



FACULTY OF TECHNOLOGY
UNIVERSITY OF COLOMBO
SRI LANKA

Database Management Systems -1

Lecture 1: Introduction of Database management System

Department of Information and Communication Technology

Outline of the syllabus

- ❖ Week 1 – Introduction, What is a Database and different usages
- ❖ Week 2 – Historical Perspective of the Databases
- ❖ Week 3 – Conceptual Database Design
- ❖ Week 4 – Relationships
- ❖ Week 5 – Logical Database Design and Relational Model
- ❖ Week 6 – Creating Tables
- ❖ Week 7 – Structured Query languages (SQL) Part 1

Outline of the syllabus


- ❖ Week 8 – Structured Query languages (SQL) Part 2
- ❖ Week 9 – Mid Semester Exam
- ❖ Week 10 – Functional Dependences and Normalization
- ❖ Week 11 – Normalization (Contd.)
- ❖ Week 12 - Relational Algebra Part - 1
- ❖ Week 13– Relational Algebra Part -2
- ❖ Week 14 – Tools for Database Design and New Types of Data model

Learning Objectives

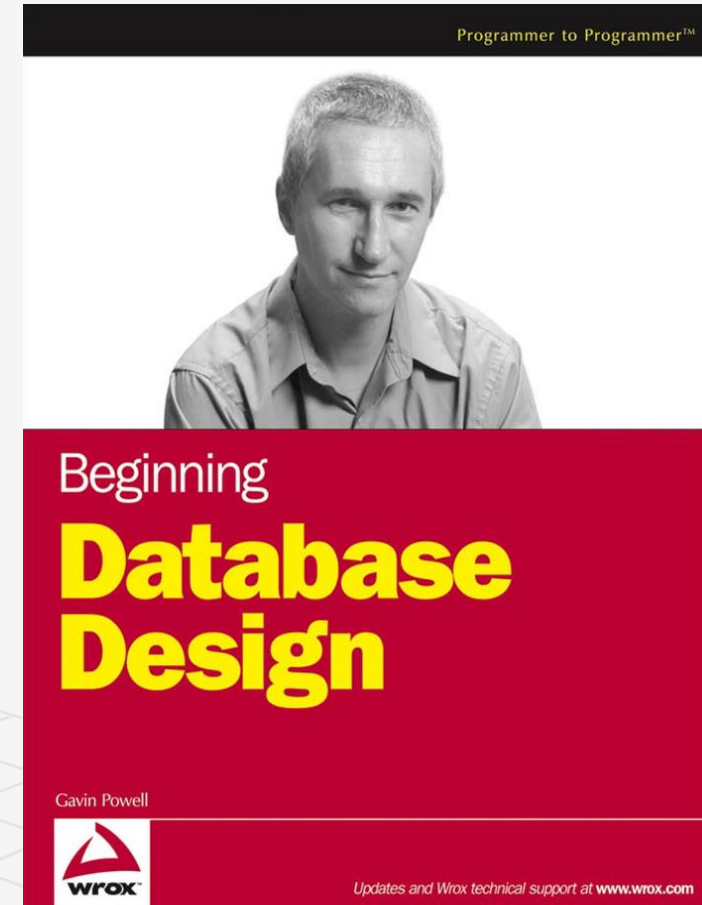
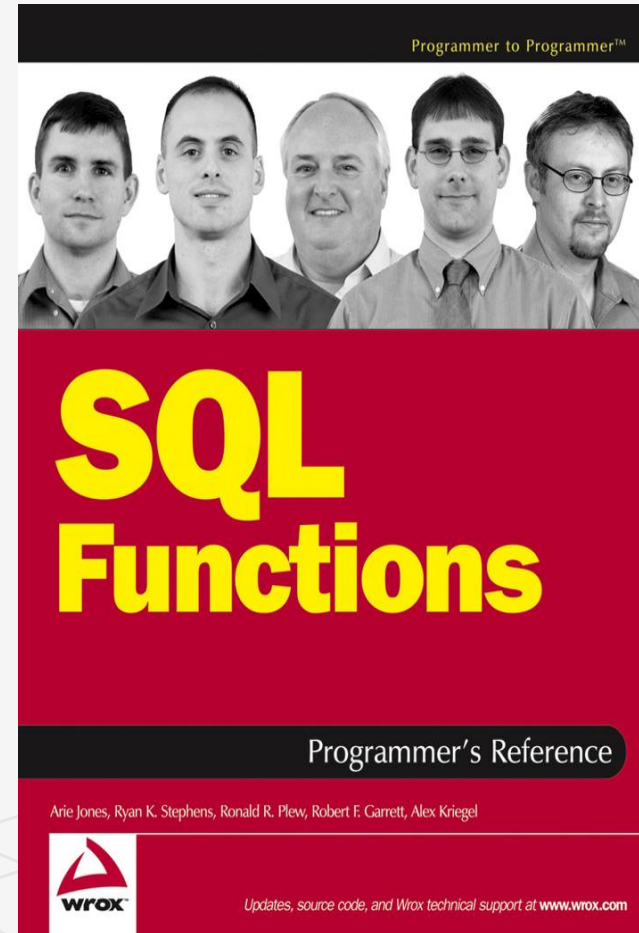
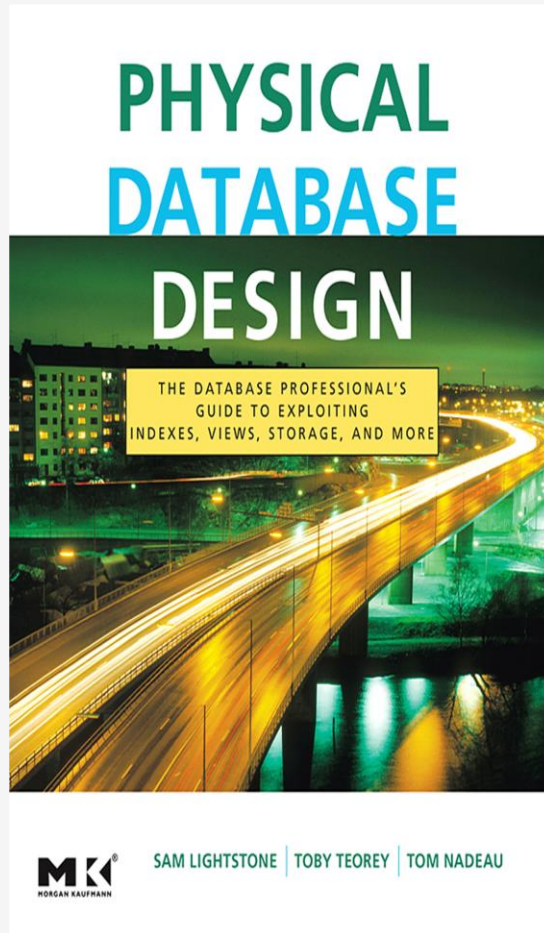
After completing this module you will be able to:

- ❖ Understand the importance of the databases, needs and use of the database management system
- ❖ Explain the fundamental concepts of Database Management Systems.
- ❖ Understand the architecture of a database and context, phases and techniques for designing and building a database.
- ❖ Learn data models and to create ER diagrams to model a scenario.
- ❖ Demonstrate an understanding of relational models.

Learning Objectives (Contd.)

- ❖ Identify anomalies in logical schema and do the normalization process.
 - ❖ Learn SQL language clauses and functions and write optimal queries in SQL.
 - ❖ Develop a database solution to model a real- world scenario.
 - ❖ Understand relational algebra and how to optimize queries.
 - ❖ Understand the new types of Data models
- 

Reference Books for this Course Module



Evaluation Criteria

- ❖ Assignments – 10%
- ❖ Mid Semester Exam – 20%
- ❖ Final Exam – 70%

The examination will be a comprehensive exam based on the lecture materials and assignments covered during the semester.

Lecture -1 Outline

- ❖ What is Data?
- ❖ Types of Data and why information storages need ?
- ❖ What is Database and DBMS?
- ❖ Characteristics of DBMS
- ❖ About DBMS Administrators
- ❖ Database Design process

Data

What is Data?

It is a collection of raw facts from which conclusions may be drawn.

Data is converted into more convenient form – digital data

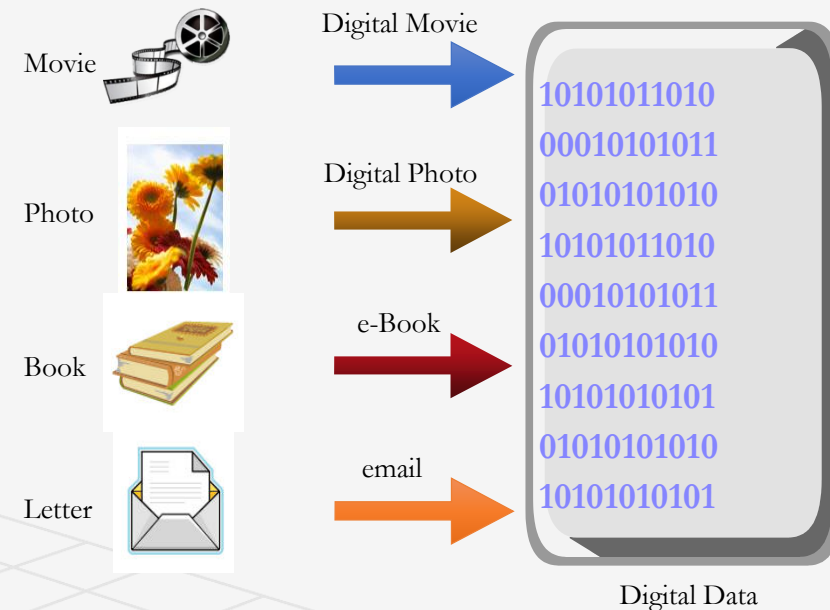
Factors for digital data growth are:

- Increase in data-processing capabilities

- Lower cost of digital storage

- Affordable and faster communication technology

- Proliferation of applications and smart devices



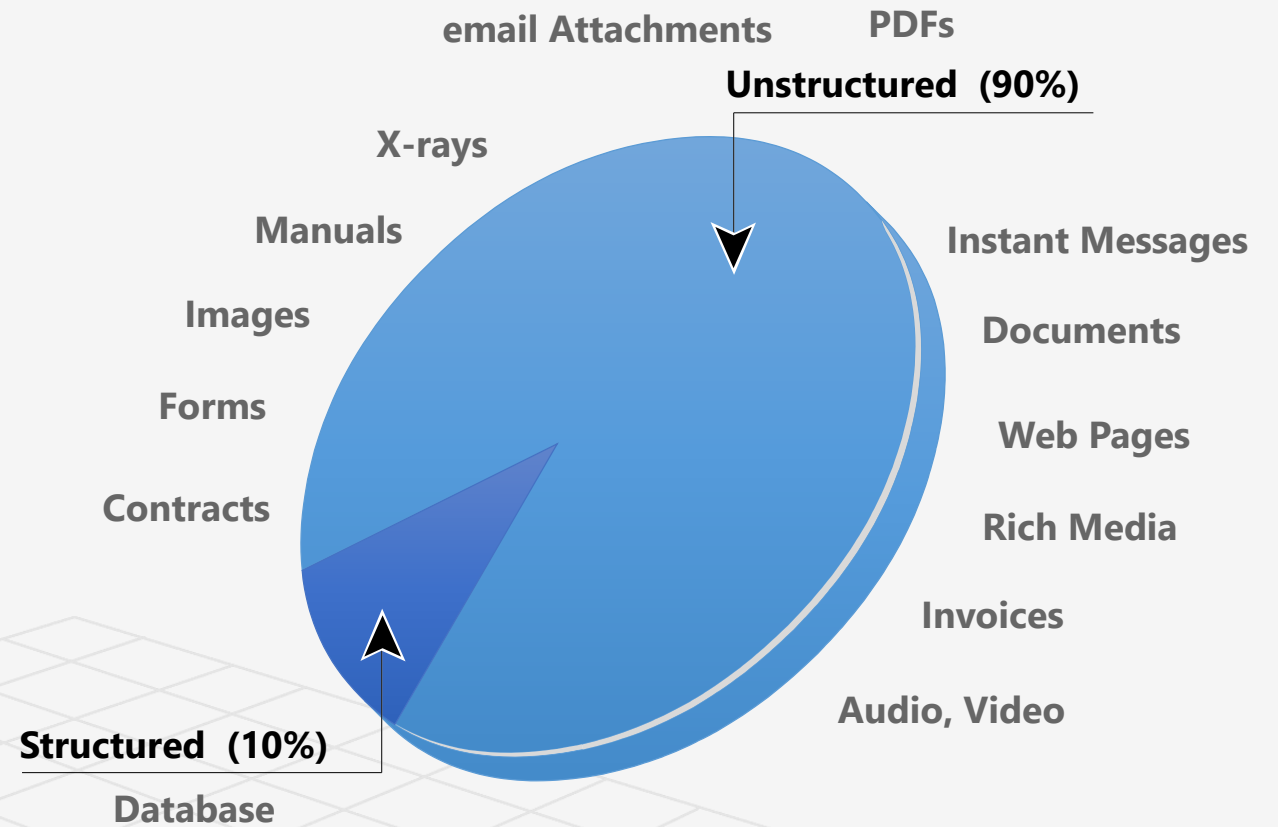
Types of Data

Data can be classified as:

Structured

Unstructured

Majority of data being created is unstructured



Why Information Storage need?

- ❖ Information is the knowledge derived from **data**
- ❖ Growth of digital information has resulted in information explosion

We live in an on-command, on-demand world

We need information when and where required

Increasing dependency on fast and reliable access to information

Businesses seek to store, protect, optimize, and leverage the information

To gain competitive advantage

To derive new business opportunity

How do you Produce this Information

Dialog Mobile Bill

Dialog Axata PLC (Pvt. Ltd.)
475, Union Place, Colombo 02.
T: +94 (0) 77 7 678 678
F: +94 (0) 77 7 678 697
E: service@dialog.lk

MS N FERNANDO
490/6A, GALLE ROAD
PANADURA
12500

Bill Period: 15/01/2014 - 14/02/2014 Acc no: 335

ACCOUNT SUMMARY

PREVIOUS MONTH: 15/01/2014	INVOICE DATE: 14/02/2014
Brought Forward	5228.02
Payments	4600.00
	628.02
DIALOG NUMBER:	7775220

Monthly Services
International Roaming
Total call charges
Misc. Charges
Contract Charges
Discounts / Surcharges
Government Taxes and Levies
Other Serv (non Taxable)

950.00
31797.66
1648.75
-367.35
151.65
75.80
9437.53
1710.00

Total Bill Amount February
45404.04

Total Due
46032.06

Payment due date: 04/03/2014

Brought Forward = Payments = Arrears + This Month's Charges = Amount Payable

5228.02 = 4600.00 = 628.02 + 45404.04 = 46032.06

Pay your bill online anytime, anywhere without any hassle. No additional charges. No registration required. Simply log on to <http://dialog.lk/paybill>

MONTHLY SERVICE	AMOUNT
Monthly Rental 15/02/2014 To 14/03/2014	300.00
Black Berry Rental 15/02/2014 To 14/03/2014	650.00
TOTAL SERVICE CHARGES	950.00
VALUE ADDED SERVICES	
International Roaming Voice	31797.66
TOTAL	31797.66
USAGE CHARGES	
Outgoing Dialog to Non Dialog UPTO 14/02/2014	776.43
Local Short Message Service UPTO 14/02/2014	7.00
International Short Message Service UPTO 14/02/2014	20.00
e-Volution UPTO 14/02/2014	138.82
Automatic Re-Routed International Calls UPTO 04/02/2014	40.00
International Direct Dialing UPTO 14/02/2014	666.50
TOTAL USAGE CHARGES	1648.75
05/02/2014 RENTAL WAIVER TAX	-367.35
14/02/2014 Commitment Penalty OTC	151.65
Interest Due to late payments	75.80
TOTAL TAXABLE CHARGES	34623.86

GOVERNMENT TAX/LEVY
Telco Levy on Internet Services 66.30
Other Government Levy 706.33
Telco Levy 8486.50
IDD Levy Rs. 3 per minute 178.40
TOTAL TAX 9437.53

OTHER SERVICES (Non Taxable)
Echannel 1710.00

TOTAL OTHER CHARGES 1710.00

PAYMENTS
28/01/2014 391936 ODEL CHEG 7010670189962 4600.00

TOTAL PAYMENTS 4600.00

DIALOG LOYALTY
TOTAL STAR POINTS AVAILABLE 645.91

NOTE: Dial #1418 to check your up to date star points balance

Please submit the Payment Form (not all parties) when settling your monthly bill / මාසික බිල්ල පැමිණි විටම පමණක් ගෙවුමේ පත්‍රය භාර දිය යුතුය.

Payment slip / ගෙවුමේ පත්‍රය / බිල්ල ගෙවූ බව පෙන්වයි

Account No. Invoice No. Bill Period

Date / දින / මාස 2014

Amount Rs. Late payment levy

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Email or Phone Password Log In

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Your Email

Re-enter Email

New Password

Birthday
Month Day Year Why do I need to provide my birthday?

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HOME INVESTOR RELATIONS CHANNEL HISTORY PARTNERS COMPANY CAREERS MEMBER HOME CONTACT US

Member Login Member ID, Email or NIC Password Login

WE ARE THE BEST

Search For Your Doctor

Doctors Name - Last Name Only

Hospital Any

Specialty Description Any

Date Any

SEARCH

What is a Database

Database is a collection of related data.

Examples : Student Database of the University, Customer database of a Bank

What is a DBMS (**Database Management System**)

Set of programs to access the data.

Is a software package designed to create and maintain databases.

What is a DBMS (Database Management System)

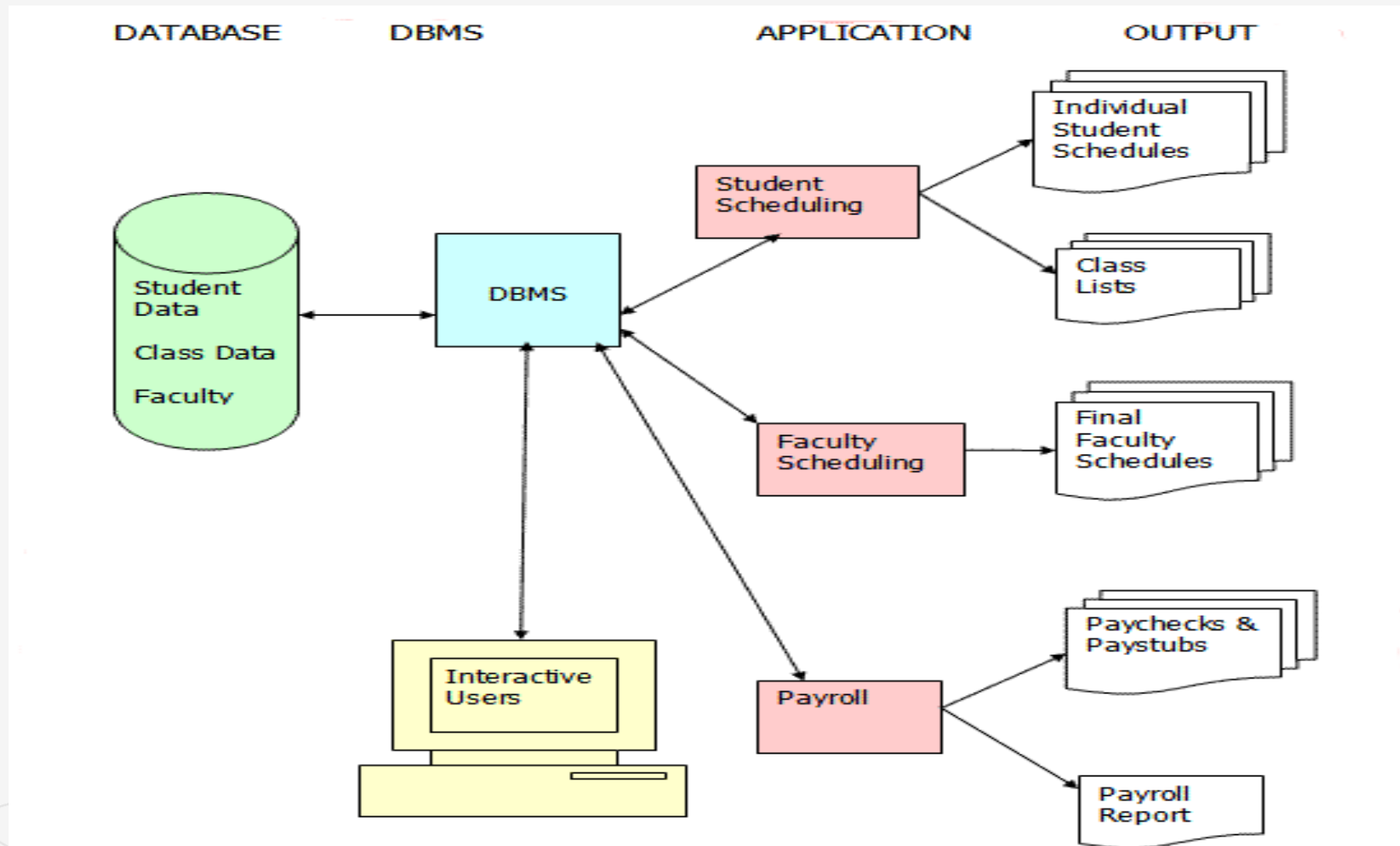


Figure 1.4 The Integrated Database Environment

Characteristics of Modern DBMS

- ❖ Sharing of data
- ❖ Redundancy control
- ❖ Security control
- ❖ Persistent storage
- ❖ Database inference
- ❖ Multiple user interfaces
- ❖ Represent complex relationships
- ❖ Integrity enforcement
- ❖ Backup and recovery
- ❖ Standards enforcement
- ❖ Flexibility
- ❖ Availability of the data
- ❖ Economies of scale
- ❖ Self describing: a catalog of meta-data
- ❖ Program-data independence
- ❖ Multiple views
- ❖ Concurrency, distributed, on-line
- ❖ Heterogonous HW and SW

Characteristics of Modern DBMS (Contd.)

- ❖ System requirements of high availability, reliability, throughput, response time, lifetime, security
- ❖ Varied content: numbers, strings, multimedia, GIS, etc.
- ❖ Very large databases (DNA sequences, GIS data, Internet of Things IoT, Google, Twitter, etc.)

Who is Database Administrator?

A database administrator (DBA) is an IT professional who

Oversee design manage resources and other users and authorization/
security control


- ❖ The software used to manage a database is properly maintained.
- ❖ Allow rapid access when needed; because constant access, searches, traffic are likely to have a damaging effect on any company database, the DBA works to maintain the efficiency of the servers.
- ❖ He or she also will typically work to ensure data security, coordinating with an IT security professional or team in larger companies to help maintain the integrity of sensitive business data.

Qualification of the Administrators

To work as a database administrator, a person typically will need

- ❖ a bachelor's degree in computer science
- ❖ an associate's degree in database administration, or a similar degree.
- ❖ Many companies will also require a DBA candidate to have a background in IT work on database administration teams.

Database Administrators' Main Tasks

- ❖ Implement, configure, and troubleshoot database instances, replication, backup, partitions, storage, and access.
 - ❖ Set user privileges within the database environment.
 - ❖ Monitor and optimize system performance using index tuning, disk optimization, and other methods.
 - ❖ Install, configure, troubleshoot, and maintain a database system.
- 

Places Where the Databases are used

- ❖ Banks: ATM
- ❖ Airlines: reservations, schedules
- ❖ Universities: registration, grades
- ❖ Sales: customers, products, purchases
- ❖ Manufacturing: production, inventory, orders, supply chain
- ❖ Human resource Management Systems: employee records, salaries, tax deductions

Databases touch all aspects of our lives

Why Study DBs?

- ❖ Very widely used.
- ❖ Part of many software solutions.
- ❖ DB expertise is a career asset.
- ❖ More Money

Database Design

How do we design a database for an application?

Design in such a way that:

- ❖ Records can be reached easily.
- ❖ Respond to the user's questions easily.
- ❖ Occupies minimum storage.
- ❖ Contains NO unnecessary data.
(storing the gross salary, calculated from the gross salary)
- ❖ Adding /Updating of data can be done easily with out causing mistakes

Database Design Process

1. Requirements Analysis

What does the user want?

2. Conceptual Database Design

Defining the entities and attributes, and the relationships between them --> The ER model

3. Logical Database Design

Map ER to Relational Schema

4. Schema Refinement

Fine tune

5. Physical Database Design

Implementation of the design using a Database Management System

6. Security Design

Implement Controls to ensure security and integrity

1. User Requirement Analysis

Requirements Analysis is the process of determining what the database is to be used for. It involves interviews with user groups and other stakeholders to identify what functionality they require from the database, what kinds of data they wish to process and the most frequently performed operations.

1. User Requirements Analysis

What users want from the database?

- What is going to be stored in the database?
- What applications are going to be built on top the database?
- What are the most frequently asked queries?

1. Requirement Analysis (Example -1)

- What does the user want ?

Ex: Wardrobe (Cupboard) to be used by mom, dad, son and daughter.

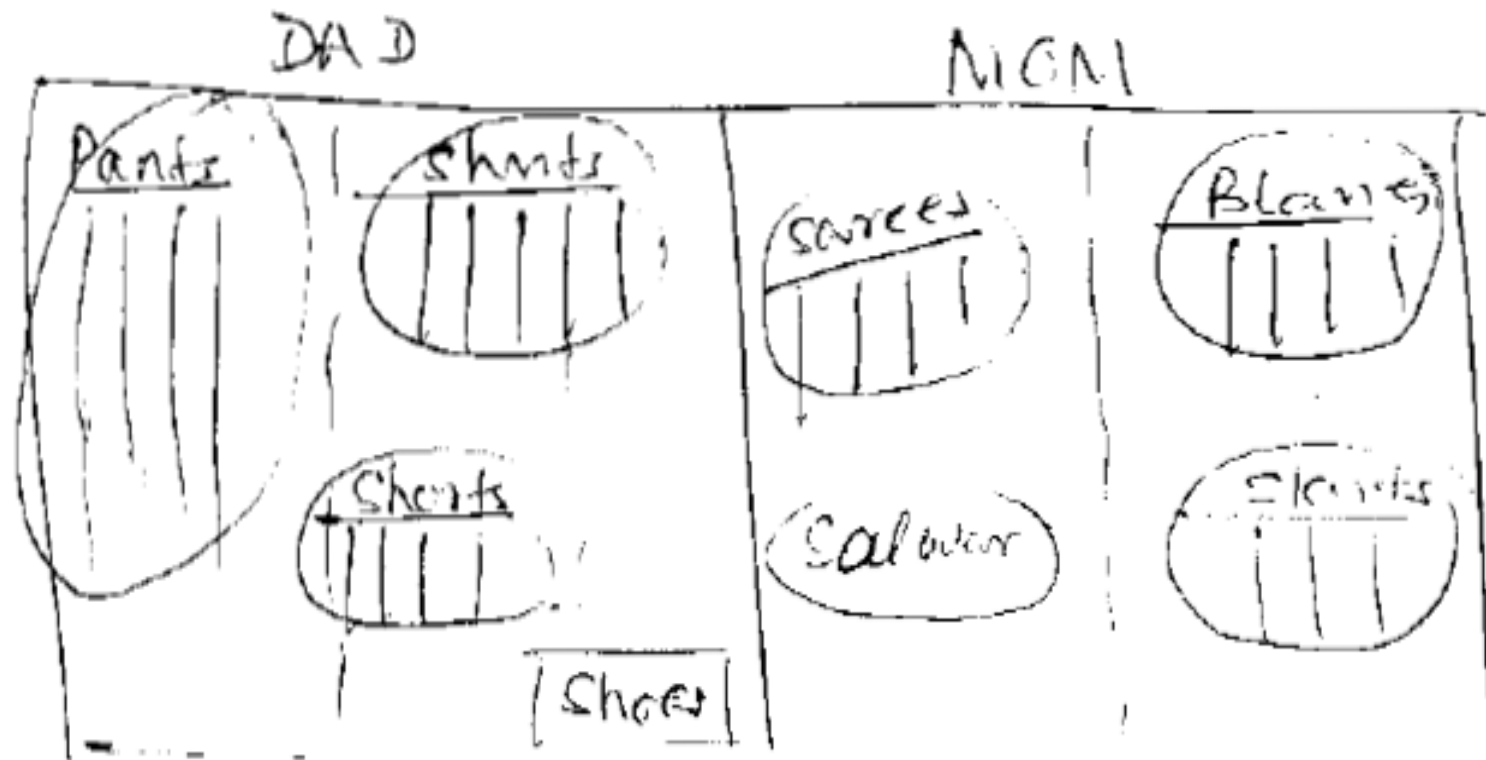
To store

DAD's : shirts, pants, shoes

MOM's : sarees, blouses, skirts etc...

2. Conceptual Design

Model the requirements- diagram



3. Logical Design

Use the conceptual design and convert it into a schema of a particular model



4. Physical Design

Enhance the design to improve performance

**Spring
loaded
Wardrobe
rail**



Sliding racks

Requirement Analysis (Example -2)

Library database

Requirements are:

- Record of all books, magazines, periodicals etc. in the library database
- Members of the library
 - Students
 - University Staff
- Add new members, remove members from the database
- Record borrowing information



Requirement Analysis (Example -2)

Some applications on top of the database can be...

- Renewal service (may be on-line)
- Borrowing-Lending service
- Resource reservation system (may be on-line)
- Resource request service (may be on-line)

Requirement Analysis (Example -3)

Think about a Social Networking Site like Facebook...

- What is going to be stored in the database?
- What applications are going to be built on top the database?
- What are the most frequently asked queries?

Conceptual Database Design

The purpose of the conceptual design phase is to build a conceptual model based upon the previously identified requirements, but closer to the final physical model. A commonly-used conceptual model is called an *entity-relationship* model.

The information gathered in the requirements analysis phase is used to create a high-level description of the data in a conceptual data model or *Semantic Data Model*.

Ex: ER Model

Database Schema

A database schema is the skeleton structure that represents the logical view of the entire database. It defines how the data is organized and how the relations among them are associated. It formulates all the constraints that are to be applied on the data.

Logical Database Design

In this step, we determine the DBMS to implement the database & also the data model.

We utilize the conceptual schema created in the previous step and convert it into a schema of a particular data model* (e.g. Relational Data Model)

Schema Refinement

The schema created by the logical database design phase is further refined for potential problems such as redundancies.

Physical Database Design

In this step, physical configuration of the database on the storage media happens and **performance criteria** are taken into consideration for **further enhancements** to the schema & **creation of indexes** are considered.

Security Design

Different user groups and their roles are identified.

Appropriate levels of access are then provided to the data ensuring that users have access to only the necessary data.

Eg. Bank

Customer – read access

Teller – read/update (limited)

Manager – read/update

End of the Lecture – 1
Thank You