

ACCA4023—Introduction to Web and Database Concepts



Learning Objectives

1. Introduction to Database
2. Database Management Systems
3. Data Modelling Basics
4. Introduction to Relational Databases
5. Applications

Learning Objectives

1. Introduction to Data, Database
2. Database Management Systems
3. Data Modelling Basics
4. Introduction to Relational Databases
5. Applications

Why Do We Need A Database?

Copy of Employee List.xlsx - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Developer

Clipboard Font Alignment Number Styles Cells Editing

A1 Employee List

	A	B	C	D	E	F	G	H	I	J	K
1	Employee List										
2											
3	First	Last	SSN	Date of Hire	Dept.	Store #	Hourly Rate	Hrs.	Gross Pay		
4	Theresa	Abel	168-91-3167	10/5/1999	Accounting	60613	\$ 18.14	40.00	\$ 725.49		
5	Lori	Miller	247-08-1243	8/25/2005	Cashier	60159	\$ 11.39	28.50	\$ 324.65		
6	Henry	Richardson	153-33-8555	11/6/2005	Sales Associate	60614	\$ 13.89	34.25	\$ 475.88		
7	Melanie	Halal	161-54-8034	9/8/2005	Sales Associate	60159	\$ 13.58	18.25	\$ 247.81		
8	Harley	Paterson	437-82-1927	10/16/2002	Cashier	60613	\$ 11.05	24.50	\$ 270.81		
9	Teri	Rapp	177-91-6128	11/20/2005	Accounting	60714	\$ 19.98	40.00	\$ 799.16		
10	James	Connors	419-19-5463	5/17/2002	Purchasing	60614	\$ 20.10	40.00	\$ 804.19		
11	Jennifer	Owens	283-29-6541	9/17/2004	Sales Associate	60540	\$ 12.94	35.50	\$ 459.32		
12	Antonio	McDonald	336-49-0303	6/27/2005	Livestock Mgt.	60613	\$ 21.68	27.25	\$ 590.67		
13	Todd	Booth	165-89-1835	12/4/2001	Sales Associate	60614	\$ 10.07	15.25	\$ 153.56		
14	Jane	Simpson	381-43-3894	7/6/2001	Customer Service	60540	\$ 12.06	19.50	\$ 235.12		
15	Colleen	Stark	180-66-2794	8/27/2001	Accounting	60626	\$ 19.35	40.00	\$ 773.83		
16	Amanda	Lewis	164-86-4378	11/1/2004	Cashier	60626	\$ 11.20	39.75	\$ 445.03		
17	Karina	Drake	411-62-6873	10/24/2003	Sales Associate	60626	\$ 8.34	44.75	\$ 373.00		
18	Harry	Chen	441-95-2099	6/20/1999	Accounting	60714	\$ 19.96	40.00	\$ 798.35		
19	Bob	Reed	295-45-3080	7/9/2004	Cashier	60540	\$ 12.07	15.50	\$ 187.02		
20	Kathy	Howard	415-07-5465	9/3/2002	Marketing	60613	\$ 22.69	40.00	\$ 907.69		
21	Dominick	Hill	209-67-5723	1/21/2000	Sales Associate	60714	\$ 13.47	12.50	\$ 168.43		
22	Erin	Rose	183-56-2052	4/14/2003	Livestock Mgt.	60540	\$ 20.78	45.00	\$ 935.04		

Employees Sheet2 Sheet3

Ready 100%



★★★★★



★★★



★★★★★



★★★★★★

Purchase

Name

Address

Phone

Credit Card

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Clipboard Font Alignment Number Styles Cells Editing Analysis Sensitivity

Comments Share

A1 : X ✓ fx Name

	A	B	C	D	E	F
1	Name	Product	Quantity	Date	Address	
2	Jenny	Cat leash	1	23-Sep	123 Main street	
3						
4						
5						
6						



	A	B	C	D	E	F	G	H	I
1	Name	Product	Quantity	Date	Address				
2	Jenny	Cat leash	1	23-Sep	123 Main street				
3	Mary Johns	Collar	3	09-Dec	15 oak avenue				
4	Kim Jones	toys	5	10-Dec	15 W Elm street				
5	Jenny	Cat leash	1	10-Dec	12 oxford street				
6									
7									
8									

When do we actually need a database?”

Consider the following potential problems:

- Size
- Accuracy
- Security
- Redundancy
- Importance
- Overwriting

What's the difference between a database and a spreadsheet?

- Databases and spreadsheets (such as Microsoft Excel) are both convenient ways to store information. The primary differences between the two are:
- How the data is stored and manipulated?
- Who can access the data?
- How much data can be stored?

Database – What is it?



"A set of information held in a computer" -
Oxford English Dictionary

Database – What is it?



"A set of information held in a computer" - Oxford English Dictionary



“One or more large structured sets of persistent data, usually associated with software to update and query the data” - Free On-Line Dictionary of Computing

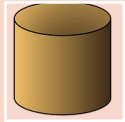
Database – What is it?



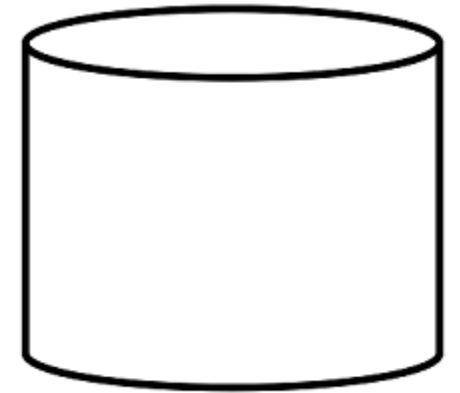
"A set of information held in a computer" - Oxford English Dictionary



"One or more large structured sets of persistent data, usually associated with software to update and query the data" - Free On-Line Dictionary of Computing



A database is often represented graphically by a cylindrical disk.



database

Database – What is it?



"A set of information held in a computer" - Oxford English Dictionary



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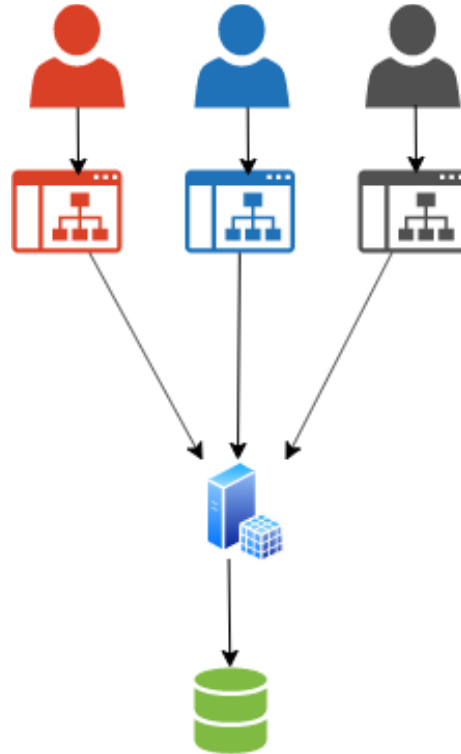


A database is often represented graphically by a cylindrical disk.



The database contains both metadata(describes the structure applied by the database to the customer data) and raw data.

DBMS – The Interface



- Add an interface in between the Apps and the Data files
- A software designed to assist in maintaining and utilizing large collections of data
- Apps link to DBMS (Database Management System) rather than custom files
- Prevents concurrency
- Adds extra integrity and security

Popular ~~Database ??~~ DBMS??



Popular Database ?? DBMS??

- MySQL
- Microsoft Access
- Microsoft SQL Server
- FileMaker Pro
- Oracle Database
- dBASE.



A DBMS is

- A General-Purpose Software System enabling
 - a. Creation of large disk-resident databases
 - b. Posing of data retrieval queries in a standard manner
 - c. Retrieval of query results effectively
 - d. Concurrent use of the system by a large number of users in a consistent manner
 - e. Guaranteed availability of data irrespective of system failures

Terms used

- **Database-** collection of related data
- **DataBase Management System (DBMS)** - software that manages and controls access to the database
- **Database application** - program that interacts with the database at some point in its execution.
- **Database system** - collection of application programs that interact with the database along with the DBMS and the database itself

University Database – Example

- Data about??
- Purpose:??

University Database – Example

- Data about:

- a. students,
- b. Faculty
- c. Courses
- d. Research-laboratories,
- e. Course registration etc.

- **Purpose:** To keep an accurate track of the academic activities of the University.

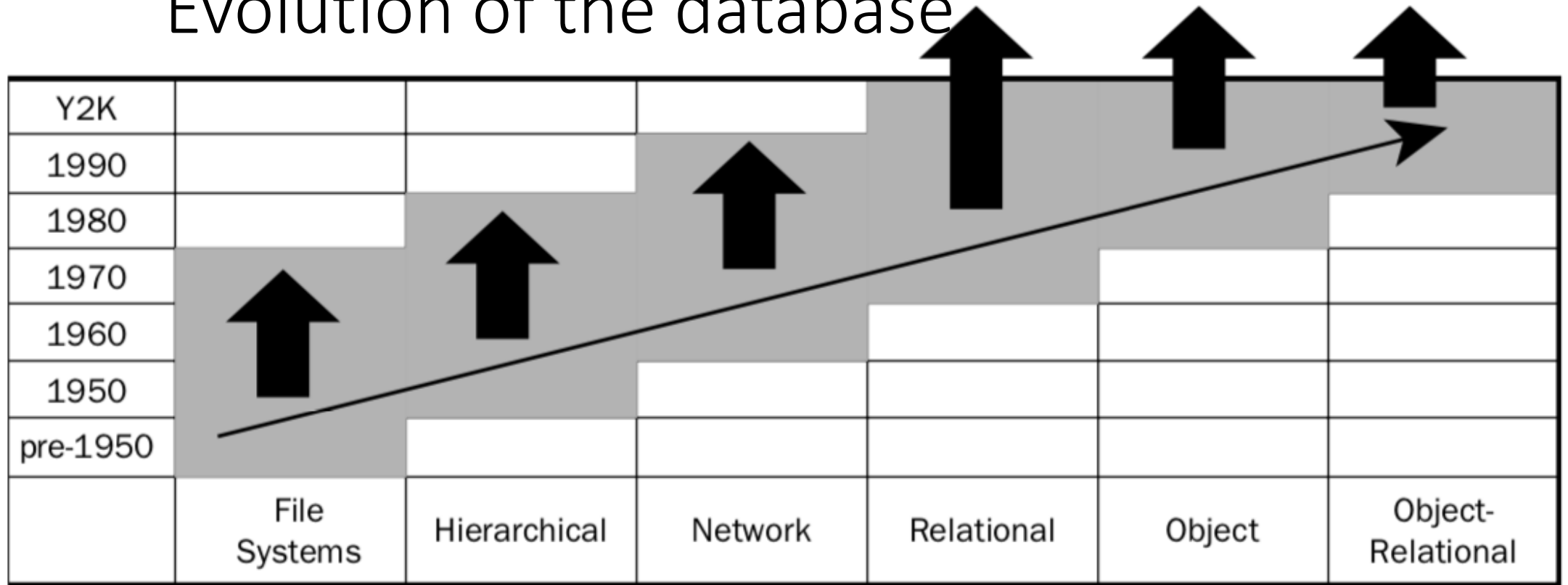
Examples

- Purchases from the supermarket
- Purchases using your credit card
- Booking a vacation with a travel agent
- Using the local library
- Taking out insurance
- Using the Internet
- Studying at College

Purchases from the supermarket

- The checkout assistant uses a bar code reader to scan each of your purchases
- Bar code reader is linked to a database application that uses the bar code to find out the price of the item from a product database
- application then reduces the number of such items in stock
- displays the price on the cash register
- If the reorder level falls below a specified threshold, the database system may automatically place an order to obtain more of that item.
- If a customer telephones the supermarket, an assistant can check whether an item is in stock by running an application program that determines availability from the database.

Evolution of the database



- It is highly unlikely that network and hierarchical databases are still in use.
- Column-oriented databases , NoSQL, Graph Databases are the new norm.

Types of databases (Tutorial 1)

- **Relational databases**
 - organized as a set of tables with columns and rows.
- **Object-oriented databases**
 - represented in the form of objects, as in object-oriented programming.
- **Distributed databases**
 - database may be stored on multiple computers, located in the same physical location, or scattered over different networks.

- NoSQL databases(nonrelational)

- unstructured and semistructured data to be stored and manipulated.

- Graph databases

- stores data in terms of entities and the relationships between entities.

Open source databases

- Source code is open source; such databases could be SQL or NoSQL databases.

Cloud databases

- collection of data, either structured or unstructured, that resides on a private, public, or hybrid cloud computing platform

- Self-driving databases

- cloud-based and use machine learning to automate database tuning, security, backups, updates, and other routine management tasks traditionally performed by database administrators.

Database

- A shared collection of logically related data and its description designed to meet the information needs of an organization.
- **Data dictionary or metadata:**

Database

- A shared collection of logically related data and its description designed to meet the information needs of an organization.
- **Data dictionary or metadata:**
 - The description of the data
 - **system catalog**

Data abstraction

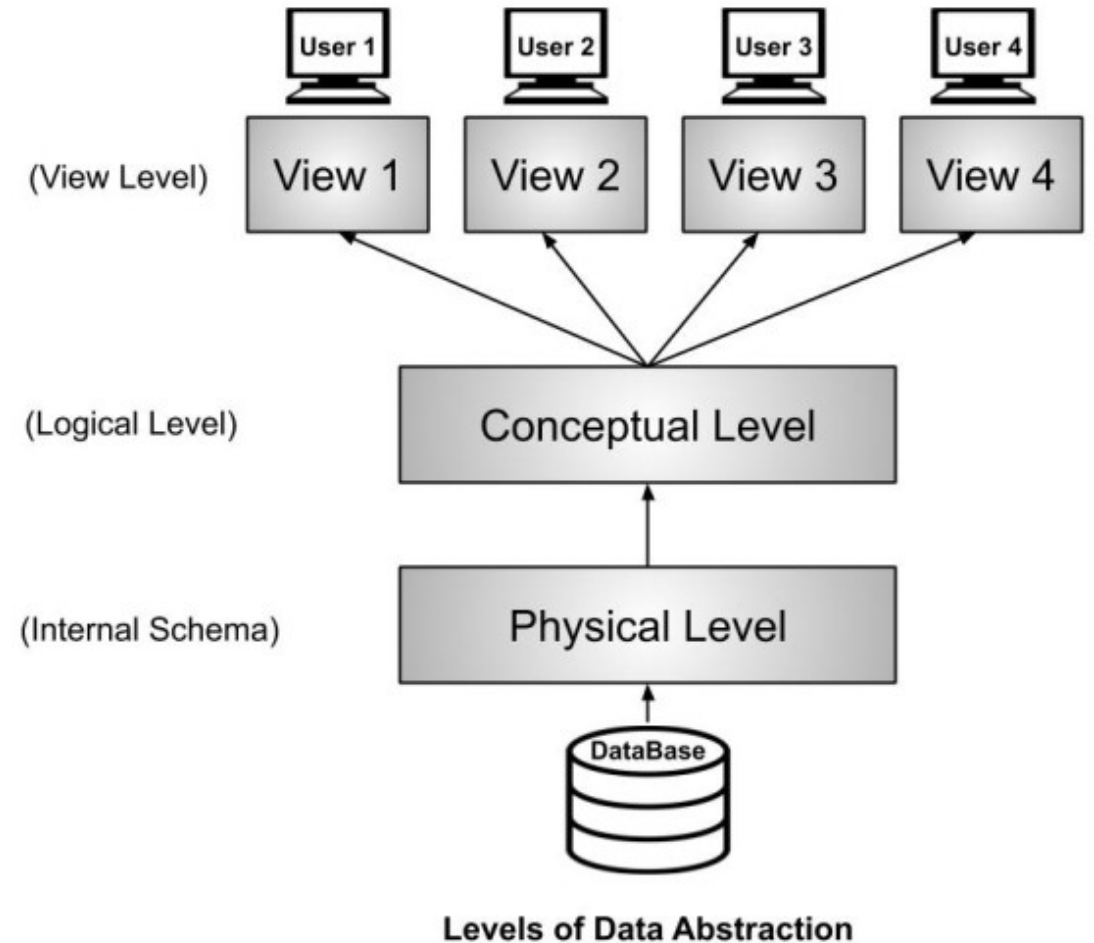
- Internal definition of an object and a separate external definition are provided.
- The users of an object see only the external definition and are unaware of how the object is defined and how it functions
- Internal definition of an object can be changed without affecting the users of the object.
- Data abstraction creates a simplified representation of the underlying data, while hiding its complexities and associated operations.

Data abstraction

- process of hiding unwanted or irrelevant details from the end user.
- provides a different view -data independence
- Data security.

Levels of abstraction

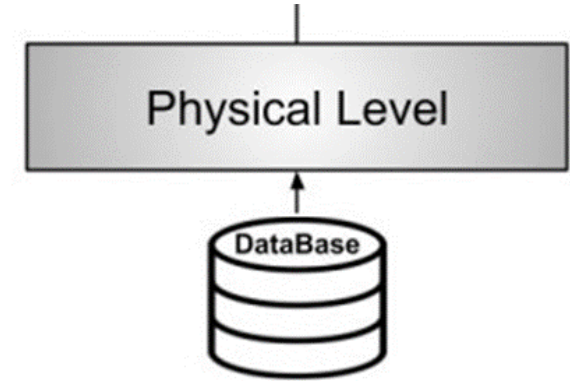
- three levels of abstraction
- Physical or Internal Level
- Logical or Conceptual Level
- View or External Level



Physical or Internal Level

- Defines
 - how the data is actually stored
 - data-structures to store data and access methods
- For example, customer's information is stored in tables and data is stored in the form of blocks of storage such as bytes, gigabytes etc.

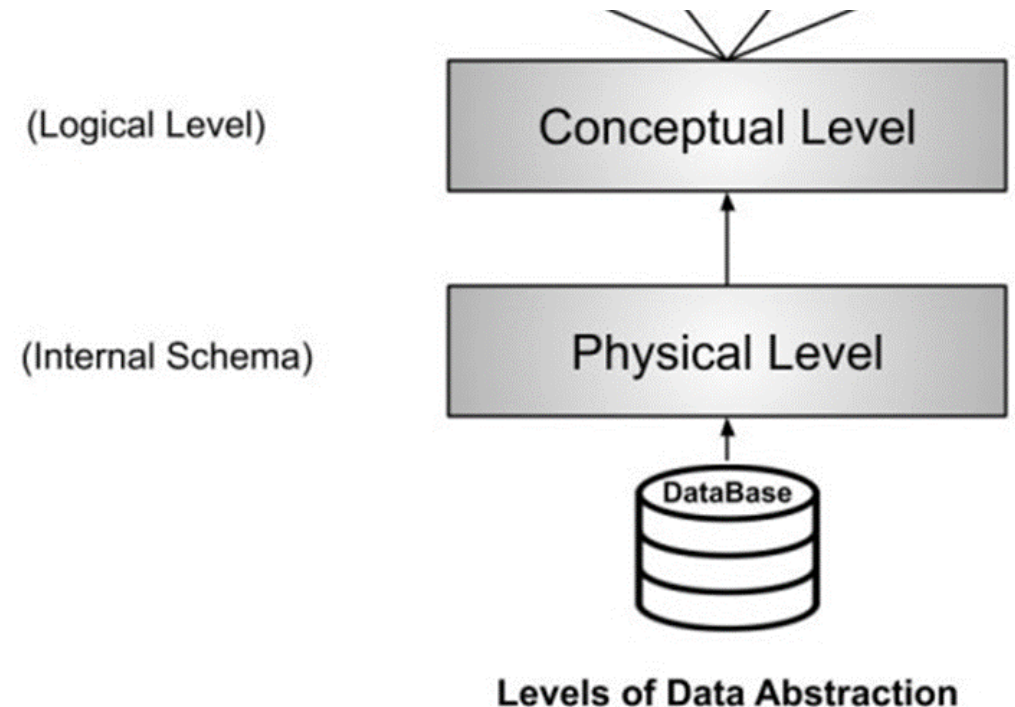
(Internal Schema)



Levels of Data Abstraction

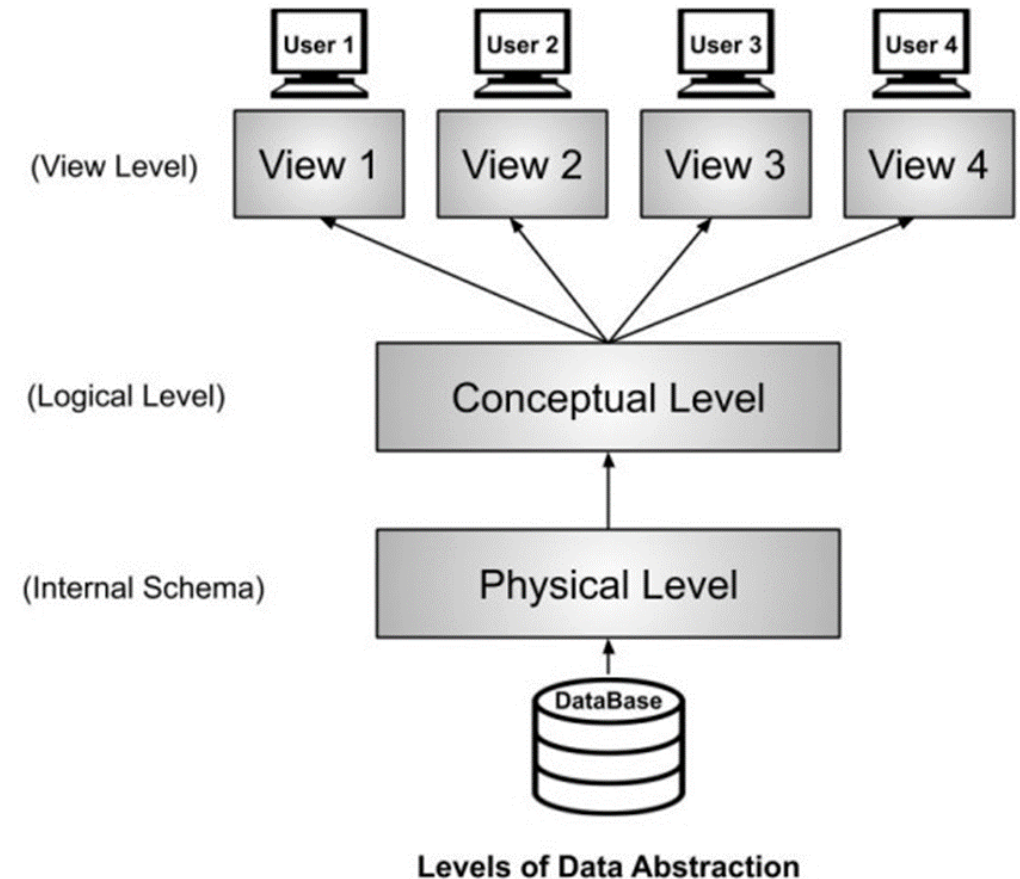
Logical or Conceptual Level

- Describes
 - what data is stored in the database
 - what relationship exists among those data
- used by developers or database administrators (DBA)
- logical level contains tables and relationships among table attributes.



View or External Level

- The users' view of the database.
- describes the part of the database that is relevant to each user.
- number of different external views of the database
- For example,
one user view (day, month, year),
another view (year, month, day)



External view 1

sNo	fName	lName	age	salary
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External view 2

staffNo	lName	branchNo
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Conceptual level

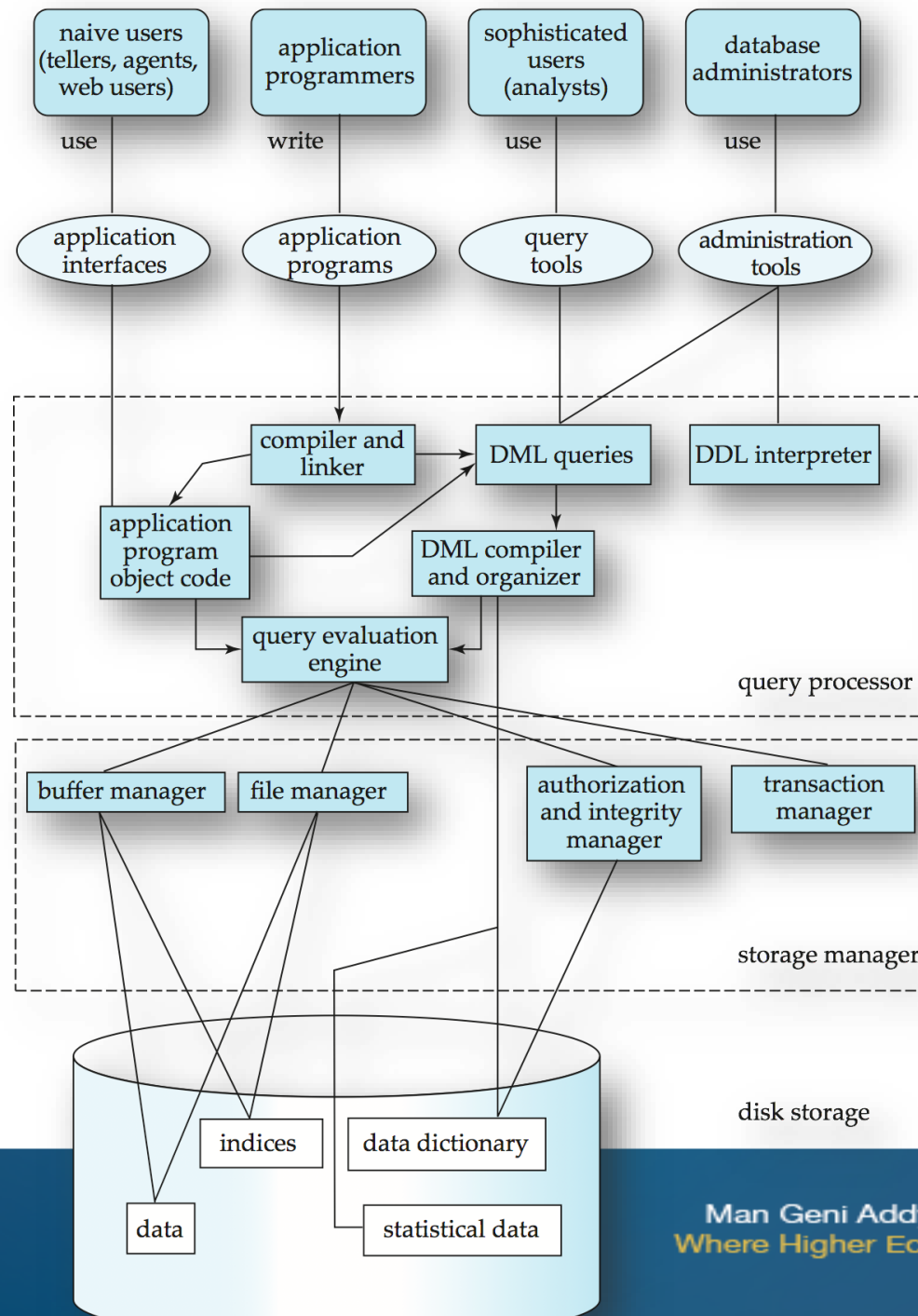
staffNo	fName	lName	DOB	salary	branchNo
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Internal level

```
struct STAFF {  
    int staffNo;  
    int branchNo;  
    char fName [15];  
    char lName [15];  
    struct date dateOfBirth;  
    float salary;  
    struct STAFF *next;  
};  
index staffNo; index branchNo;
```

/* pointer to next Staff record */
/* define indexes for staff */

Figure 2.2 Differences between the three levels.



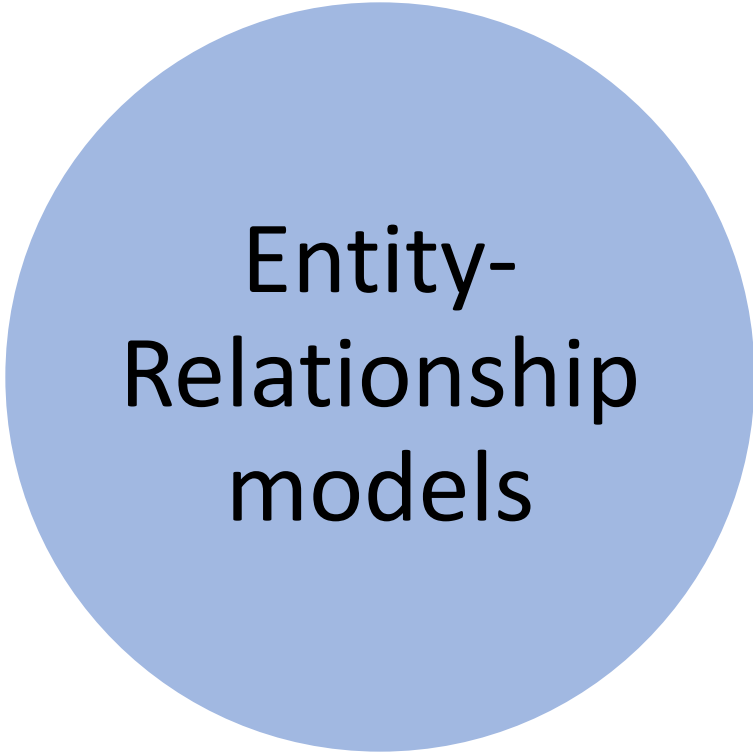
Summary

- Database
- DBMS
- Abstraction Levels
 - Schemas
 - Conceptual, Logical, Physical
 - Views
 - External, Logical, Internal/Physical
 - Data Independence
 - Physical, Logical

INDICATIVE READING LIST

Module Code	ACCA4023	
Module Title	Introduction to Web and Database Concepts	
Classification	Reading List entry	Electronic*
Essential	Connolly, T., Begg, C., 2015, <i>Database Systems: A Practical Approach to Design, Implementation and Management</i> , 6th Edition, Addison Wesley	☒
Essential	Viescas, J. L., 2018, <i>SQL Queries for Mere Mortals: A Hands-On Guide to Data Manipulation in SQL</i> , 4 th Edition, Addison-Wesley Professional	☒
Further	Coronel, C. & Morris, S., 2018, <i>Database Systems: Design, Implementation, & Management</i> , 13 th Edition, Cengage Learning	☒

Coming up...



Entity-
Relationship
models