

Computer Fundamentals: Pradeep K. Sinha & Priti Sinha

Learning Objectives

In this chapter you will learn about:

- § Difference between data and information
- § Data processing converts raw data into useful information
- § Data storage hierarchy commonly used to facilitate data processing
- § Standard methods of organizing data
- § Basic concepts of database systems

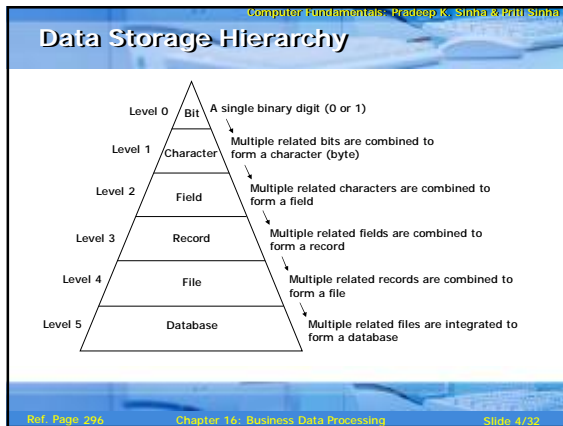
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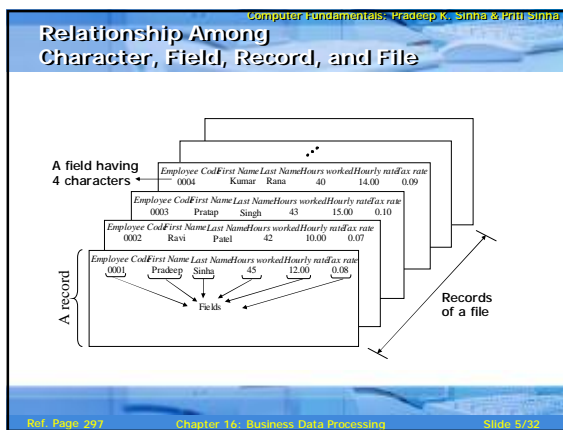
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Data Processing

- § Data is a collection of facts – unorganized but able to be organized into useful information
- § Information is data arranged in an order and form that is useful to the people who receive it
- § Data processing is a series of actions or operations that converts data into useful information
- § A data processing system includes resources such as people, procedures, and devices used to process input data for producing desirable output

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- ## Standard Methods of Organizing Data
- § **File-oriented approach:** Application's data is organized into one or more files and application program processes them to generate the desired output
 - § **Database-oriented approach:** Data from multiple related files are integrated together to form a database:
 - § Provides greater query flexibility
 - § Reduces data redundancy
 - § Solves data integrity (inconsistency) problem
 - § Makes data independent of the application programs
 - § Includes data security features at database level, record level, and field level
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File Management System

- § In *file-oriented approach* of organizing data, an application's data is organized into one or more files
- § Application program processes the data stored in these files to generate the desired output
- § Set of programs is provided to facilitate the users in organizing, creating, deleting, updating, and manipulating their files
- § All these programs together form a File Management System (FMS)

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File Types

A file management system supports following file types:

- § **Transaction file:** Stores input data until it can be processed
- § **Master file:** Contains all current data relevant to an application
- § **Output file:** Stores output produced by one program that is used as input to another program
- § **Report file:** Holds a copy of a report generated by an application
- § **Backup file:** Copy of a file, created as a safety precaution against loss of data

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File Organizations

- § File organization is the physical organization of the records of a file for convenience of storage and retrieval of data records
- § Three commonly used file organizations are:
 - § **Sequential:** Records are stored one after another in ascending or descending order determined by the value of the key field of the records
 - § **Direct/random:** Desired record pertaining to current transaction can be directly located by its key field value without having to navigate through sequence of other records

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File Organizations

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§ Indexed sequential: There are two files for every data file – the data file which contains the records stored in the file, and the smaller index file which contains the key and disk address of each record stored in the data file

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Organization of An Indexed Sequential File

Employee Code (key)	Address Location
0001	1003
0002	1001
0003	1004
0004	1002

Index file

Address Location	Employee Record
1001	0002 R. S. Patel ...
1002	0004 R. K. Rana ...
1003	0001 K. P. Sinha ...
1004	0003 N. P. Singh ...

Data file

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File Utilities

§ Routines to perform a variety of generalized operations on data files

§ Operations performed by some commonly used file utilities are Sorting, Searching, Merging, Copying, Printing, and Maintenance

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Sorting On One Key

Employee Code	Department Code	Other fields (Name, Address, Qualification, Basic Salary, etc.)
101	2	---
123	3	---
124	1	---
176	2	---
178	1	---
202	3	---
213	1	---

Sorting on ascending employee code sequence

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Sorting On Two Key

Employee Code	Department Code	Other fields (Name, Address, Qualification, Basic Salary, etc.)
124	1	---
178	1	---
213	1	---
101	2	---
176	2	---
123	3	---
202	3	---

Sorting on a ascending employee code (secondary key) within ascending department code (primary key)

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Merging of Two Files

Input file	
Employee code	Other fields
125	---
127	---
137	---
146	---
159	---

File A

Output file	
Employee code	Other fields
112	---
119	---
125	---
127	---
129	---
137	---
139	---
146	---
150	---
152	---
159	---

File C

Input file	
Employee code	Other fields
112	---
119	---
129	---
139	---
150	---
152	---

File B

Merging of files A and B to produce file C

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Database Management System

- § In *database-oriented approach* of organizing data, a set of programs is provided to facilitate users in organizing, creating, deleting, updating, and manipulating data in a database
- § All these programs together form a *Database Management System (DBMS)*

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Database Models

- § *Database model* defines the manner in which the various files of a database are linked together.
- § Four commonly used database models are:
 - § Hierarchical
 - § Network
 - § Relational
 - § Object-oriented

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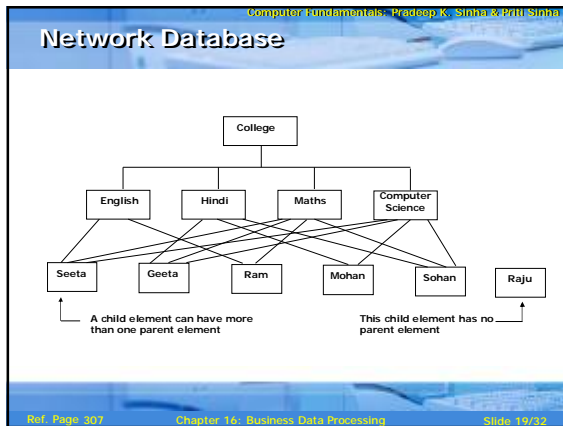
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Hierarchical Database

```

graph TD
    Org[Organization] --> PD[Personnel Department]
    Org --> FD[Finance Department]
    Org --> TD[Technical Department]
    PD --> PM[Managers]
    PD --> PSt[Support Staff]
    FD --> FMan[Managers]
    FD --> FSt[Support Staff]
    TD --> TMan[Managers]
    TD --> TE[Engineers]
    TD --> TT[Technicians]
    TD --> TSt[Support Staff]
  
```

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Relational Database

Membership No.	Member's name	Member's Address	Borrower (Membership No.)	Book No. (ISBN)	Due Date (DD-MM-YYYY)
83569	K. N. Raina	C-15, Sarita Vihar, Pune-7	12859	27-21675-2	10-12-2007
62853	D. P. Singh	A-22, Anand Park, Pune-5	11348	89303-530-0	08-11-2007
12859	R. Pandey	D-18, Vrindavan, Pune-7	32228	13-201702-5	10-11-2007
32228	R. S. Gupta	A-12, Nandanvan, Pune-2	16185	22-68111-7	05-12-2007
23466	S. K. Ray	B-05, Royal Villa, Pune-3	12859	71606-214-0	06-11-2007
11348	P. K. Sen	B-16, Anand Park, Pune-5	62853	13-48049-8	15-11-2007
16185	T. N. Murli	A-11, Vrindavan, Pune-7	11348	18-23614-1	12-11-2007

(a) Members data table. (b) Borrowed books data table

Book No. (ISBN)	Book Title	Author
13-201702-5	Concepts of Physics	H. C. Verma
13-48049-8	Concepts of Chemistry	S. S. Dubey
18-23614-1	Astrology for You	N. K. Sharma
22-68111-7	Fundamentals of Computers	K. Ramesh
27-21675-2	C++ Programming	R. P. Rajan
71606-214-0	Computer Networks	A. N. Rai
89303-530-0	Database Systems	P. N. Dixit

(c) Books data table

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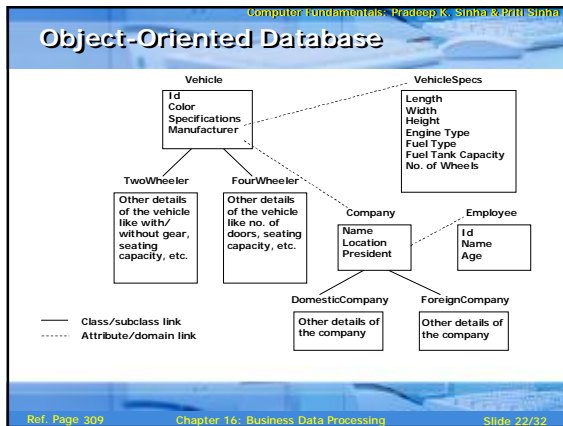
Sample Report

List of overdue books as on 10-11-2007

Membership No.	Member's Name	Member's Address	Due Date	Book No.	Book Title	Book Author
11348	P. K. Sen	B-16, Anand Park, Pune-5	08-11	89303-530-0	Database Systems	P. N. Dixit
32228	R. S. Gupta	A-12, Nandanvan, Pune-2	10-11	13-201702-5	Concepts of Physics	H. C. Verma
12859	R. Pandey	D-18, Vrindavan, Pune-7	06-11	71606-214-0	Computer Networks	A. N. Rai

A report of overdue books as of 10-11-2007 from the sample database of previous slide

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Main Components of a DBMS

- § DBMS allows users to organize, process and retrieve selected data from a database without knowing about the underlying database structure
- § Four major components of a DBMS that enable this are:
 - § *Data Definition Language (DDL)*: Used to define the structure (schema) of a database
 - § *Data Manipulation Language (DML)*: Provides commands to enable the users to enter and manipulate the data

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Main Components of a DBMS

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- § *Query Language*: Enables users to define their requirements for extracting the desired information from the database in the form of queries
- § *Report generator*: Enables the users of a database to design the layout of a report so that it can be presented in the desired format

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Creating a Database

Creation of a database is a three step process:

- § Defining its structure (schema)
- § Designing forms (custom screens) for displaying and entering data
- § Entering the data into it

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Sample Database Form

EMPLOYEE DATABASE DATA ENTRY FORM

EMPLOYEE ID: 856392

SEX: M

AGE: 42

EMPLOYEE NAME:

LAST NAME: SINHA

FIRST NAME: PRADEEP

MIDDLE NAME: KUMAR

CONTACT ADDRESS:

ADDRESS 1: 7/B, ANAND PARK

ADDRESS 2: SOCIETY, AJUNDH

CITY: PUNE

STATE: MH

POSTAL CODE: 411007

TELEPHONE NO.: (020) 5680-489

ANY OTHER INFORMATION:

IS FLUENT IN JAPANESE LANGUAGE

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Viewing, Modifying, Deleting, and Adding Records

- § All database systems provide commands to view, modify, delete, or add records of an already established database
- § Many database systems also provide a facility to set up a filter allowing user to browse through and view only those records that meet some criterion

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Searching a Database

Commonly supported features for enabling a user to search for desired information in a database are:

- § *Find command*: Used for simple database queries
- § *Query language*: Used for more complex database queries
- § *Query By Example (QBE)*: Provides a simple user interface for specifying search criteria

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Creating Reports

- § Reports are generated by using report generator of a database system to assemble the output of a database query in desired format
- § Report generator enables user to specify layout of the report, titles & subtitles for the report, column headings for various fields, and other elements to make the report appear more presentable

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Sample Output of Report

LIST OF EMPLOYEES WHO BELONG TO PUNE
DATE: DECEMBER 15, 2007

LAST NAME	FIRST NAME	ADDRESS-1	ADDRESS-2	TELEPHONE NUMBER
Gupta	Rajiv	A-12, Nandanvan	M. G. Road	4623-4892
Murli	Tapan	A-11, Vrindavan	Pashan Road	5863-4905
Pandey	Rupa	D-18, Vrindana	Pashan Road	5865-3236
Raina	Pushpa	C-15, Sarita Vihar	Aundh Road	5755-8328
Ray	Suhas	B-05, Royal Villa	M. G. Road	4685-6356
Sen	Prakash	B-16, Anand Park	Aundh Road	5762-3333
Singh	Deepak	A-22, Anand Park	Aundh Road	5728-6287

The report is sorted to present the list in alphabetical order of their last name

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Key Words/Phrases

- Activity ratio
- Backup file
- Collision
- Copying
- Data
- Data Definition Language (DDL)
- Data dependence
- Data dictionary
- Data file
- Data integrity
- Data Manipulation Language (DML)
- Data processing
- Data redundancy
- Data storage hierarchy
- Database
- Database administrator
- Database Management System (DBMS)

- Database model
- Direct file
- Field
- File
- File Management System (FMS)
- File utilities
- Filter
- Hashing
- Hashing algorithm
- Hierarchical database
- Index file
- Indexed sequential file
- Information
- Master file
- Merging
- Network database
- Output file
- Peripheral Interchange Program
- Primary key

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Key Words/Phrases

- Query By Example
- Query language
- Record
- Relational database
- Report file
- Report Generator
- Schema
- Searching
- Secondary key
- Secondary key
- Sequential file
- Sorting
- Transaction file
- Tuple

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