



**DATABASES
DBAS6211/d/p
MODULE OUTLINE 2024
(First Edition: 2021)**

This guide enjoys copyright under the Berne Convention. In terms of the Copyright Act, no 98 of 1978, no part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or by any other information storage and retrieval system without permission in writing from the proprietor.



The Independent Institute of Education (Pty) Ltd is registered with the Department of Higher Education and Training as a private higher education institution under the Higher Education Act, 1997 (reg. no. 2007/HE07/002).
Company registration number: 1987/004754/07.

Table of Contents

Introduction.....	3
Using this Module Outline	4
This Module on Learn.....	5
Icons Used in this Document and on Learn	6
Module Resources.....	7
Module Purpose.....	8
Module Outcomes.....	8
Assessments	9
Module Pacer	12
Glossary of Key Terms for this Module.....	18

Introduction

In our lives today, data is everywhere. We create more data every time we take a photograph or post something on social media. We shop online and read (or listen to) electronic books. We play games online and we communicate with people around the world by means of electronic communication.

Data is the raw facts that get recorded, for example, a purchase that is made by a customer. That data can be processed into a format called information which can be used for decision making. (Coronel et al., 2013) An online retailer can use statistical modelling to find out which products are most popular, for example. And that could inform decisions around which products to market most aggressively.

How does all this data get stored? How can we process it to create information that is relevant to businesses, governments, and individuals? How can we keep our data safe?

In this module, we will learn how relational databases work as well as NoSQL databases. And we will learn when it is most appropriate to use each of these technologies.

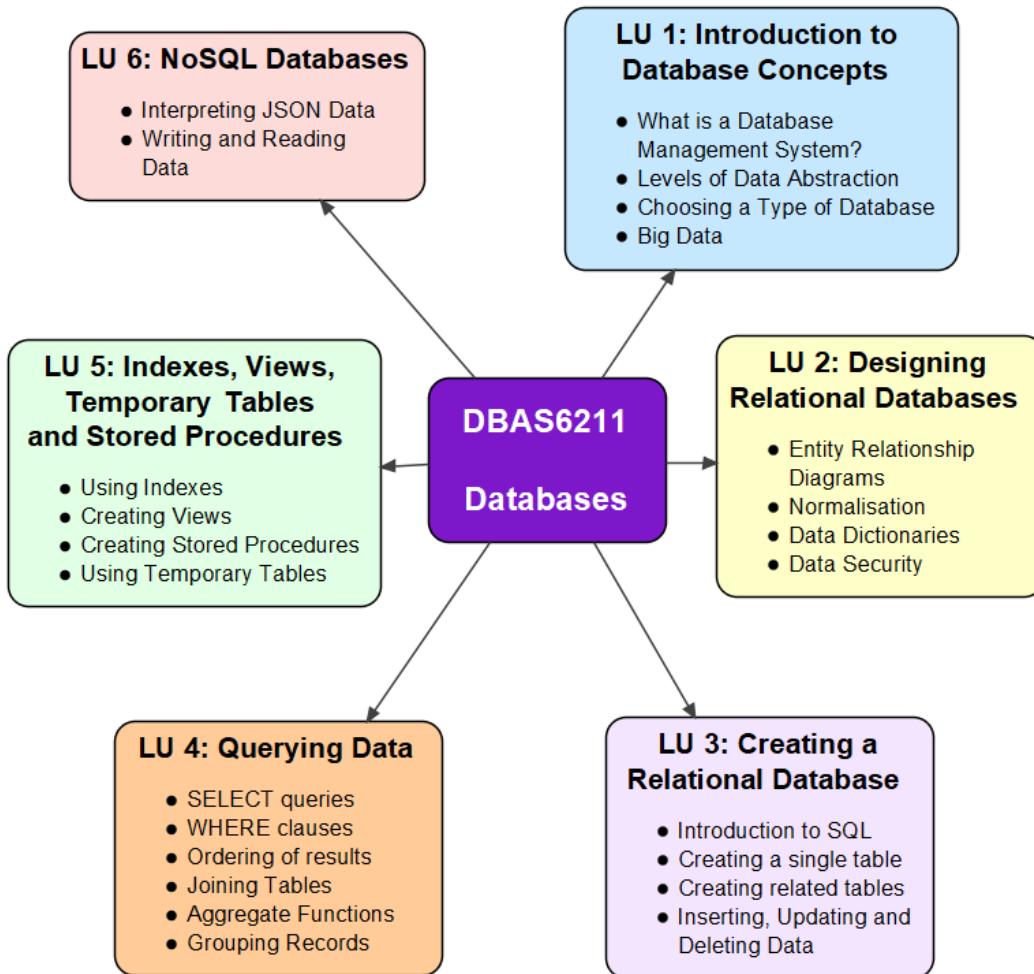


Figure 1. Module Outline

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.
- DBAS6211 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	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. 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.
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.
REMEMBER:	
<p>You need to log onto Learn to:</p> <ul style="list-style-type: none"> Access online resources such as articles, interactive graphics, explanations, video clips, etc. which will assist you in mastering the content; and View instructions and submit or post your contributions to individual or group activities which are managed and tracked on Learn. 	

Module Resources	
Prescribed Material (PM) for this Module	Databases Module Manual. 2023.
Recommended Readings, Digital, and Web Resources	<p>Watt, A. and N. Eng. 2014. <i>Database Design</i>. 2nd Edition. Victoria, B.C. Available at: https://open.bccampus.ca/browse-our-collection/find-open-textbooks/?uuid=5b6f010a-0563-44d4-94c5-67caa515d2c5 [Accessed 22 October 2020].</p> <p>Coronel, C., Morris, S., Crockett, K. and Rob, P. 2013. <i>Database Principles: Fundamentals of Design, Implementation and Management</i>. 2nd edition. Cengage Learning EMEA.</p> <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>
Software required	MySQL MongoDB Visual Studio 2022 8.0
Software Licence requirements	MySQL and MongoDB are Open Source Visual Studio 2022 has a free Community Edition
System Requirements	None
Lab minimum requirements	Standard lab computers
Lab configuration settings	See installation instructions for the required software.
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 provide students with the knowledge and applied skills necessary for the design, implementation and management of database systems.	
Module Outcomes	
MO1	Identify a relational database and a non-relational database to be applied to a specific business problem.
MO2	Design a relational database from a business problem through to Third Normal Form (3NF).
MO3	Implement a relational database design using a relevant relational database management system (RDBMS).
MO4	Demonstrate applied knowledge and understanding of various statements using the selected database technology to write database queries.
MO5	Implement a non-relational database using a relevant NoSQL database management system.

Assessments

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

Formatives	Assignment	Test
Weighting	30%	25%
Duration	Approximately 10 hours	1 hours
Learning Units covered	LU1 to 2 (Theme 1)	LU1 to 3
Period	1	4
Resources required	Additional research required	N/A
Open/Closed book	N/A	Open book

Summative	Examination
Weighting	35%
Duration	2 hours
Total marks	120
Open/Closed book	Open book
Resources required	None
Learning Units covered	All

Assessment Preparation Guidelines	
Format of the Assessment	Preparation Hints
Assignment	
The assignment will assess your ability to apply the content in Learning Unit 1 and 2 (up to Theme 1).	<ul style="list-style-type: none"> • Read through the prescribed chapters and content for Learning Units 1 and 2 (up to Theme 1). • Ensure your assignment is proofread and polished for style, language, and syntax. • Improve the quality of your assignment by using the provided rubric.
Test	
The test for this module will assess your understanding of Learning Units 1 to 3 of this module and will include a series of short and medium-length questions and one longer question. You will be expected to apply and recall information per your objectives for these learning units.	<ul style="list-style-type: none"> • This test will be an open book. • Ensure you work through all the relevant activities, exercises and revision questions on Learn in your Module Manual. • Brainstorm possible questions based on the learning outcomes and objectives provided. Then complete these as practise tests. • During both, your preparation for the test and during the test itself, pay attention to the instruction words (like list, apply, describe, etc.) and to the mark allocations of each question to ensure that you can provide the correct depth and detail in your answers. • Ensure you have mastered the objectives in Learning Units 1 to 3.

Examination	
The examination will assess all learning units in this module and include theory and application-type questions.	<ul style="list-style-type: none">● The examination will be an open book.● Make sure that you practise answering the sample questions in the brief to become familiar with the questions likely to appear in the examination itself.● Ensure you work through all the activities, exercises and revision questions on Learn in your Module Manual. You must have completed close readings of your prescribed material to ensure that you have prepared adequately for your examination for this module.● Pay close attention to the instruction words (like list, apply, describe, analyse, etc.) and to the mark allocations of each question to ensure that you provide the correct depth and detail in your answers.● Make sure that you are comfortable in responding to all the objectives for all learning units.● Brainstorm possible questions based on the learning outcomes and objectives provided.

Module Pacer						
Code	Programme	Contact Sessions	Credits			
DBAS6211	BCA2	48 contact	15			
	BCIS2					
	BIB2					
	BCI2					
	BIS2					
DBAS6211d	BIB2d	36 contact + 12 Learn				
Learning Unit 1	Introduction to Database Concepts					
Overview:						
<p>In this learning unit we will explore the different technological options for managing data. We will see how a database management system can be classified and which types of databases are currently used for storing and managing data in enterprises. We will also explore the concept of Big Data.</p> <p>Please work through Themes 1 and 2 on Learn, together with the relevant sections of your prescribed source/s.</p>						

Learning Unit 1: Theme Breakdown		
DBAS6211 Sessions 1–4	Theme 1: Introduction to Databases	Prescribed Material (PM)
DBAS6211d Sessions 1–2	LO1: Explain what a database management system is. LO2: Identify the different ways of categorising database management systems. LO3: Identify the levels of data abstraction.	PM: Learning Unit 1
Related Outcomes: MO1	Theme 2: Types of Databases LO4: Identify the different types of databases. LO5: Choose the appropriate type of database to use for a business problem. LO6: Explain the concept of Big Data.	

Learning Unit 2	Designing Relational Databases
Overview:	
<p>In this learning unit we will design a relational database from business rules through to creating a data dictionary. We will learn how to draw entity relationship diagrams (ERDs) using Unified Modelling Language (UML) and how to normalise to third normal form.</p> <p>Please work through Themes 1, 2, 3 and 4 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>The challenge you may experience in this learning unit relates to finding information about modelling database using Unified Modelling Language.</p>	

Learning Unit 2: Theme Breakdown		
DBAS6211 Sessions 5–18	Theme 1: Entity Relationship Diagrams	Prescribed Material (PM)
DBAS6211d Sessions 3–14	LO1: Interpret an entity relationship diagram. LO2: Create entity relationship diagrams using Unified Modelling Language notation. LO3: Review and revise an entity relationship diagram. LO4: Distinguish between primary and foreign keys.	PM: Learning Unit 2
Related Outcomes: MO2	Theme 2: Normalisation LO5: Identify the benefits of normalisation. LO6: Normalise data to first normal form. LO7: Normalise data to second normal form. LO8: Normalise data to third normal form. Theme 3: Data Dictionaries LO9: Explain what a data dictionary is. LO10: Create a data dictionary. Theme 4: Data Security LO11: Identify data that requires additional security.	

Learning Unit 3	Creating a Relational Database
Overview:	
<p>In this learning unit, we will learn how to create a database with tables using Structured Query Language (SQL). We will also see how to insert data into those tables, how to update data and how to delete data.</p> <p>Please work through Themes 1, 2, 3 and 4 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>The challenge you may experience in this learning unit relates to finding information that is specifically about the MySQL dialect of SQL.</p>	

Learning Unit 3: Theme Breakdown		
DBAS6211 Sessions 19–24	Theme 1: Introduction to SQL	Prescribed Material (PM)
DBAS6211d Sessions 15–18	LO1: Explain the difference between SQL and programming languages.	PM: Learning Unit 3
Related Outcomes: MO3 MO4	Theme 2: Creating a Single Table LO2: Create schemas. LO3: Create tables. Theme 3: Creating Related Tables LO4: Create tables with constraints. Theme 4: Inserting, Updating and Deleting Data LO5: Use SQL to insert data into a database. LO6: Use SQL to update data. LO7: Use SQL to delete data. LO8: Explain the purpose of transactions.	

Learning Unit 4	Querying Data
Overview:	
<p>In this learning unit we will learn how to access data that is stored in a relational database using Structured Query Language (SQL). We will look at getting results that are just rows in the tables, and how to get calculated results that combine multiple rows into fewer aggregate rows. We will also see how to join related tables to get data from multiple tables in the same result set.</p> <p>Please work through Themes 1, 2, 3 and 4 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>The challenge you may experience in this learning unit relates to finding information that is specifically about the MySQL dialect of SQL.</p>	

Learning Unit 4: Theme Breakdown		
DBAS6211 Sessions 25-32	Theme 1: Basic Queries	Prescribed Material (PM)
DBAS6211d Sessions 19-24	LO1: Create queries to retrieve data from a database. LO2: Explain how to order the results returned by a query.	PM: Learning Unit 4
Related Outcomes: MO3 MO4	Theme 2: Joining Tables LO3: Create queries that retrieve data from multiple tables. Theme 3: Aggregate Functions LO4: Create queries that calculate aggregate values. Theme 4: Grouping Records LO5: Use grouping to calculate aggregate values on groups of records.	

Learning Unit 5	Indexes, Views, Temporary Tables and Stored Procedures
Overview:	
<p>In this learning unit we will learn how to use indexes to improve performance. We will create views to easily access data. And we will create stored procedures that can be reused. Finally, we will look at how temporary tables can be used.</p> <p>Please work through Themes 1, 2, 3 and 4 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>The challenge you may experience in this learning unit relates to finding information that is specifically about the MySQL dialect of SQL.</p>	

Learning Unit 5: Theme Breakdown		
DBAS6211 Sessions 33–40	Theme 1: Indexes	Prescribed Material (PM)
DBAS6211d Sessions 25–30	LO1: Explain the purpose of an index. LO2: Create an index using SQL.	PM: Learning Unit 5
Related Outcomes: MO3 MO4	Theme 2: Views LO3: Explain the purpose of a view. LO4: Create a view using SQL. Theme 3: Stored Procedures LO5: Explain the purpose of a stored procedure. LO6: Create a stored procedure using SQL. Theme 4: Temporary Tables LO7: Explain the purpose of a temporary table. LO8: Identify the types of temporary tables. LO9: Use temporary tables in queries.	

Learning Unit 6	NoSQL Databases
Overview:	
<p>In this learning unit we will make use of a NoSQL database to write and read data. And then we will make use of a NoSQL database to write and read data.</p> <p>Please work through Themes 1 and 2 on Learn, together with the relevant sections of your prescribed source/s.</p> <p>The challenge you may experience in this learning unit relates to understanding how a NoSQL database stores data.</p>	

Learning Unit 6: Theme Breakdown		
DBAS6211 Sessions 41–48	Theme 1: JSON Documents	Prescribed Material (PM)
DBAS6211d Sessions 31 - 36	LO1: Interpret JSON data. LO2: Explain the benefits of using JSON.	PM: Learning Unit 6
Related Outcomes: MO5	Theme 2: Writing and Reading Data LO3: Explain how to use MongoDB. LO4: Write data to a NoSQL database. LO5: Read data from a NoSQL database.	

Glossary of Key Terms for this Module

Term	Definition	My Notes
Big Data	“High-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation.” (Gartner, Inc., n.d.)	
Business Rule	“A brief, precise and unambiguous description of a policy, procedure or principle within a specific organisation.” (Coronel, et al., 2013)	
Cardinality	“The maximum number of times an instance in one entity can relate to instances of another entity.” (Lucid Software Inc., 2020)	
Data Abstraction	“The reduction of a particular body of data to a simplified representation of the whole.” (Rouse, 2014)	
Database	“An organized collection of structured information, or data, typically stored electronically in a computer system.” (Oracle, 2020)	
Data Dictionary	“A centralized repository that provides information about specific data such as meaning, relationships to other data, origin, usage, and format. A data dictionary stores metadata that defines and describes data so that it can be easily understood by anyone who would like to use it or analyze it at a later date.” (National Institutes of Health, n.d.)	
Data Lake	“Centralized repository that allows you to store all your structured and unstructured data at any scale.” (Amazon Web Services, Inc., 2020)	
Declarative Languages	“Also called nonprocedural or very high level, are programming languages in which (ideally) a program specifies what is to be done rather than how to do it.” (Encyclopædia Britannica, Inc., 2020)	
Entity	“A real-world object such as an employee or a project.” (Watt & Eng, 2014)	

Entity Integrity	<p>"Entity Integrity ensures that there are no duplicate records within the table and that the field that identifies each record within the table is unique and never null.</p> <p>"The existence of the Primary Key is the core of the entity integrity. If you define a primary key for each entity, they follow the entity integrity rule."</p> <p>(databasedev.co.uk, 2015)</p>	
Entity Relationship Diagram	<p>"A graphical representation of an organization's data storage requirements. Entity relationship diagrams are abstractions of the real world which simplify the problem to be solved while retaining its essential features." (Kirs, 2003)</p>	
Foreign Key	<p>"An attribute in a table that references the primary key in another table OR it can be null. Both foreign and primary keys must be of the same data type." (Watt & Eng, 2014)</p>	
Functional Dependency	<p>"A relationship between two attributes, typically between the PK and other non-key attributes within a table." (Watt & Eng, 2014)</p>	
Index	<p>"An on-disk structure associated with a table or view that speeds retrieval of rows from the table or view. An index contains keys built from one or more columns in the table or view." (Guyer, et al., 2019)</p>	
JavaScript Object Notation (JSON)	<p>"A lightweight data-interchange format. It is easy for humans to read and write. It is easy for machines to parse and generate." (json.org, n.d.)</p>	
Normalisation	<p>"The process of determining how much redundancy exists in a table." (Watt & Eng, 2014)</p>	
No-SQL Databases	<p>"High-performance, non-relational data stores. They excel in their ease-of-use, scalability, resilience, and availability characteristics. Instead of joining tables of normalized data, NoSQL stores unstructured or semi-structured data, often in key-value pairs or JSON documents." (Vettor, et al., 2020)</p>	

Primary Key	"The column (field) in a relational database that uniquely identifies the row in the table. For example, account number is often a primary key. A 'composite primary key' or 'super key' is made up of two or more columns such as account number + name." (PCMag Digital Group, 2020)	
Referential Integrity	"Referential integrity requires that a foreign key must have a matching primary key or it must be null. This constraint is specified between two tables (parent and child); it maintains the correspondence between rows in these tables. It means the reference from a row in one table to another table must be valid." (Watt & Eng, 2014)	
Relationship	"An association among entities; for example, an employee works on many projects. A relationship exists between the employee and each project." (Watt & Eng, 2014)	
Transaction	"MySQL transaction allows you to execute a set of MySQL operations to ensure that the database never contains the result of partial operations." (mysqltutorial.org, n.d.)	
View	"A virtual table whose contents (columns and rows) are defined by a query." (Milener, et al., 2020)	