United States International University-Africa

DATABASE SYSTEMS

Presented by Prof. Elisha T. Opiyo Omulo

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WEEK 1 AGENDA

- Importance of the Course: DATABASE SYSTEMS
- SOME IMMEDIATE TERMINOLOGIES- data, information, database, database management system
- Limitations of conventional (traditional) file processing systems
- Advantages of the database approach, compared to traditional file processing
- Costs and risks of the database approach
- The components of a typical database environment
- The roles of individuals who design, implement, use, and administer databases

Course Textbook: Carlos Coronel, Steven Morris, Peter Rob and Keeley Crockett Database Principles: Fundamentals of Design, Implementation, and Management, 14th Edition, 2022, ISBN-13978-0357673034.

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Importance of the Course: DATABASE SYSTEMS

- **Part of the curriculum and is compulsory- you must take and pass it;**

- **Data is an asset and managing it is important for individuals and organizations;**

- **Information is vital in decision making and managing it is critical for individuals and organizations;**
- **You can build a career out of the skills in Database Systems- eg. Database Administrator;**
- **Data storage and information management form virtually every aspect of applications.**

Task: Do you agree that data and information are assets? Support your stand with some reasons.

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SOME IMMEDIATE TERMINOLOGIES

Data- measurable features or attributes of things in the environment

feature or attribute- used to describe things

environments- any part of the universe eg this room, university, area, country, body, etc.

things- entities in the environments

at the University- students, staff, furniture, roads, trees, etc

student- features- height, age, hobbies, address

each feature is measurable- ie assigned a value eg height

is a number or a description eg tall, short, etc.

Task: Can we have something that has no data? More examples of data?

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SOME IMMEDIATE TERMINOLOGIES

Information- data that has been processed and is useful (in decision making, answering some questions, increasing knowledge)

Data → Processing → Information

Re-arrange in some order

Select

Analyze(mean, deviations, max, min, median,etc)

Task: Can data act as information? Can an organization survive without information management?

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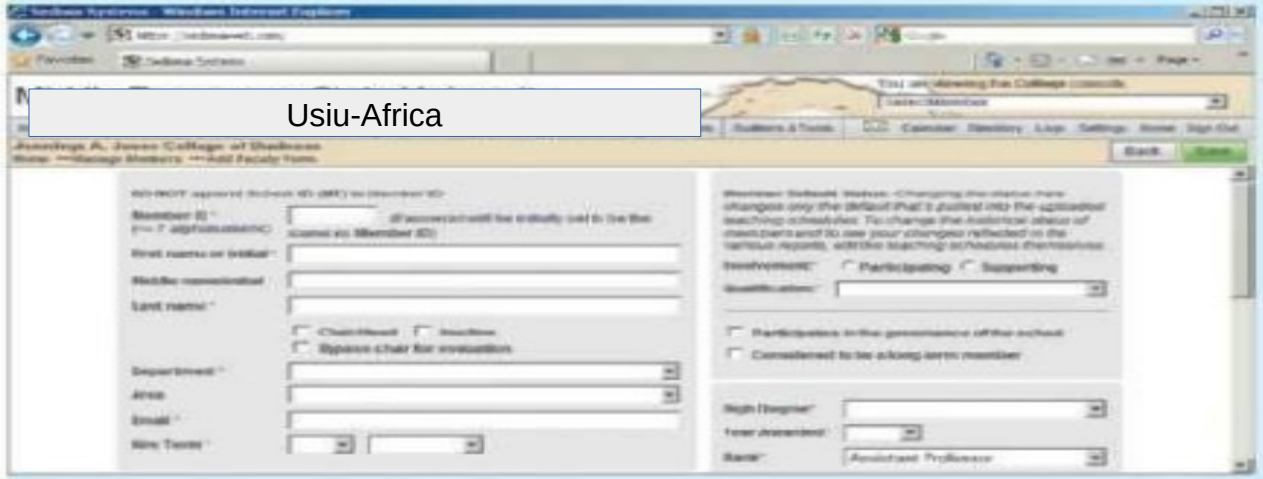
SOME IMMEDIATE TERMINOLOGIES

Data/Information

a) Data entry screen

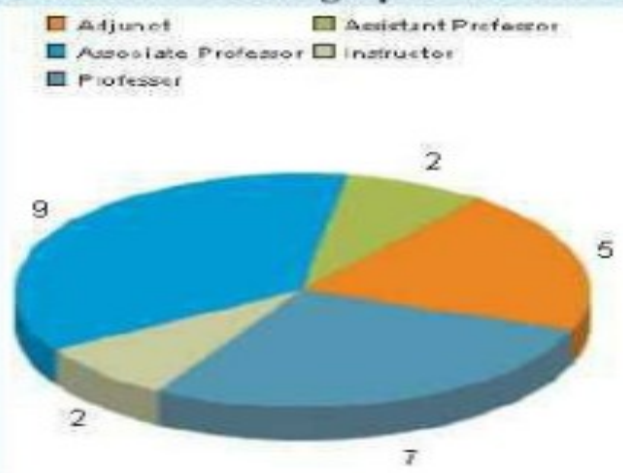


b) Raw data

c) Information in summary format

Rank	COUNT	%/INFS	TOT/COL	%/COL. TOT.	%/COL. FAC.
Adjunct	5	20.00%	23	21.74%	3.27%
Assistant Professor	2	8.00%	28	7.14%	1.31%
Associate Professor	9	36.00%	37	24.32%	5.88%
Instructor	2	8.00%	18	11.11%	1.31%
Professor	7	28.00%	47	14.89%	4.58%

d) Information in graphical format



SOURCE: Course Technology/Cengage Learning Data entry screen courtesy of Sedona Systems, 2011. Information screens courtesy of JCBDashboard, 2011.

SOME IMMEDIATE TERMINOLOGIES

Database

A database is a shared, integrated computer structure that stores a collection of:

- **End-user data—that is, raw facts of interest to the end user.**
- **Metadata, or data about data, through which the end-user data are integrated and managed.** **(Course Textbook)**

A database is a shared collection of logically related data (and description of this data) designed to meet the information needs of an organization.

(Thomas M. Connolly, Carolyn E. Begg (2021). Database Systems: A Practical Approach to Design, Implementation, and Management. Published by Pearson (July 14th 2021). ISBN-13: 9780137517053)

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SOME IMMEDIATE TERMINOLOGIES

Database

Database name: Ch01_Text

Table name: EMPLOYEE

Employee_ID	Employee_FName	Employee_LName	Employee_HireDate	Employee_Title
02345	Johnny	Jones	2/14/1993	DBA
03373	Franklin	Johnson	3/15/2000	Purchasing Agent
04893	Patricia	Richards	6/11/2002	DBA
06234	Jasmine	Patel	8/10/2003	Programmer
08273	Marco	Bienz	7/28/2004	Analyst
09002	Ben	Joiner	5/20/2006	Clerk
09283	Juan	Chavez	7/4/2008	Clerk
09382	Jessica	Johnson	8/2/2008	Database Programmer
10282	Amanda	Richardson	4/11/2009	Clerk
13383	Raymond	Matthews	3/12/2010	Programmer
13567	Robert	Almond	9/30/2010	Analyst
13932	Megan	Lee	9/29/2011	Programmer
14311	Lee	Duong	9/1/2012	Programmer

Table name: CERTIFIED

Employee_ID	Skill_ID	Certified_Date
02345	100	2/14/1993
02345	110	8/8/1999
02345	180	2/14/1993
03373	120	6/20/2007
04893	180	6/11/2002
04893	220	9/20/2008
06234	110	8/10/2003
06234	200	8/10/2003
06234	210	1/29/2008
08273	110	3/8/2005
08273	190	8/19/2008
09002	110	5/16/2009
09002	120	5/16/2009
09382	140	8/2/2008
09382	210	8/2/2008
09382	220	5/1/2009
13383	170	3/12/2010
13567	130	9/30/2010
13567	140	5/23/2011
14311	110	9/1/2012

Table name: SKILL

Skill_ID	Skill_Name	Skill_Description
100	Basic Database Management	Create and manage database user accounts.
110	Basic Web Design	Create and maintain HTML and CSS documents.
120	Advanced Spreadsheets	Use of advanced functions, user-defined functions, and macroing.
130	Basic Process Modeling	Create core business process models using standard libraries.
140	Basic Database Design	Create simple data models.
150	Master Database Programming	Create integrated trigger and procedure packages for a distributed environment.
160	Basic Spreadsheets	Create single tab worksheets with basic formulas.
170	Basic C# Programming	Create single-tier data aware modules.
180	Advanced Database Management	Manage Database Server Clusters.
190	Advanced Process Modeling	Evaluate and Redesign cross-functional internal and external business processes.
200	Advanced C# Programming	Create multi-tier applications using multi-threading.
210	Basic Database Manipulation	Create simple data retrieval and manipulation statements in SQL.
220	Advanced Database Manipulation	Use of advanced data manipulation methods for multi-table inserts, set operations, and correlated subqueries.

SOURCE: Course Technology/Cengage Learning

Source: Course Text page 48

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SOME IMMEDIATE TERMINOLOGIES

Database Management System (DBMS)

DBMS is a collection of programs that manages the database structure and controls access to the data stored in the database. In a sense, a database resembles a very well-organized electronic filing cabinet in which powerful software (the DBMS) helps manage the cabinet's contents. (Course Text page: page 41)

PRODUCT	NUMBER OF USERS			DATA LOCATION		DATA USAGE		XML
	SINGLE USER	MULTIUSER		CENTRALIZED	DISTRIBUTED	OPERATIONAL	ANALYTICAL	
		WORKGROUP	ENTERPRISE					
MS Access	X	X		X		X		
MS SQL Server	X[3]	X	X	X	X	X	X	X
IBM DB2	X[3]	X	X	X	X	X	X	X
MySQL	X	X	X	X	X	X	X	X
Oracle RDBMS	X[3]	X	X	X	X	X	X	X

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SOME IMMEDIATE TERMINOLOGIES

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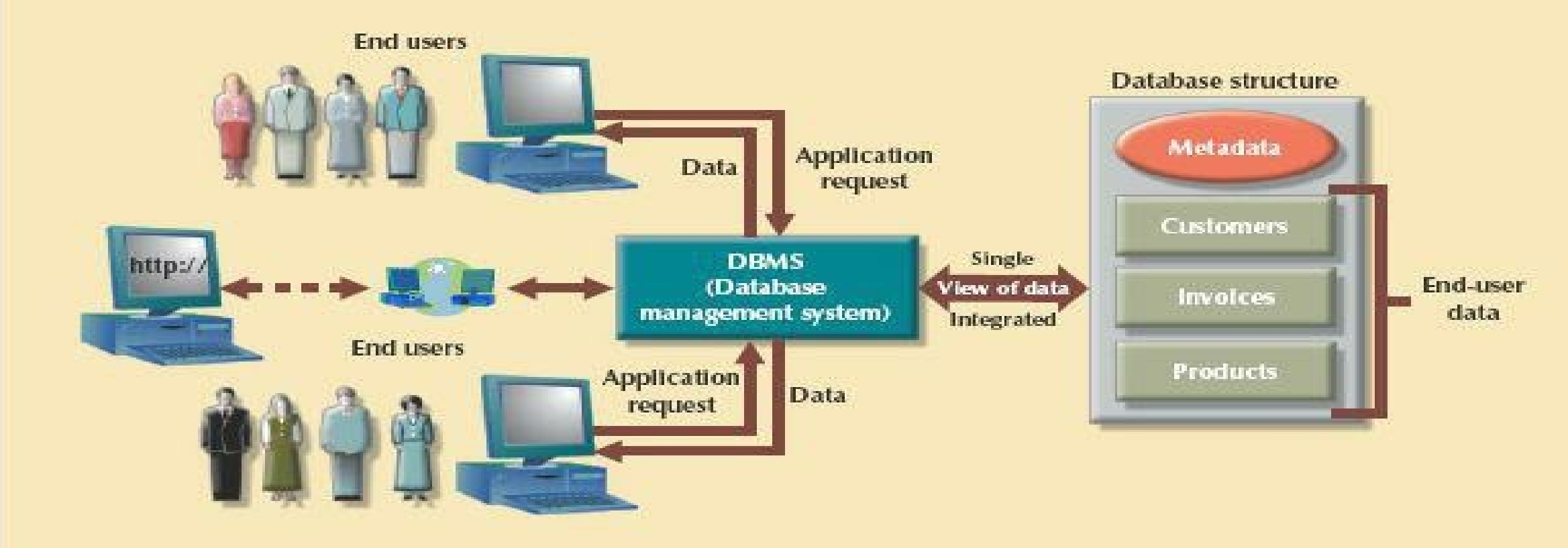

Course Text page 42

Limitations of conventional (traditional) file processing systems

Conventional (Traditional) File based systems- use application programs to give the services that they need. Each program manages its own data files.

Problems

- **Separation and isolation of data- data stored in different files, hard to access data and process data from more than one file.**
- **Duplication of data- similar data is kept in different files and places(departments); wasteful and leads to loss of data integrity (eg. which name?); Anomalies- updates, insertion, deletion- data losses and integrity issues;**
- **Data dependence- program code define file structures making it hard to make any modifications; programs and data are coupled together; changes in either affects the other ie. changing data changes the programs and vice versa.**
- **Incompatibility of files- different programs will have their own file formats, cobol, c.**
- **Fixed queries/proliferation of application programs- different queries require their own application programs.**

Task: Summarize the limitations of conventional(traditional) file

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Limitations of conventional (traditional) file processing systems

- **Lengthy development times- even the simplest data-retrieval task requires extensive programming, specifying what must be done and how to do it;**
- **Difficulty of getting quick answers- ad hoc queries almost impossible;**
- **Complex system administration- many files and each file must have its own file management programs that allow the user to add, modify, and delete records; to list the file contents; and to generate reports;**
- **Lack of security and limited data sharing- creating data management and reporting programs, security and data-sharing features are difficult to program and consequently are often omitted from a file system environment.**
- **Extensive programming occurs since changing just one field in the original CUSTOMER file would requires many activities such as: Read a record from the original file; transform the original data to conform to the new structure's storage requirements; write the transformed data into the new file structure; repeat the preceding steps for each record in the original file.**

Task: Summarize the limitations of conventional(traditional) file

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Advantages of the database approach, compared to traditional file processing

- **Improved data sharing- end users have better access to more and better-managed data.**
- **Improved data security- A DBMS provides a framework for better enforcement of data privacy and security policies.**
- **Better data integration- a well-managed data promotes an integrated view of the organization's operations and a clearer view of the big picture.**
- **Minimized data inconsistency- data stored in the same place will be generally the same after any operations and will be seen the same by the users.**
- **Improved data access-it is possible to produce quick answers to ad hoc queries.**
- **Improved decision making- generate better-quality information, on which better informed decisions are arise.**
- **Increased end-user productivity - empowers end users to make quick, informed decisions due to data and tools that are available.**

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Costs and risks of the database approach (Pg. 66)

- **Increased costs- require sophisticated hardware and software and highly skilled personnel. The cost items include: hardware, software, and personnel, Training, licensing, and regulation compliance costs.**
- **Management complexity- they have significant impact on a company's resources and culture; the changes must be properly managed; data accessed from multiple sources also require that the security issues are addressed.**
- **Maintaining currency- keep updated and current; perform frequent updates and apply the latest patches and security measures to all components.**
- **Vendor dependence- due to the heavy investment in technology and personnel training, companies might be reluctant to change database vendors. This locks them.**
- **Frequent upgrade/replacement cycles- vendors frequently upgrade their products by adding new functionality; new features often come bundled in new upgrade may require hardware upgrades. These also lead to costs to train database users and administrators to properly use and manage the new features.**

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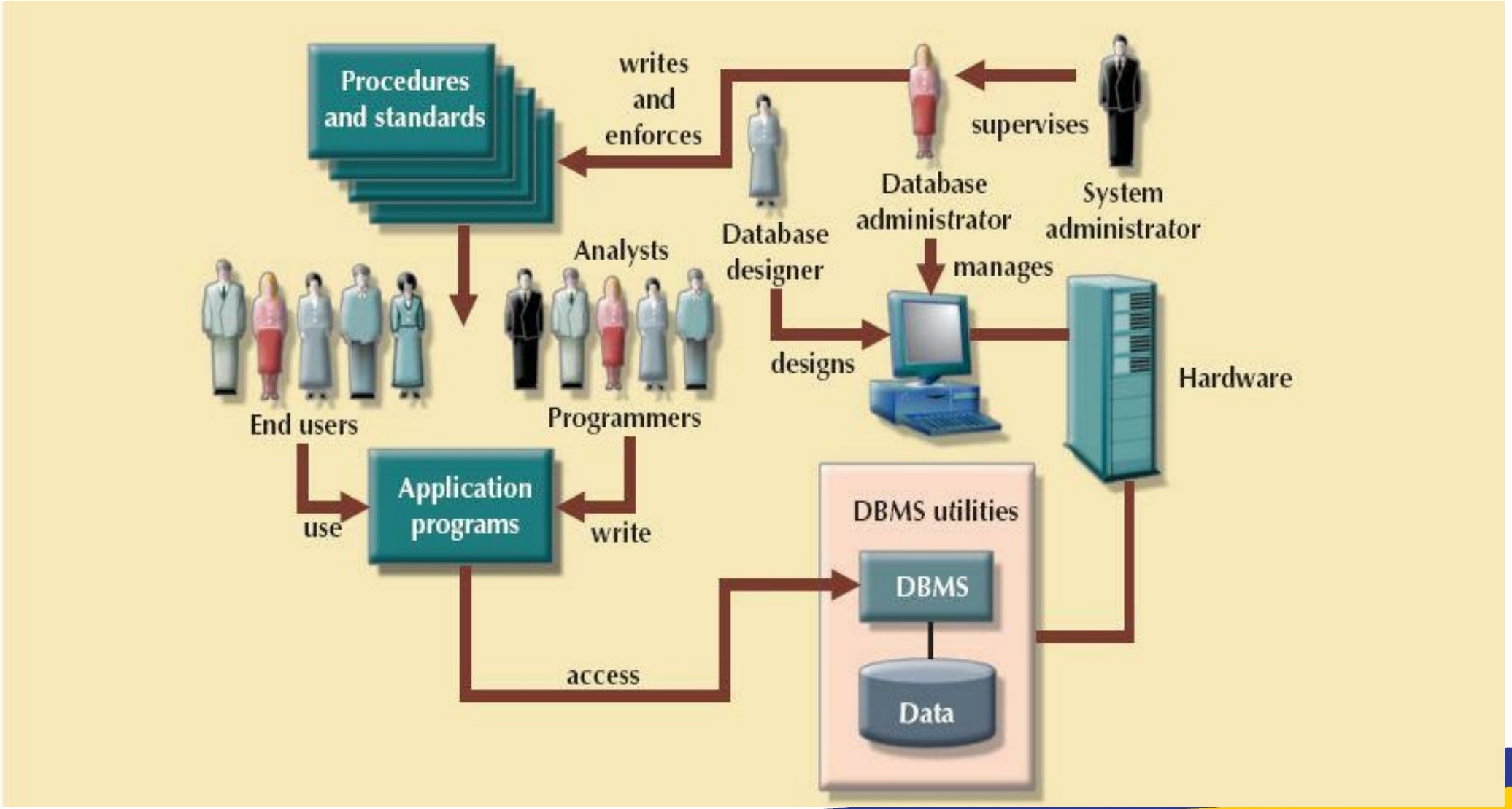
The components of a typical database environment (Pg. 60)



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The components of a typical database environment

- **Hardware - physical devices, including computers (PCs, workstations, servers, and supercomputers), storage devices, printers, network devices (hubs, switches, routers, fiber optics), and other devices (automated teller machines, ID readers).**
- **Software – three main types: operating system software; DBMS software; and application programs and utilities.**
  - **Operating system software eg. MS Windows, Linux, Mac OS, UNIX, and MVS.**
  - **DBMS eg. MS SQL Server, Oracle Corporation's Oracle, MySQL, and IBM's DB2.**
  - **Application programs and utility software;**
- **People - all users of the database system eg. system administrators, database administrators, database designers, system analysts and programmers, and end users.**

- **Procedures- instructions and rules that govern the design and use of the database system.**
- **Data- facts stored in the database. They are the raw material from which information is generated.**

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The roles of individuals who design, implement, use, and administer databases

- **System administrators- oversee the database system's general operations.**
- **Database administrators, also known as DBAs- manage the DBMS and ensure that the database is running or working properly.**
- **Database designers design the database structure- are the database architects.**
- **System analysts and programmers- design and implement the application programs.**
- **End users- use the application programs to run the organization's daily operations eg. sales clerks, supervisors, managers, and directors.**

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Week 1 Exercises

1)Explain advantages of the database approach, compared to traditional file processing.
2)Identify several costs and risks of the database approach.
3)List and briefly describe nine components of a typical database environment.
4)Explain the roles of individuals who design, implement, use, and administer databases

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Thank You