the material and activities on Learn;
- Read the prescribed material.

Your lecturer will decide when activities are available/open for submission and when these submissions or contributions are due. Ensure that you take note of announcements made during lectures and/or posted in the Student Portal and within Learn in this regard.

- Your campus will provide you with details about when your assessments are due.

Module Resources	
Prescribed Material (PM) for this Module	Open Source Coding (Introduction) Module Manual [PM1] GitHub source code repository for the module [PM2] https://github.com/iie-opsc/opsc7311kotlin [Accessed 21 September 2023].
Recommended Readings, Digital, and Web Resources (RM)	Please note that a number of additional resources and links to resources are provided throughout this module on the Learn platform. You are encouraged to engage with these as they will assist you in mastering the various objectives of this module. They may also be useful resources for completing assignments. You will not, however, be assessed under examination conditions on any additional or recommended reading material. RM1: Karanpuria, R. and Roy, A.S. (2018) *Kotlin Programming Cookbook: Explore More Than 100 Recipes That Show How to Build Robust Mobile and Web Applications with Kotlin, Spring Boot, and Android*. Birmingham, UK: Packt Publishing. Available at: https://search-ebscohost-com.ezproxy.iielearn.ac.za/login.aspx?direct=true&db=e000xww&AN=1699229&site=ehost-live&scope=site [Accessed 21 September 2023]. RM2: Smyth, N. (2020) *Android Studio 3.6 Development Essentials - Kotlin Edition: Developing Android 10 (Q) Apps Using Android Studio 3.6, Kotlin and Android Jetpack*. Payload Media, Inc. Available at: https://search-ebscohost-com.ezproxy.iielearn.ac.za/login.aspx?direct=true&db=e000xww&AN=2643704&site=ehost-live&scope=site [Accessed 21 September 2023].
Software required	Latest Version of Android Studio (with the Android 8.0 *Oreo* SDK installed) Java SE 7 or later Software Development Kit (SDK)
Software Licence requirements	Open Source – Download the latest version of Android Studio from: https://developer.android.com/studio [Accessed 21 September 2023]. and the Java SDK from:

	http://www.oracle.com/technetwork/java/javase/downloads/index.html [Accessed 21 September 2023].
System Requirements	• Microsoft Windows 8/10 (64-bit) • 8 GB RAM recommended (plus 1 GB for the Android Emulator) • 8 GB of available disk space minimum • 1280 x 800 minimum screen resolution
Lab minimum requirements	Same as above.
Module Overview	You will find an overview of this module on Learn under the *Module Information* link.
Assessments	Find more information on this module's assessments in this document and on the Student Portal.

This Module on Learn

Learn is an online space, designed to support and maximise your learning in an active manner. Its main purpose is to guide and pace you through the module. In addition to the information provided in this document, you will find the following when you access Learn:

- A module overview;
- A list of prescribed material;
- Critical questions to guide you through the module's objectives;
- A variety of additional online resources (articles, videos, audio, interactive graphics, etc.) in each learning unit that will further help to explain theoretical concepts;
- Collaborative and individual activities with time-on-task estimates to assist you in managing your time around these;
- Revision questions, or references to revision questions, after each learning unit.

Kindly note:

- Unless you are completing this as a distance module, Learn does not replace your contact time with your lecturers and/or tutors.
- This module is a Learn module, and as such, you are required to engage extensively with the content on the Learn platform. Effective use of this tool will provide you with opportunities to discuss, debate, and consolidate your understanding of the content presented in this module.
- You are expected to work through the learning units on Learn in your own time – especially before class. Any contact sessions will therefore be used to raise and address any questions or interesting points with your lecturer, and not to cover every aspect of this module.
- Your lecturer will communicate submission dates for specific activities in class and/or on Learn.

Icons Used on Learn

The following icons are used in all your modules on Learn:

Icon	Description
	A list of what you should be able to do after working through the learning unit.
	Specific references to sections in the prescribed work.
	Questions to help you recognise or think about theoretical concepts to be covered.
	Sections where you get to grapple with the content/theory. This is mainly presented in the form of questions which focus your attention and are aimed at helping you to understand the content better and to achieve the learning objectives. Ensure that you can answer all these questions in detail. In these sections, you will also be presented with online resources to work through (in addition to the prescribed work) that will help you to understand the work better and to achieve the learning objectives.
	Opportunities to make connections between different chunks of theory in the module or across modules.
	Real life or world of work information or examples of application of theory for self-exploration.
REMEMBER: You need to log onto Learn to: • Access the learning material and online resources such as articles, interactive graphics, explanations, video clips, etc. which will assist you in mastering the content; • View instructions and submit or post your contributions to individual or group activities which are managed and tracked on Learn; and • Submit assessment documents.	

Module Purpose	
The purpose of this module is to introduce students to open source software development for mobile devices.	
Module Outcomes	
MO1	Demonstrate knowledge and understanding of principles, key concepts and practices in open source software development for mobile devices.
MO2	Apply various open source development techniques to develop software for mobile devices.
MO3	Solve given problems by developing open source applications for mobile devices.

Assessments

Integrated Curriculum Engagement (ICE)	
Minimum number of ICE activities to complete	4
Weighting towards the final module mark	10%

Formatives	Part 1	Part 2
Weighting	25%	30%
Write/Submit after	LU3	LU4
Learning Units covered	LU1 to 3	LU1 to 4
Resources required	Prescribed Material	Prescribed Material

Summative	POE
Weighting	35%
Total marks	100
Open/Closed book	Open
Resources required	Prescribed Material
Learning Units covered	All

Assessment Preparation Guidelines	
Format of the Assessment	Preparation Hints
Part 1	
This assessment will assess your understanding of Learning Unit 1 to 3 of this module and will consist of one application for a simple mobile application. You will be working in a team and expected to create an application as per your objectives for these learning units.	• Ensure that you work through all the relevant activities, exercises and revision questions on Learn and in your textbook. • Brainstorm possible gaming programs based on the learning outcomes and objectives provided. • Pay attention to the instructions and to the mark allocations of each question to ensure that you are able to meet the requirements. • Make sure that you have mastered the objectives in Learning Units 1 to 3.
Part 2	
The task will assess you and your team's ability to integrate and apply the content in Learning Units 1 to 4 of this module to build on the app you created in Task 1.	• Read through the prescribed chapters and content for Learning Units 1 to 4 and ensure that you have engaged before you proceed with your coding. • Remember to analyse all elements required and ensure that your task meets the requirements. • Improve the quality of your task by using the provided rubric and addressing any areas of concern prior to submitting it for marking.
Portfolio of Evidence (PoE)	
The PoE will consist of Part 1, Part 2 and further activities to complete the PoE. All learning units will be assessed in the PoE, and reflection on your learning will be included.	• Ensure that you work through all the activities, exercises and revision questions on Learn and consult your textbook. • Include the tasks as submitted, together with your lecturer's feedback and your corrected tasks based on the feedback received. • Include the reflection of your learning (each member to submit this). • Complete other activities included in the PoE.

Module Pacer			
Module Code	Programme	Contact Sessions	Credits and notional time
OPSC7311	BCA3, BCI3, BIS2	72 Contact	15 (150 notional hours)
Learning Unit 1	Introduction to Android Development		

Overview:

This introductory learning unit focuses on the Android Operating System (OS) ecosystem, helping you understand why developing for the Android OS is so popular. It also introduces source control using GitHub.

Please work through Themes 1 and 2 on Learn, together with the relevant sections of your prescribed source/s. To ensure that you are working towards mastering the objectives for this learning unit, please also ensure that you complete all the activities on Learn.

One aspect that you may find challenging in this Learning Unit is getting Android Studio up and running. Read the official Android Studio documentation to assist with any issues you may encounter.

<table>
<tr><th colspan="3">Learning Unit 1: Theme Breakdown</th></tr>
<tr><th>Sessions:
1-10</th><th>Theme 1: The Android Eco System</th><th>Prescribed Material (PM)</th></tr>
<tr><td rowspan="4">Related Outcomes:
MO001</td><td>LO1: Identify the tools used in Android development.
LO2: Provide an overview of the history of the Android Operating System.</td><td rowspan="4">PM1: Learning Unit 1
PM2: LearningUnit1 folder</td></tr>
<tr><td>Theme 2: Git and GitHub</td></tr>
<tr><td>LO3: Explain the purpose of Git.
LO4: Contrast Git and GitHub.
LO5: Create a working copy of a repository hosted on GitHub.</td></tr>
</table>

Learning Unit 2	Creating a Basic Application

Overview:

This learning unit introduces the Android Studio user interface as well as showing you how to create a new app. It further also introduces the Layout Editor, and how to apply various layouts to your app. It also explores using the TextView and ImageView controls. Finally, it concludes with internationalizing your app and running your app for the first time.

Please work through Themes 1 to 4 on Learn, together with the relevant sections of your prescribed source/s. To ensure that you are working towards mastering the objectives for this learning unit, please also ensure that you complete all the activities on Learn.

One aspect that you may find challenging in this learning unit is the use of the layout editor. Ensure that you refer to the Prescribed Material's sections on the layout editor.

<table>
<tr><th colspan="3">Learning Unit 2: Theme Breakdown</th></tr>
<tr><th>Sessions:
11-27</th><th>Theme 1: Creating an App</th><th>Prescribed Material (PM)</th></tr>
<tr><td rowspan="8">Related Outcomes:
MO002
MO003</td><td>LO1: Create a new app.</td><td rowspan="8">PM1: Learning Unit 2
PM2: LearningUnit2 folder</td></tr>
<tr><td>Theme 2: Building a User Interface</td></tr>
<tr><td>LO2: Explain the purpose of the windows in Android Studio.
LO4: Explain the use of the layout editor.
LO5: Use images in an app.
LO6: Apply layouts to the user interface of an app.
LO6: Use the TextView and ImageView controls in an app.</td></tr>
<tr><td>Theme 4: Running an App</td></tr>
<tr><td>LO7: Run a newly created app using the Android emulator.</td></tr>
<tr><td>Theme 5: Internationalizing an App</td></tr>
<tr><td>LO8: Explain how to internationalize an app.</td></tr>
</table>

Learning Unit 3	Introduction to Kotlin

Overview:

This learning unit introduces the programming language used in this module: Kotlin. You will be introduced to the basic syntax of Kotlin, and then move on to object-oriented programming in Kotlin.

Please work through Themes 1 and 2 on Learn, together with the relevant sections of your prescribed source/s. To ensure that you are working towards mastering the objectives for this learning unit, please also ensure that you complete all the activities on Learn.

One aspect that you may find challenging in this Learning Unit is getting used to Kotlin syntax. Complete the activities on Learn to get some hands-on practice with the language.

<table>
<tr><th colspan="3">Learning Unit 3: Theme Breakdown</th></tr>
<tr><th>Sessions:
28-35</th><th>Theme 1: Kotlin Basics</th><th>Prescribed Material (PM)</th></tr>
<tr><td rowspan="3">Related Outcomes:
MO002
MO003</td><td>LO1: Differentiate between Kotlin and Java or C#.
LO2: Use Kotlin to write a basic program with variables and calculations.</td><td rowspan="3">PM1: Learning Unit 3
PM2: LearningUnit3 folder</td></tr>
<tr><td>Theme 2: Object-Oriented Programming in Kotlin</td></tr>
<tr><td>LO3: Explain the following object-oriented programming concepts:
• Inheritance;
• encapsulation;
• polymorphism.

LO4: Explain object-oriented programming in Kotlin.</td></tr>
</table>

Learning Unit 4	More Advanced Techniques

Overview:

This learning unit introduces several new features and techniques of Android Studio through the creation of an updated app. These features and techniques include: the LinearLayout, EditText, SeekerBar, EventHandling, NumberFormat and Intents. This learning unit will also discuss how to adjust custom theme colours, as well as apply the logic of the app by overriding methods in the Main Activity using anonymous inner classes.

Please work through Themes 1 to 4 on Learn, together with the relevant sections of your prescribed source/s. To ensure that you are working towards mastering the objectives for this learning unit, please also ensure that you complete all the activities on Learn.

One aspect that you may find challenging in this Learning Unit is where and how to add code to an Android App. Ensure that you refer to the Prescribed Material's sections on adding logic to the app.

Learning Unit 4: Theme Breakdown		
Sessions: 36-50	Theme 1: Layouts and Controls	Prescribed Material (PM)
Related Outcomes: MO002 MO003	LO1: Apply layouts in an app. LO2: Use the EditText, NumberFormat and SeekBar in an app. LO3: Use a navigation drawer in an app. LO4: Apply colours to an app. LO5: Create a launcher icon for an app.	PM1: Learning Unit 4 PM2: LearningUnit4 folder
	Theme 2: Event Handling	
	LO6: Apply event handling in an app.	
	Theme 3: Activity Life Cycle	
	LO7: Explain the activity life cycle in an Android App. LO8: Create an activity. LO9: Use overridden methods.	
	Theme 4: Using Intents	
	LO10: Explain the purpose of an intent. LO11: Apply an intent in an application.	

Learning Unit 5	Modern Data Management Techniques

Overview:

This learning unit works through the process of adding an online database connection to your app. The learning unit will be focusing on the use of the Firebase database.

Please work through Themes 1 to 3 on Learn, together with the relevant sections of your prescribed source/s. To ensure that you are working towards mastering the objectives for this learning unit, please also ensure that you complete all the activities on Learn.

One aspect that you may find challenging in this Learning Unit is parsing JSON data from a Firebase database. Make sure you understand how JSON is structured before you implement it in a Firebase database.

<table>
<tr><th colspan="3">Learning Unit 5: Theme Breakdown</th></tr>
<tr><th>Sessions:
50-60</th><th>Theme 1: Introduction to NoSQL Databases</th><th>Prescribed Material (PM)</th></tr>
<tr><td rowspan="6">Related Outcomes:
MO002
MO003</td><td>LO1: Explain the difference between Firebase and a traditional SQL database.
LO2: Describe the advantages of using Firebase.</td><td rowspan="6">PM1: Learning Unit 5
PM2: LearningUnit5 folder</td></tr>
<tr><td>Theme 2: Connect an App to Firebase</td></tr>
<tr><td>LO3: Explain why an application would need to be authorized to access a Firebase database.
LO4: Create a connection between an application Firebase.</td></tr>
<tr><td>Theme 3: Firebase Data Storage</td></tr>
<tr><td>LO5: Explain the purpose of JSON in a mobile development.
LO6: Create a Firebase database.
LO7: Create code to read data from the Firebase database.
LO8: Create code to write data to the Firebase database.</td></tr>
</table>

Learning Unit 6	Developing a Graphical Game

Overview:

This learning unit works through the process of developing a small graphical game using Android. The learning unit will also discuss Views, Drawing Images and using the Canvas as well as the use of various methods to perform the logic of the app.

Please work through Themes 1 and 2 on Learn, together with the relevant sections of your prescribed source/s. To ensure that you are working towards mastering the objectives for this learning unit, please also ensure that you complete all the activities on Learn.

One aspect that you may find challenging in this Learning Unit is using positioning graphics. Ensure that you refer to the Prescribed Material's sections on drawing graphics on the canvas.

Learning Unit 6: Theme Breakdown		
Sessions: 60-72	Theme 1: Working with Resources	Prescribed Material (PM)
Related Outcomes: MO002 MO003	LO1: Explain the purpose of defining XML resource files. LO2: Apply animations to controls in an app.	PM1: Learning Unit 6 PM2: LearningUnit6 folder
	Theme 2: Building a Game in Android Studio	
	LO3: Explain the use of touch events. LO4: Explain how to draw on a canvas. LO5: Use a Timer object in Android.	