



**PROGRAMMING 3A  
PROG7311  
MODULE OUTLINE 2024  
(First Edition:2018)**

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## Introduction

In PROG6212, you have learned the skills required to solve the functional requirements of business systems. To a large extent, the difference between small business and large enterprise software systems is focused on non-functional requirements (also called quality attributes) such as maintainability and scalability.

In this module, you will learn how using design patterns and architecture patterns can help fulfil non-functional requirements (NFRs). You will learn about technologies that are frequently in use in enterprise applications. And you will learn about commonly used software development methodologies.

Success can be ensured by practising new knowledge and applying the more theoretical parts of this module to real-life situations.

## Using this Module Outline

This module outline has been developed to **support your learning**.

Please note that 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.

- This document does not reflect all the content on Learn, the links to different resources, nor the specific instructions for the group and individual activities.
- 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 within Learn in this regard.

## 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 list of prescribed material;
- A variety of additional online resources (articles, videos, audio, interactive graphics, etc.) in each learning unit that will further help to explain theoretical concepts;
- Critical questions to guide you through the module's objectives;
- Collaborative and individual activities (all of which are gradable) 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.
- **PROG7311** 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 in this Document and on Learn

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

Icon	Description
 Objectives	A list of what you should be able to do after working through the learning unit.
 Prescribed Work	Specific references to sections in the prescribed work.
 ThinkAbout	Questions to help you recognise or think about theoretical concepts to be covered.
 Active Learning	<p>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.</p> <p>You will be presented with online resources to work through (in addition to the textbook or manual references) and find some of the answers to the questions posed.</p>
 Connect the dots	Opportunities to make connections between different chunks of theory in the module or to real life.
 That is life!	Real life or world of work information or examples of application of theory, using online resources for self-exploration.
<p><b>REMEMBER:</b></p> <p>You need to log onto Learn to:</p> <ul style="list-style-type: none"> <li>• Access online resources such as articles, interactive graphics, explanations, video clips, etc. which will assist you in mastering the content; and</li> <li>• View instructions and submit or post your contributions to individual or group activities which are managed and tracked on Learn.</li> </ul>	

Module Resources	
Prescribed Material (PM) for this Module	<p>Programming 3A Module Manual. 2024.</p> <p><i>Please note that this module guide is intended to support your learning — the content of this module should be sourced from the prescribed material. You will not succeed in this module if you focus on this module guide only.</i></p>
Recommended Readings, Digital, and Web Resources	<p>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 any assignments. You will not, however, be assessed under examination conditions on any additional or recommended reading material.</p> <p><i>The following titles include information related to this module and may be consulted as additional resources. Please note, however, that you will not be tested on any content from these titles.</i></p> <ul style="list-style-type: none"> <li>• Troelsen, A and Japikse, P. 2017. <i>Pro C# 7. With .NET and .NET Core</i>. 8<sup>th</sup> ed. Apress.</li> </ul> <p>The Internet is a valuable resource for all programming students as it provides up-to-date developments on the language and tools, as the language and Microsoft.NET IDE get updated.</p> <ul style="list-style-type: none"> <li>• Design Patterns. [Online]. Available at: <a href="https://sourcemaking.com/design_patterns">https://sourcemaking.com/design_patterns</a> [Accessed 12 October 2022.]</li> <li>• Byte Bot [Online]. Available at <a href="https://landbot.online/v3/H-1471321-8E8ERBM520BXNWZV/index.html">https://landbot.online/v3/H-1471321-8E8ERBM520BXNWZV/index.html</a> [Accessed 26 October 2023]</li> </ul>

Software required	Microsoft Visual Studio 2022 Windows 10 Professional
System Requirements	7 GB – .iso is provided for the students on the FTP Server for downloading.  Run on Host Computer – Standalone Machine
Lab configuration settings	Microsoft Visual Studio 2022 Windows 10 Professional
Module Overview	You will find an overview of this module on Learn under the <i>Module Information</i> link in the Course Menu.
Assessments	Find more information on this module's assessments in this document and on the Student Portal.



**Module Purpose**

The purpose of this module is to build on the object-oriented concepts learnt in Programming 2B to an advanced level, developing large integrated systems.

**Module Outcomes**

MO1	Demonstrate knowledge and understanding of advanced object-oriented concepts.
MO2	Design and develop large Object-oriented systems to solve given enterprise problems.

## Assessments

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

Formative 1	Part 1
Weighting	25%
Duration	15 hours
Total marks	100
Open/Closed book	Open book
Resources required	<ul style="list-style-type: none"> <li>• Prescribed module manual;</li> <li>• Microsoft Visual Studio 2022 (C#);</li> <li>• Access to the Internet.</li> </ul>
Learning Units covered	1-2
Period	Period 3

Formative 2	Part 2
Weighting	30%
Duration	15 hours
Total marks	100
Open/Closed book	Open book
Resources required	<ul style="list-style-type: none"> <li>• Prescribed module manual;</li> <li>• Microsoft Visual Studio 2022 (C#);</li> <li>• Access to the Internet.</li> </ul>
Learning Units covered	1-3
Period	6

Summative	POE
Weighting	35%
Duration	15 hours
Total marks	100
Open/Closed book	Open book
Resources required	<ul style="list-style-type: none"> <li>• Prescribed module manual;</li> <li>• Microsoft Visual Studio 2019 (C#);</li> <li>• Access to the Internet.</li> </ul>
Learning Units covered	All

Assessment Preparation Guidelines	
Format of the Assessment	Preparation Hints
POE	
<p>The POE will assess all learning units in this module and will be application-type questions. The POE is composed of Part 1 and Part 2.</p> <p>In part 1, you are required to write up a short report (500 words) that will be submitted to the bid committee.</p> <p>In part 2, you are required to develop a prototype web application using Visual Studio and C#.</p> <p>Parts 1 and 2 are then resubmitted together with the POE, incorporating any feedback provided by the lecturer in Parts 1 and 2.</p> <p>In the POE (the final document), you must write a report (at least 1000 words).</p>	<ul style="list-style-type: none"> <li>• Ensure that you work through all the activities, exercises, and revision questions on Learn and in your module manual.</li> <li>• Make sure that you are comfortable in responding to all the objectives for all learning units.</li> <li>• Brainstorm possible questions based on the learning outcomes and objectives provided.</li> <li>• Software development and writing skills are assessed in this module, so spend some time reading and understanding the requirements of the POE.</li> </ul>

Module Pacer			
Code	Programme	Contact Sessions	Credits
PROG7311	BCA3; BCAD3	60	15
Learning Unit 1	Characteristics of Enterprise Software Systems		
<p><b>Overview:</b></p> <p>In PROG6212, you have learned the skills required to solve the functional requirements of business systems. To a large extent, the difference between small business systems and large enterprise software systems is the focus on non-functional requirements (also called quality attributes) such as maintainability and scalability.</p> <p>In this learning unit, you will explore the characteristics of such enterprise software systems.</p> <p>The learning unit relates to MO2.</p> <p>Please work through Themes 1, 2 and 3 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>To ensure that you are working towards mastering the objectives for this learning unit, please also ensure that you complete the activities on Learn.</p>			

Learning Unit 1: Theme Breakdown		
Sessions: 1-12	<b>Theme 1: Introduction to Enterprise Software Systems</b>	<b>Module Manual (MM)</b>
	LO1: Explain the scope of enterprise software systems.	MM: Learning Unit 1, Sections 1 and 2
	<b>Theme 2: Non-functional Requirements</b>	MM: Learning Unit 1, Section 3
	LO2: Differentiate between functional and non-functional requirements. LO3: Explain how non-functional requirements impact software design.	
	<b>Theme 3: Challenges in Enterprise Software Systems</b>	MM: Learning Unit 1, Section 4
	LO4: Discuss what emergent behaviour is. LO5: Discuss the challenges brought about by organisational growth in Enterprise Software Systems. LO6: Motivate the need for change management in large enterprises.	

Learning Unit 2	Design and Architecture Patterns
<p><b>Overview:</b></p> <p>By following the object orientation principles such as abstraction and encapsulation (as we did in PROG6112), we can solve any design problem. However, it is not necessary to waste a lot of time for no reason – reusable solutions have been documented that can be applied to many situations. In this learning unit, you will explore the most common design and architecture patterns, as well as some anti-patterns (ways of doing things that are proven to NOT work).</p> <p>The learning unit relates to MO1.</p> <p>Please work through Themes 1, 2 and 3 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>To ensure that you are working towards mastering the objectives for this learning unit, please also ensure that you complete the activities on Learn.</p>	

Learning Unit 2: Theme Breakdown		
Sessions: 13-27	Theme 1: Design Patterns	Module Manual (MM)
	LO1: Explain the purpose of design patterns. LO2: Use creational design patterns to develop applications. LO3: Use structural design patterns to develop applications. LO4: Use behavioural design patterns to develop applications. LO5: Use concurrency design patterns to develop applications.	MM: Learning Unit 2, Sections 1 and 2
	Theme 2: Architecture Patterns	MM: Learning Unit 2, Section 3
	LO6: Differentiate between design patterns and architecture patterns.	
	LO7: Use n-tier architecture to develop software applications.	
	LO8: Use event-driven architecture to develop software applications.	
	LO9: Compare Service Oriented Architecture and Microservices Architecture.	
	LO10: Use Command Query Responsibility Segregation pattern to develop software applications.	
	LO11: Use Domain-Driven Design to develop software applications.	
	Theme 3: Anti-Patterns	MM: Learning Unit 2, Section 4
	LO12: Differentiate between anti-patterns and code smells.	

Learning Unit 3	Enterprise Software System Development
<p><b>Overview:</b></p> <p>To develop enterprise software systems, knowledge of specialised technologies and concepts is required. In this learning unit, you will learn about the conceptual Microsoft Enterprise Application Development Platform. You will understand transaction management, messaging, directory services, security, service orchestration, choreography, and portals. Finally, you will look at how enterprise software systems can be deployed.</p> <p>This learning unit relates to MO2.</p> <p>Please work through Themes 1, 2, 3, 4, 5, 6, 7 and 8 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>To ensure that you are working towards mastering the objectives for this learning unit, please complete the activities on Learn.</p>	



Learning Unit 3: Theme Breakdown		
Sessions: 28-41	<b>Theme 1: Microsoft Enterprise Application Development Platform</b>	<b>Module Manual (MM)</b>
	LO1: Discuss the building blocks of the Microsoft Enterprise Application Development Platform and their relationships to each other.	MM: Learning Unit 3, Sections 1 and 2
	<b>Theme 2: Transaction Management</b>	MM: Learning Unit 3, Section 3
	LO2: Design software applications using end-to-end transaction management to ensure data integrity.	
	<b>Theme 3: Messaging</b>	MM: Learning Unit 3, Section 4
	LO3: Use enterprise software messaging standards to develop software applications to achieve efficient communication.	
	<b>Theme 4: Directory Services</b>	MM: Learning Unit 3, Section 5
	LO4: Use the Lightweight Directory Access Protocol (LDAP) to develop applications that integrate with enterprise identity-related services.	
	<b>Theme 5: Security</b>	MM: Learning Unit 3, Section 6
	LO5: Discuss the principles of enterprise system security.	
	<b>Theme 6: Services, Orchestration and Choreography</b>	MM: Learning Unit 3, Section 7
	LO6: Compare service orchestration and choreography.	
	LO7: Use service orchestration to develop software applications.	
	LO8: Use service choreography to develop software applications.	
	<b>Theme 7: Portal</b>	MM: Learning Unit 3, Section 8
	LO9: Explain the role of an enterprise portal.	
	<b>Theme 8: Application Deployment</b>	MM: Learning Unit 3, Section 9
	LO10: Compare the various possible ways in which an enterprise software system can be deployed and managed.	

Learning Unit 4	Optimising Application Performance
<p><b>Overview:</b></p> <p>Solutions that work perfectly well in small systems may cause havoc when the number of users rise to hundreds of thousands. In this learning unit, you will understand where bottlenecks typically are in systems and how to improve performance.</p> <p>This learning unit relates to MO2.</p> <p>Please work through Themes 1, 2 and 3 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>To ensure that you are working towards mastering the objectives for this learning unit, please complete the activities on Learn.</p>	

Learning Unit 4: Theme Breakdown		
Sessions: 42-50	<b>Theme 1: C# Topics</b>	<b>Module Manual (MM)</b>
	LO1: Discuss the performance implications of using Strings in loops.	MM: Learning Unit 4, Sections 1 and 2
	LO2: Use asynchronous calls to optimise application performance.	
	LO3: Explain the performance implications of using reflection.	
	<b>Theme 2: Databases and Entity Framework</b>	MM: Learning Unit 4, Section 3
	LO4: Explain what n+1 queries are.	
	LO5: Explain how to avoid n+1 queries.	
	LO6: Explain the performance implications of using cursors.	
	LO7: Explain how cross applies can be used to optimise performance.	
	<b>Theme 3: Service Design</b>	MM: Learning Unit 4, Section 4
	LO8: Differentiate between chunky services and chatty services.	
	LO9: Use caching to improve application performance.	
	LO10: Use lists optimally to avoid performance issues.	

Learning Unit 5	Methodologies and Architecture Frameworks
<p><b>Overview:</b></p> <p>In practice, teams of people develop large business systems. The larger the enterprise (and the application), the more complex the process of developing and maintaining it becomes. In this learning unit, you will explore the software development methodologies commonly in use today, learn what DevOps is and briefly touch on enterprise architecture and the frameworks that can be used in large enterprises.</p> <p>This learning unit relates to MO2.</p> <p>Please work through Themes 1, 2 and 3 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>To ensure that you are working towards mastering the objectives for this learning unit, please complete the activities on Learn.</p>	

Learning Unit 5: Theme Breakdown		
Sessions: 51-60	<b>Theme 1: Software Development Methodologies</b>	<b>Module Manual (MM)</b>
	LO1: Contrast various common software development methodologies.	MM: Learning Unit 5, Sections 1 and 2
	<b>Theme 2: DevOps</b>	MM: Learning Unit 5, Section 3
	LO2: Explain what the DevOps is. LO3: Explain what continuous integration and continuous delivery is.	
	<b>Theme 3: Enterprise Architecture</b>	MM: Learning Unit 5, Section 4
	LO4: Discuss the challenges involved in modelling large enterprises. LO5: Compare ITIL, TOGAF and the Zachman framework.	

## Glossary of Key Terms for this Module

Refer to the Glossary in the Module Manual.