



MONASH
University

MONASH
INFORMATION
TECHNOLOGY

Topic 1 - Introduction

FIT9132 Databases
2025 S1



Acknowledgement of Country

I wish to acknowledge the people of the Kulin Nations, the traditional owners of the land on which we are gathered today. I pay my respects to their Elders, past and present.

Your FIT9132 2025 S1 Lead Staff

Chief Examiner



Dwi Rahayu

Workshop Leaders



Lindsay Smith



Minh Le



Isma Siddiqui

Meet your study colleagues

Introduce yourself to your fellow students on the table



Image created by Microsoft Copilot

Using Poll Everywhere



- Visit the URL provided by your workshop leader
- Log in using your Monash login details if needed
- Answer questions when they pop up

Optional Poll: Select your home country on the map shown by Poll Everywhere



<https://worldmapwithcountries.net/>

Q1. $1 + 1 = ?$

Hint: There are 10 types of people in this world. Those who understand binary and those who don't.

- A. 2
- B. 10
- C. 11
- D. Not sure

Q2. What is the email address to use for admin enquiries for this unit?

- A. dwi.rahayu@monash.edu
- B. databases.allcampuses-x@monash.edu
- C. lindsay.smith@monash.edu
- D. fit9132.allcampuses-x@monash.edu

Unit Overview

- Unit purpose/background
 - An introduction to databases, mostly RELATIONAL databases (RDBMS)
 - NO expected background in databases
- Student time commitment
 - Monash University 6 credit point unit = 12 hours of work per week
 - Schedule
 - 2 hrs workshop
 - 2 hrs applied session
 - 8 hrs of your own assigned time (pre workshop activities, completing applied session activities, assignments etc)

Unit Communications

- **Main channel**
 - ed discussion forum messages, need to keep up to date
 - Public
 - Private
- **Email Contact - admin matters ONLY**
 - Admin matters (absences, class issue etc) email the FIT9132 role account:
fit9132.allcampuses-x@monash.edu
 - **Note** the FIT9132 Email requirements:

"When you contact staff via email, please ensure you clearly include your full name, unit code, campus (MUM/Clayton) and applied session number as part of every email you send. This will ensure we can respond as quickly and accurately as possible."

 - You must email from your Monash University email account
 - *email which does not comply with the above will **not be responded to***
- **Please DO NOT email staff members directly via their @monash.edu address**

Study Program

Focus	Week/Topic	Study Area	Assessment Due
DB Design	1	Introduction to Database	
	2	Database Design I: Conceptual Modelling	
	3	Relational Model	
	4	Normalisation	
	5	Database Design II: Logical level modelling	
SQL	6	Creating and Altering the Database Structure	Class Test 1 - in person During Workshop (10%)
	7	DML and Transaction Management	
	8	SQL Part I - SQL Basic	A1 Database Design - individual Wednesday 30th April 4:30 PM (40%)
	9	SQL Part II - SQL Intermediate	
	10	SQL Part III - SQL Advanced and Query Optimisation	
	11	Non Relational Databases - Big Data and NoSQL	
	12	Business Intelligence, Data Warehousing and Legal/Ethical issues with Database Use	Class Test 2 - in person During workshop (10%)
		Final Assessment week	A2 - Creating, Populating and Manipulating Databases - individual Monday 9th June 4:30 PM (40%)

**Assessment
In Semester Only**

Total 100 marks
100% of grade

NO examination

NO hurdle

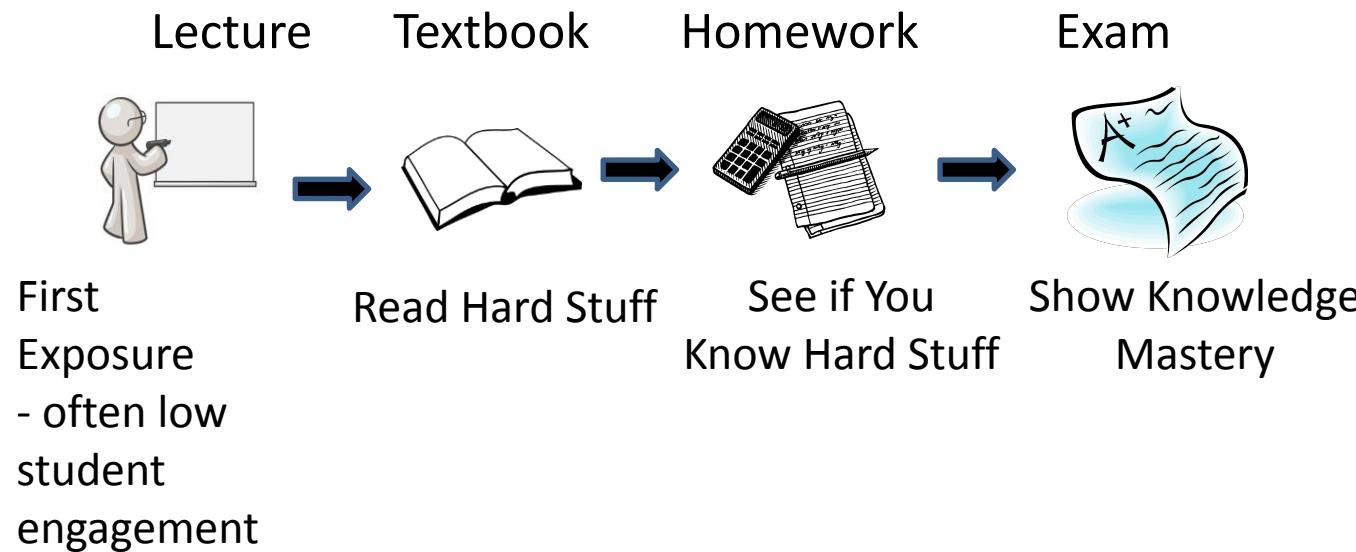
**Requirement to maintain history of ALL work in GitLab
Must use provided repo folder/s for Assignment work**

Monash University Grading Scheme

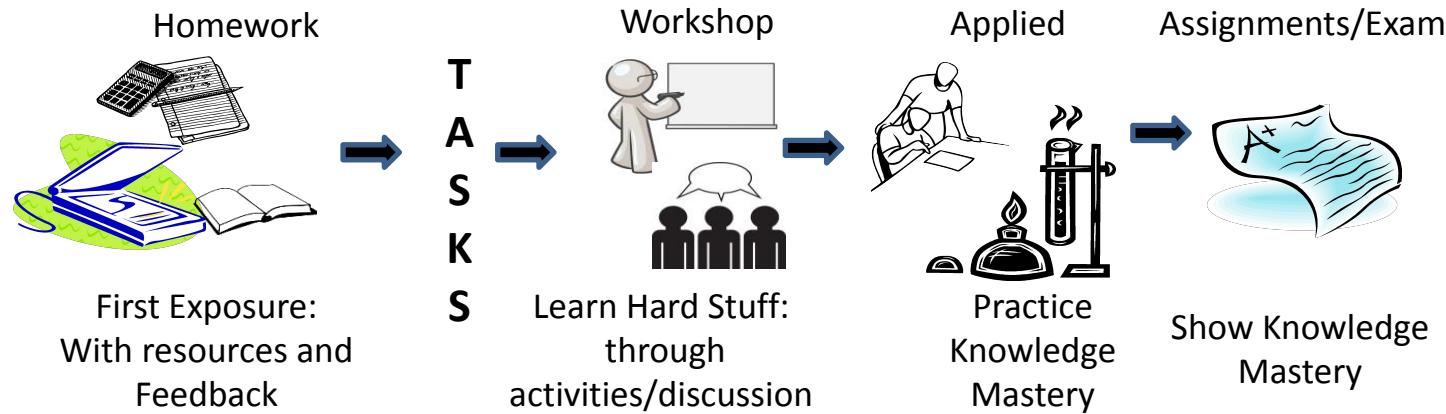
*Overall student
average result*

High Distinction (HD) 80-100	Distinction (D) 70-79	Credit (C) 60-69	Pass (P) 50-59	Fail (N) 0-49
Demonstration of extended knowledge, skills and attributes at an exceptional level*, showing fluency, originality and integration of concepts.	Demonstration of extended knowledge, skills and attributes at a superior level*, showing fluency and emerging originality and integration of concepts.	Demonstration of fundamental knowledge, skills and attributes at a proficient level*, showing fluency in concepts.	Demonstration of fundamental knowledge, skills and attributes at a satisfactory level*.	Lack of satisfactory demonstration of fundamental knowledge, skills and expected attributes*.

Traditional Teaching Method



Flipped Classroom – Full Picture



Flipped Classroom – Scenario

- Process starts with assigned readings followed by review activities to test understanding and provide feedback (***complete before workshop***)
- Workshop then poses questions as part of the lesson flow
 - provides an opportunity to engage with the content and seek *clarification*
 - be part of a wider discussion with your peers on the material
 - will include polls/questions/group activities to gauge understanding
 - completing the in-workshop activities are a key part of your learning
- Apply knowledge in ***following*** Applied Session and complete Applied Session tasks
 - feedback provided on attempt via sample solutions

Why Flipped Learning?



- **Engage students to take ownership of their learning**
- Build and test one's understanding in a supportive environment.
- Develop critical thinking, communication and reflection skills.

Attendance and Weekly Git Push is Critical

An overview of DataBase Management Systems (DBMS)



You are in 1960s, you have a task to create a system to record information on Monash students (ie. student, unit and enrolment details).

- **What kind of approaches would you propose?**
- **What kinds of problems are involved?**

Pre-Database Systems

- Manual System
 - recording data on paper/cards stored (filed) in folders/cabinets
 - management (insert/update and delete of data) and reporting are slow and cumbersome
- File Processing Systems
 - recording of data in computer based files

Figure 1.7 Contents of the Customer File

Database name: Ch01_Text							
C_NAME	C_PHONE	C_ADDRESS	C_ZIP	A_NAME	A_PHONE	TP	AMT
Alfred A. Rames	615-844-2573	218 Fork Rd., Babs, TN	36123	Leah F. Hahn	615-882-1244	T1	100.00
Leona K. Dunne	713-894-1238	Box 12A, Fox, KY	25246	Alex B. Alby	713-228-1249	T1	250.00
Kathy W. Smith	615-894-2285	125 Oak Ln., Babs, TN	36123	Leah F. Hahn	615-882-2144	S2	150.00
Paul F. Olowksi	615-894-2180	217 Lee Ln., Babs, TN	36123	Leah F. Hahn	615-882-1244	S1	300.00
Myron Orlando	615-222-1672	Box 111, Newv, TN	36155	Alex B. Alby	713-228-1249	T1	100.00
Amy B. O'Brian	713-442-3381	387 Troll Dr., Fox, KY	25246	John T. Okon	615-123-5589	T2	850.00
James G. Brown	615-297-1228	21 Tie Rd., Nash, TN	37118	Leah F. Hahn	615-882-1244	S1	120.00
George Williams	615-280-2556	155 Maple, Nash, TN	37119	John T. Okon	615-123-5589	S1	250.00
Anne G. Farris	713-382-7185	2119 Elm, Crew, KY	25432	Alex B. Alby	713-228-1249	T2	100.00
Olette K. Smith	615-297-3809	2782 Main, Nash, TN	37118	John T. Okon	615-123-5589	S2	500.00
C_NAME = Customer name		A_NAME = Agent name					
C_PHONE = Customer phone		A_PHONE = Agent phone					
C_ADDRESS = Customer address		TP = Insurance type					
C_ZIP = Customer zip code		AMT = Insurance policy amount, in thousands of \$					
CEN = Insurance renewal date		REN = Insurance renewal date					

Figure 1.8 Contents of the Agent File

A_NAME	A_PHONE	A_ADDRESS	ZIP	HIRED	YTD_PAY	YTD_FIT	YTD_FICA	YTD_SLS	DEP
Alex B. Alby	713-228-1249	123 Toll, Nash, TN	37119	01-Nov-2004	26566.24	6641.56	2125.30	132737.75	3
Leah F. Hahn	615-882-1244	334 Main, Fox, KY	25246	23-May-1990	32213.78	8053.44	2577.10	138967.35	0
John T. Okon	615-123-5589	452 Elm, Newv, TN	36155	15-Jun-2009	23198.29	5799.57	1855.86	127093.45	2

A_NAME = Agent name

YTD_PAY = Year-to-date pay

A_PHONE = Agent phone

YTD_FIT = Year-to-date federal income tax paid

A_ADDRESS = Agent address

YTD_FICA = Year-to-date Social Security taxes paid

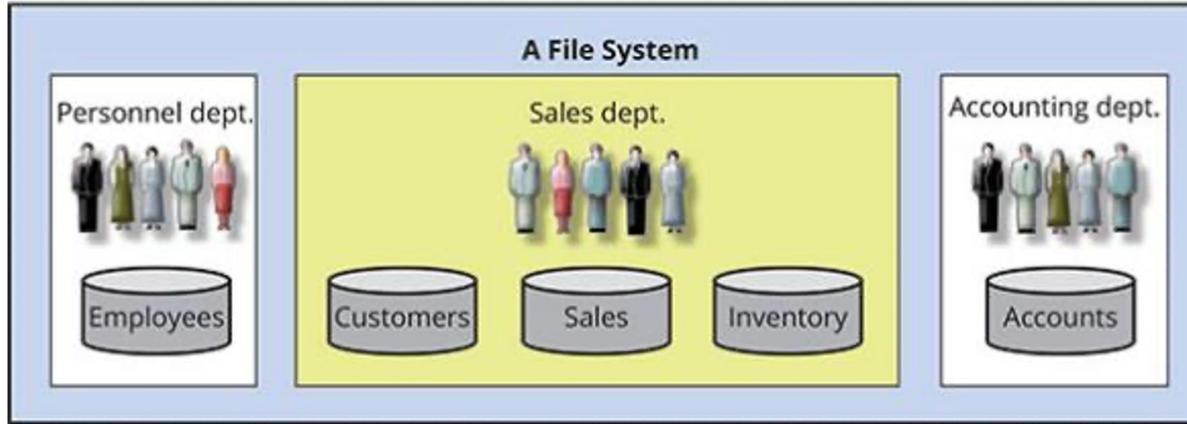
ZIP = Agent zip code

YTD_SLS = Year-to-date sales

HIRED = Agent date of hire

DEP = Number of dependents

Problems with file processing systems



- Data duplication, leads to inconsistent data
- Program and data dependence
- Lack of security and limited data sharing (islands of information)
- Lengthy development times, difficulty of getting quick answers
 - Extensive programming needed

What is a database?

database

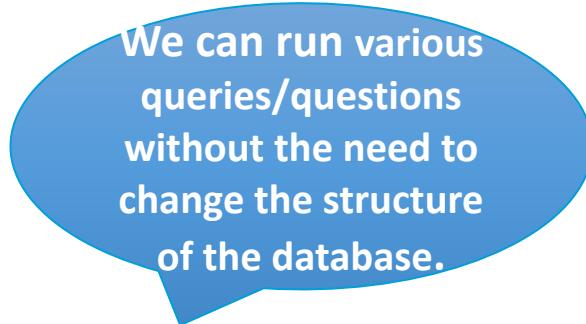
/'dætəbeɪs/ 

noun

plural noun: **databases**



How do we
structure our data?



We can run various
queries/questions
without the need to
change the structure
of the database.

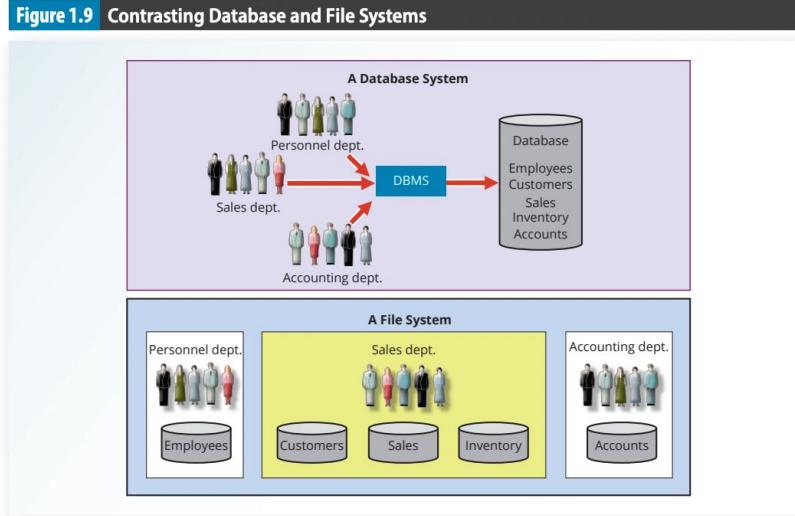
a structured set of data held in a computer, especially one that is accessible in various ways.

"a database covering nine million workers"

A database

- Logically related data stored in a single logical data repository (the Database)
 - the repository may be stored on one local computer, distributed or in the cloud
 - stores data structures, relationships between structures, and access paths
 - defines, stores, and manages all access paths and components

Figure 1.9 Contrasting Database and File Systems



Database Visualisations



Search by Country, Territory, or Area

Covid-19 Response Fund

Donate

WHO Coronavirus (COVID-19) Dashboard

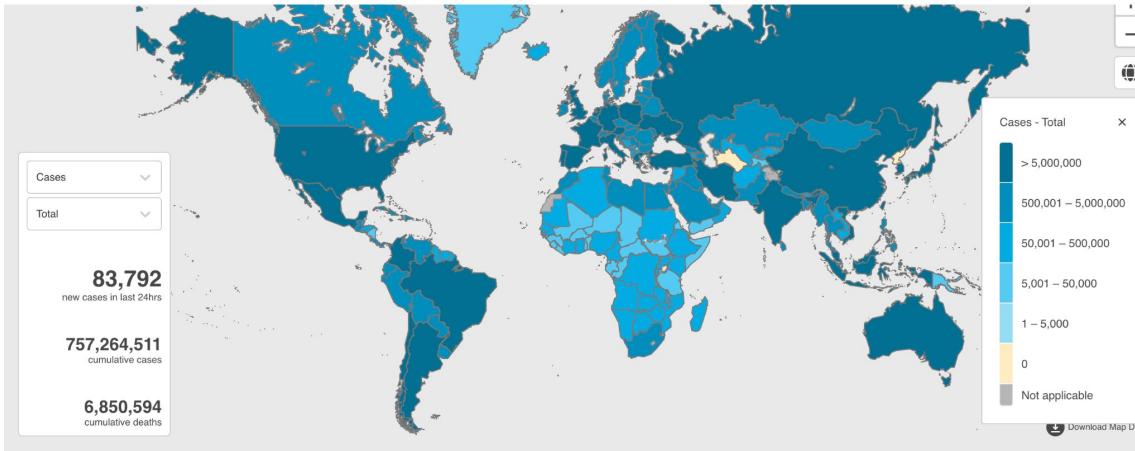
Overview

Measures

Table View

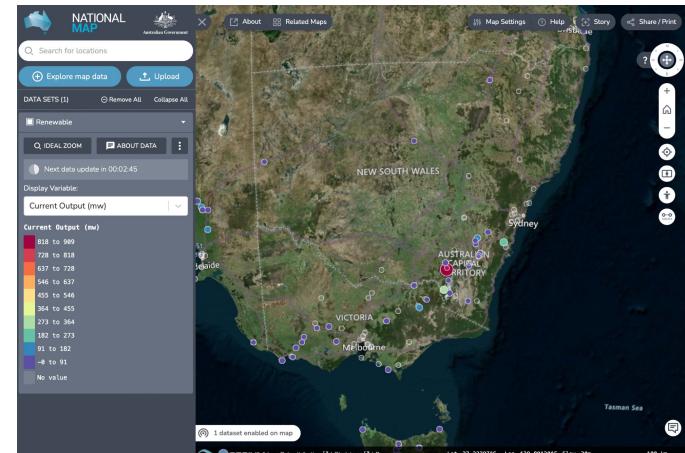
Data

More Resources



Globally, as of 4:24pm CET, 21 February 2023, there have been **757,264,511 confirmed cases** of COVID-19, including **6,850,594 deaths**, reported to WHO. As of 22 February 2023, a total of **13,223,135,400 vaccine doses** have been administered.

<https://covid19.who.int/>



<https://nationalmap.gov.au/>

<https://nationalmap.gov.au/#share=s-hjPYKUqB8c51yKYcCjLvb3OUSuR>

Q3. Which of the following is not a database type:

- A. Hierarchical
- B. Network
- C. Oracle
- D. Relational
- E. No SQL

Types of database

- Hierarchical
- Network
- Relational *
- Object Oriented/ Object Relational
- XML/Hybrid
- No SQL

* Unit focus

Table 2.1 Evolution of Major Data Models

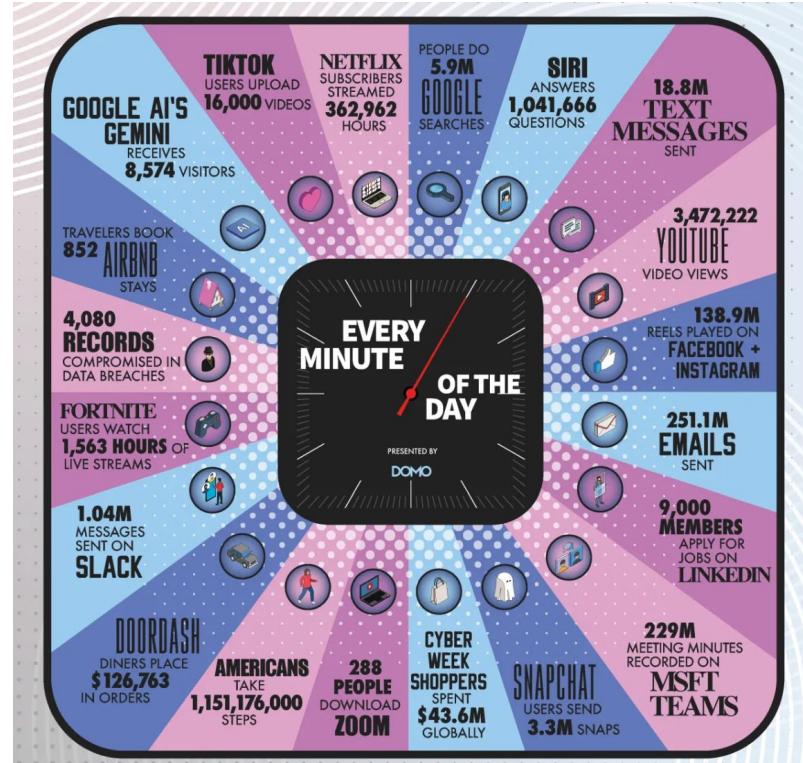
Generation	Time	Data Model	Examples	Comments
First	1960s–1970s	File system	VMS/VSAM	Used mainly on IBM mainframe systems Managed records, not relationships
Second	1970s	Hierarchical and network	IMS, ADABAS, IDS-II	Early database systems Navigational access
Third	Mid-1970s	Relational	DB2 Oracle MS SQL Server MySQL	Conceptual simplicity Entity relationship (ER) modeling and support for relational data modeling
Fourth	Mid-1980s	Object-oriented Object/relational (O/R)	Versant Objectivity/DB DB2 UDB Oracle	Object/relational supports object data types Star Schema support for data warehousing Web databases become common
Fifth	Mid-1990s	XML Hybrid DBMS	dbXML Tamino DB2 UDB Oracle MS SQL Server PostgreSQL	Unstructured data support O/R model supports XML documents Hybrid DBMS adds object front end to relational databases Support large databases (terabyte size)
Emerging Models: NoSQL	Early 2000s to present	Key-value store Column store	SimpleDB (Amazon) BigTable (Google) Cassandra (Apache) MongoDB Riak	Distributed, highly scalable High performance, fault tolerant Very large storage (petabytes) Suited for sparse data Proprietary application programming interface (API)

Q4. Which database management systems (DBMS) are you most familiar with?:

- A. Oracle
- B. MySQL
- C. MS Access
- D. SQL Server
- E. Others
- F. I am not familiar with any of these database systems

Data Management Today

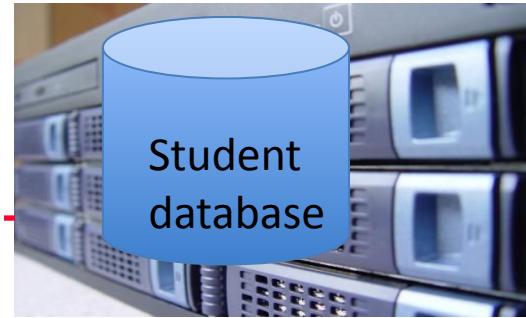
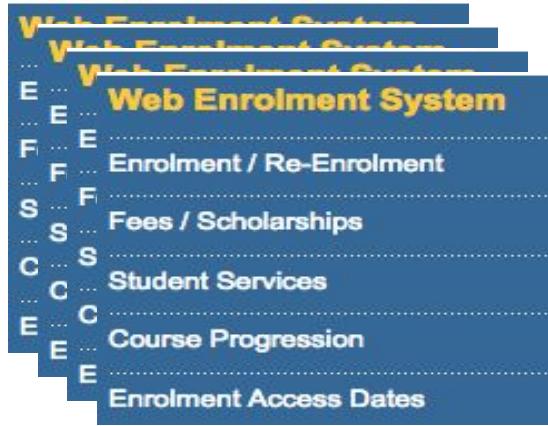
- Relational databases are still very popular. But ...
 - Social Networks (Facebook, Twitter, Foursquare etc.)
 - Multimedia data (YouTube, Pinterest, Facebook etc.)
 - Data streams (Twitter, computer networks)
 - Spatial data (Road networks, Google Earth, Space etc.)
 - Web data
 - Big Data



[Data Never Sleeps 12.0 Domo - Year 2024](#)

RANK	DBMS	TYPE	INTRODUCED
1	 ORACLE®	Commercial, Relational DBMS	1979
2	 MySQL™	Open source, Relational DBMS	1995
3	 Microsoft® SQL Server®	Commercial, Relational DBMS	1989
4	 PostgreSQL	Open source, Relational DBMS	1996
5	 mongoDB	Open Source, NoSQL - Document Store	2009
6	 snowflake®	Commercial, Relational DBMS	2014

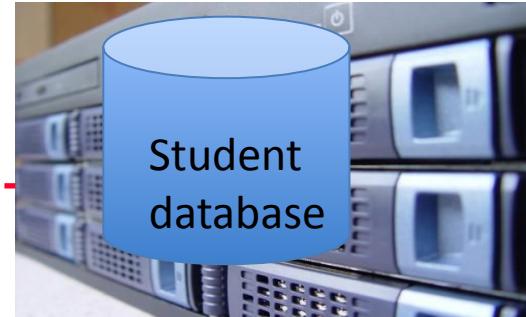
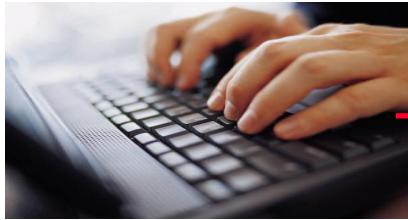
Relational database systems in action: End-users' view



Student Database is implemented in an Oracle DBMS (server)

Database Systems in Action

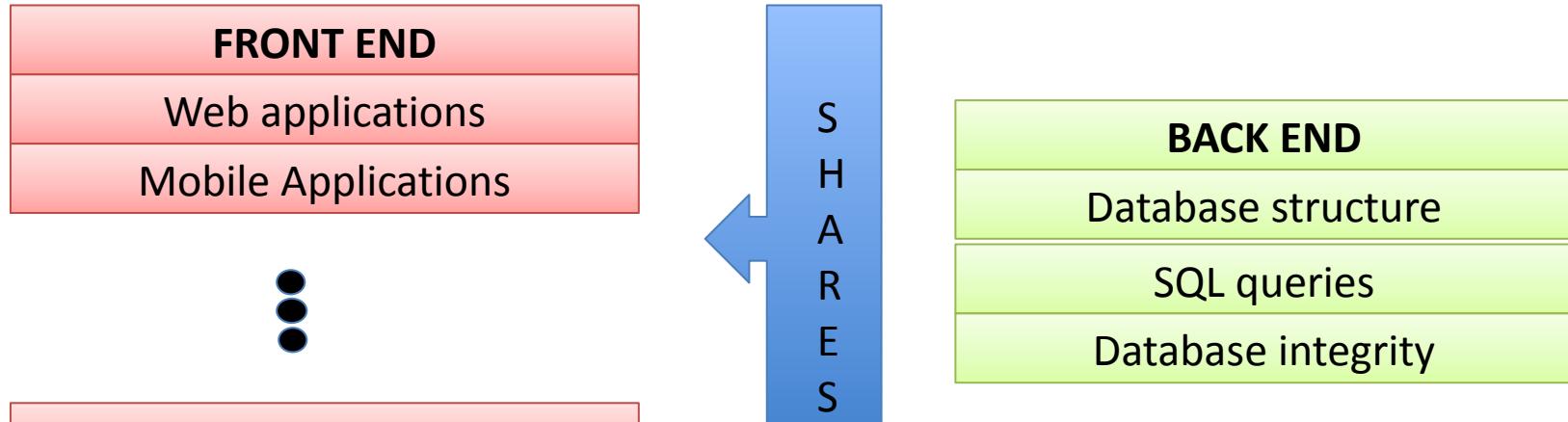
Developers' View



Development environment (client, eg
Visual Studio Code, Integrated
Development Environment for web
scripting)

Student Database
(server)

Developing Application with Database



In this unit, we will concentrate on building the back end.

Database Careers

Table 1.3 Database Career Opportunities

Job title	Description	Sample Skills Required
Database Developer	Create and maintain database-based applications	Programming, database fundamentals, SQL
Database Designer	Design and maintain databases	Systems design, database design, SQL
Database Administrator	Manage and maintain DBMS and databases	Database fundamentals, SQL, vendor courses
Database Analyst	Develop databases for decision support reporting	SQL, query optimization, data warehouses
Database Architect	Design and implementation of database environments (conceptual, logical, and physical)	DBMS fundamentals, data modeling, SQL, hardware knowledge, etc.
Database Consultant	Help companies leverage database technologies to improve business processes and achieve specific goals	Database fundamentals, data modeling, database design, SQL, DBMS, hardware, vendor-specific technologies, etc.
Database Security Officer	Implement security policies for data administration	DBMS fundamentals, database administration, SQL, data security technologies, etc.
Cloud Computing Data Architect	Design and implement the infrastructure for next-generation cloud database systems	Internet technologies, cloud storage technologies, data security, performance tuning, large databases, etc.
Data Scientist	Analyze large amounts of varied data to generate insights, relationships, and predictable behaviors	Data analysis, statistics, advanced mathematics, SQL, programming, data mining, machine learning, data visualization

Database Careers

Learn About 14 Careers in Database Technology

The screenshot shows the SEEK website interface. At the top, there are navigation links for 'Jobs' (which is underlined), 'Courses', 'Businesses for sale', and 'Volunteering'. On the right, there are links for 'AU' and 'NZ'. The 'seek' logo is in the top left. In the center, there are links for 'Sign in or Register' and 'Employer site'. Below the header, there are four main menu items: 'Job Search', 'Profile', 'Career Advice', and 'Company Reviews'. The 'Job Search' section has a search bar with 'database' typed in, a clear button, and dropdown menus for 'Any Classification' and 'Enter suburb, city, or region'. A large pink 'SEEK' button is prominent. Below this, there are filters for 'All work types', 'paying \$0', 'to \$200k+', and 'listed any time'. At the bottom of the search area, it says '9,257 jobs found' and 'Sorted by relevance'. The overall background is white with blue and grey accents.

<https://www.seek.com.au/database-jobs>



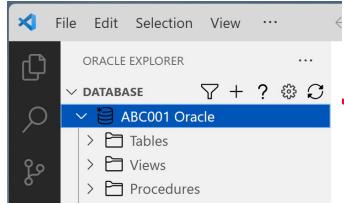
<https://www.careergirls.org/career/database-administrator/>

Q5. What is the Operating System on your main computer?

- A. Windows 10
- B. Windows 11
- C. Mac OS
- D. Other

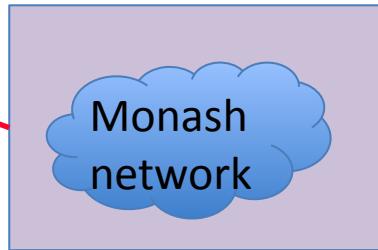
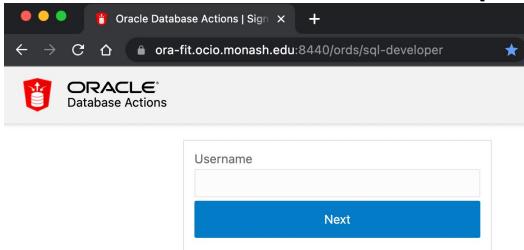
Our Database Systems Environment as covered in Applied Sessions

Local install of Visual Studio Code
using the Oracle Explorer and Monash
Virtual Private Network (VPN)

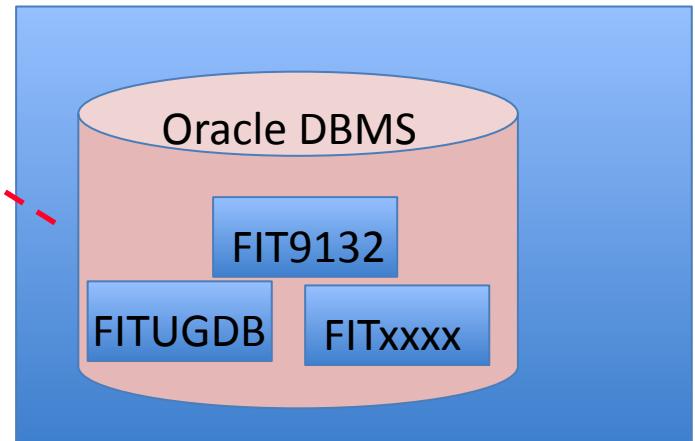


OR

Oracle REST Data Services (ORDS) and
Monash Virtual Private Network (VPN)



ora-fit.ocio.monash.edu



<https://ora-fit.ocio.monash.edu:8440/ords/sql-developer>

Problems with installing during week 1



Special Software Help Desk sessions will run this week

Collecting data about people



Sensitive and protected attributes

- Personal information is considered “sensitive”
- Collection of personal information is protected under privacy and discrimination laws
- “Protected attributes” include age, disability, race, sex, intersex status, gender identity and sexual orientation
- Most countries have laws/ Acts protecting people’s privacy and ensuring anti-discrimination



Print

Rights and protections

Australia's Open Government Partnership

In Australia, it is unlawful to discriminate on the basis of a number of protected attributes including age, disability, race, sex, intersex status, gender identity and sexual orientation in certain areas of public life, including education and employment. Australia's federal anti-discrimination laws are contained in the following legislation:



For Individuals

For organisations

For public sector

About us

Education

Legal and policy

Dispute resolution

Quick exit

Privacy

Freedom of information

Information policy

Consumer D

Home / Legal and policy / Victoria's human rights laws /

Equal Opportunity Act

The Equal Opportunity Act 2010 aims to make public life free from discrimination, sexual harassment and victimisation. The law provides avenues for people to resolve complaints, and outlines the Commission's role in helping government, business and the community to identify and eliminate discrimination, sexual harassment and victimisation.

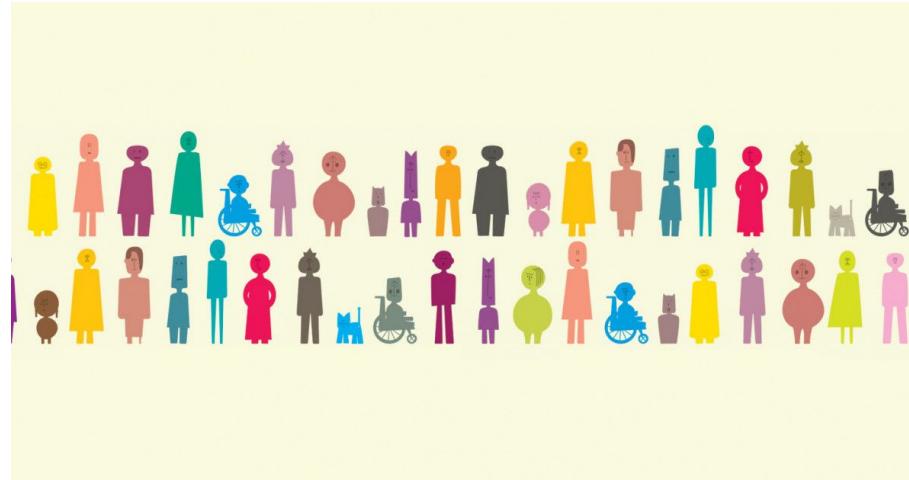
The Privacy Act

What is discrimination?

Discrimination is unfavourable treatment or an unreasonable demand
– whether direct or indirect – because of a personal characteristic protected by law. Even assuming that the person might have this characteristic, or may have it in the future, can count as discrimination. Either way, it's against the law.

Personal characteristics protected by law in Australia include:

- race, colour and national or social origin
- sex, gender identity or sexual orientation
- age
- physical, intellectual, mental or psychiatric disability
- pregnancy or potential pregnancy
- marital status, relationship status and family or carer's responsibilities
- religion
- political opinion
- trade union activity



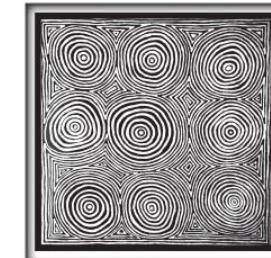
<https://www.monash.edu/students/support/safety-and-security/concerning-behaviour/discrimination>

Collecting data about race, ethnicity and culture

- Language spoken at home
 - e.g. Mandarin, Spanish, Vietnamese, English, Bahasa Malay
- Country of Origin
 - e.g. Malaysia, China, Australia, Colombia
- Race (physical differences that groups and cultures consider socially significant)
 - e.g. biracial, interracial, Black, Caucasian, person of colour, Asian, Polynesian
- Ethnicity (shared identity or similarity of a group) or cultural heritage
 - [https://www.abs.gov.au/statistics/classifications/australian-standard-classification-cultural-and-ethnic-groups-ascceg/latest-release\)](https://www.abs.gov.au/statistics/classifications/australian-standard-classification-cultural-and-ethnic-groups-ascceg/latest-release)
 - e.g. Maori, Indigenous Australian, Fijian, Malaysian
- Indigenous status
 - being of Aboriginal or Torres Strait Islander descent
 - identifying as an Aboriginal or Torres Strait Islander person
 - being accepted as such by the community in which you live, or formerly lived.



National best practice guidelines
for collecting Indigenous status
in health data sets



Cover artwork: Jackie Kurtjungintja Giles, *Tjumu Tjumu* 2009,
152 x 152cm acrylic on linen, Kayili Artists, © Jackie Kurtjungintja Giles
art.kayili.com.au

Data privacy and collection

- Data privacy refers to protecting people's privacy around the collection, use and disclosure of personal information.
- Governed by state and federal laws
- In Australia, an organisation may only collect your personal information that is reasonably necessary for their work.
- An organisation doesn't need your consent unless the information is sensitive.
 - Sensitive include racial or ethnic origin, political opinions or associations, religious or philosophical beliefs, trade union membership or associations, sexual orientation or practices, criminal record, health or genetic information
- When an organisation or agency collects your personal information they must take reasonable steps to tell you:
 - Their contact details
 - The fact and way they collected your personal information
 - If collection is required by law
 - The consequences if the organisation or agency doesn't collect your information
 - The organisation or agency's usual disclosures of the kind of personal information being collected
 - And more...



Some other considerations about data collection

- Gender bias
 - Job recruitment
 - Medical trials
 - Gender can sometimes be inferred from names and colour of skin
- Supporting inclusion
 - Gender identity
 - Facilities for people with pregnancy or disability
- Discrimination based on sexuality or pregnancy
 - People not asked to disclose unless necessary
- Addressing discrimination and enhancing equity for marginalised identities
 - Indigenous only opportunities
 - Women and non-binary only opportunities
 - Places for students from low socioeconomic backgrounds
- Racial bias
 - Job recruitment
 - Race can still be inferred from names and physical attributes

Collecting data about disability

- Different types of disability (defined by National Disability Services)
 - Intellectual (impairments in mental functions, learning difficulties, and difficulty performing daily live skills)
 - Physical (impact on physical activities, such as mobility)
 - Acquired brain injury
 - Neurological (e.g. epilepsy or Alzheimer's disease)
 - Deafblind (dual sensory impairment)
 - Vision (blindness and impairment)
 - Hearing (deafness and hearing impairment or loss)
 - Speech (loss, impairment or difficulty)
 - Psychiatric
 - Development delay (ages 0-5)
- Can include people who may not identify as having a disability (e.g broken limb or using crutches)
- Different definitions of disability
 - Self-identified
 - Impairment, long-term health condition or disability restricts everyday activities, for at least six months (disability or restrictive long-term health condition)
 - At least one condition restricts everyday activities, for at least 6 months (disability or restriction long-term health condition)

Australia's Disability Discrimination Act (1992)

disability, in relation to a person, means:

- (a) total or partial loss of the person's bodily or mental functions; or
- (b) total or partial loss of a part of the body; or
- (c) the presence in the body of organisms causing disease or illness; or
- (d) the presence in the body of organisms capable of causing disease or illness; or
- (e) the malfunction, malformation or disfigurement of a part of the person's body; or
- (f) a disorder or malfunction that results in the person learning differently from a person without the disorder or malfunction; or
- (g) a disorder, illness or disease that affects a person's thought processes, perception of reality, emotions or judgment or that results in disturbed behaviour;

and includes a disability that:

- (h) presently exists; or
- (i) previously existed but no longer exists; or
- (j) may exist in the future (including because of a genetic predisposition to that disability); or
- (k) is imputed to a person.

To avoid doubt, a *disability* that is otherwise covered by this definition includes behaviour that is a symptom or manifestation of the disability.



Ways and reasons to collect data about disability

Services for students with disabilities

ABOUT

AVAILABLE SERVICES

To access our services you must first register with Disability Support Services. This helps us assess which services you need to enable you to participate productively and independently in your studies.

Registration with Disability Support Services and discussions with advisers remain private. Information will not be released or shared without your permission.

Should I disclose my disability?

You're not obliged to disclose a disability or medical condition to the University. There are a number of considerations when deciding to disclose or not.

- If you do choose to disclose your disability and the impacts on your studies, we may be able to provide you with support.
- Even if you don't need support services, disclosing your disability when enrolling helps us develop accurate statistics about students with disabilities at Monash.

ABOUT

AVAILABLE SERVICES

The following services are offered by Disability Support Services. Please note that registering with us doesn't provide automatic access to all services.

Academic support workers

Accessible accommodation on campus

Alternative formatting

Alternative arrangements for final assessments

Assistive technology

Equipment

Graduate employment opportunities - GradWISE

Library services

Hearing augmentation

Resting rooms



Questions to ask when creating a database

- Am I following the law?
- Why do I need to collect information about this protected characteristic/ attribute?
- Could collecting information about this protected attribute lead to **discrimination**?
 - E.g. not offering someone a job because they are pregnant
- Could **not** collecting information about this protected attribute lead to discrimination?
 - E.g. Not identifying racial or gender biases in a medical trial that has different outcomes for different races/ sexes/ genders
- Are there extra protections or **privacy** restrictions that I need to place on collecting certain protected attributes?
 - E.g. disability
- Could collecting data about protected attributes help to create more **equitable outcomes** for a group of people who are experiencing discrimination
 - E.g. Indigenous employment, education and grant opportunities



Imagine you are designing a database for a gym. Which attributes should you collect about the gym's members when they join and why?

- A. Sex / Gender identity
- B. Language spoken at home
- C. Pregnancy
- D. Race / Ethnicity
- E. Indigenous status
- F. Disability
- G. Something else?

Q6. Do you think equity, diversity and inclusion (EDI) issues (e.g. how and when to collect sensitive information on people's gender, race, ethnicity, disability/ ability etc.) are relevant to the design of databases?

- A. Yes, in all circumstances
- B. Yes, but only in some circumstances
- C. No
- D. I'm not sure