Geographic Information System (GIS)

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Data Management

Introduction

- Data Management: Is the process of storing and retrieving data.
- There are two approaches for spatial data management:

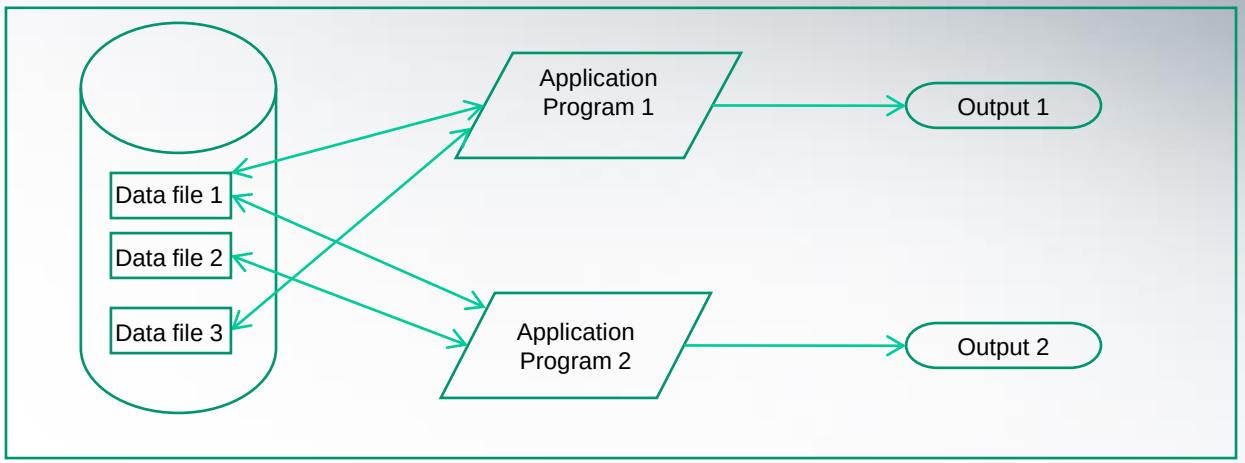
1. File Processing.
2. Database management Environment (DBMS).

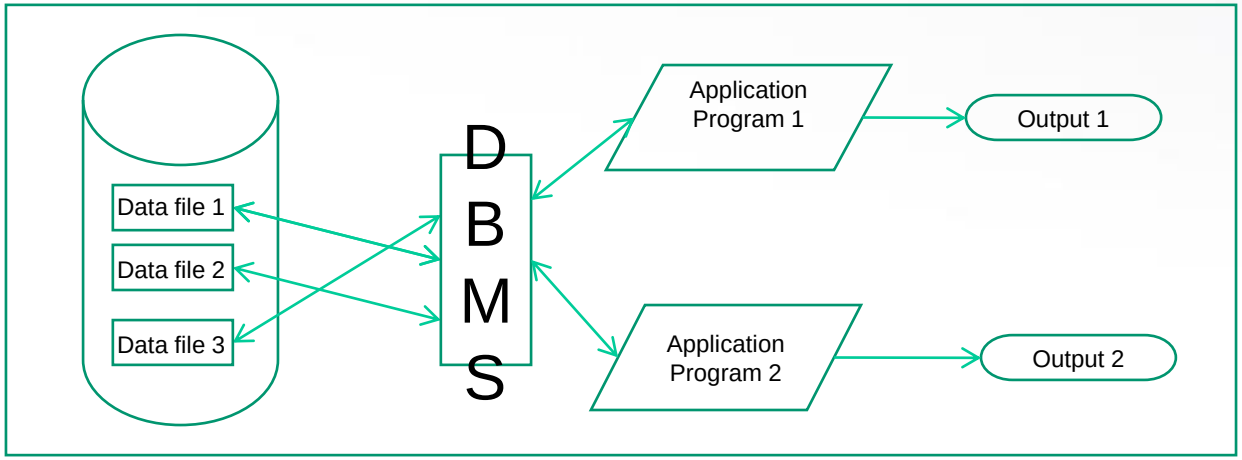
- DBMS: Is a set of programs that manipulate and maintain the data in a database.

File Processing Vs DBMS

- DBMS approach provide data independence. That is, the application program does not need to know how the data is physically stored because all access to the data base is via the DBMS.
- File processing is the most common approach to using a data base. However, it has some serious drawbacks. Since each application program must directly access each data file that it uses, the program must know how the data in each file are stored. This can create considerable redundancy because the instructions to access a data file must be present in each application program. If modifications are made to the data file, these access instructions must be modified in each application program.

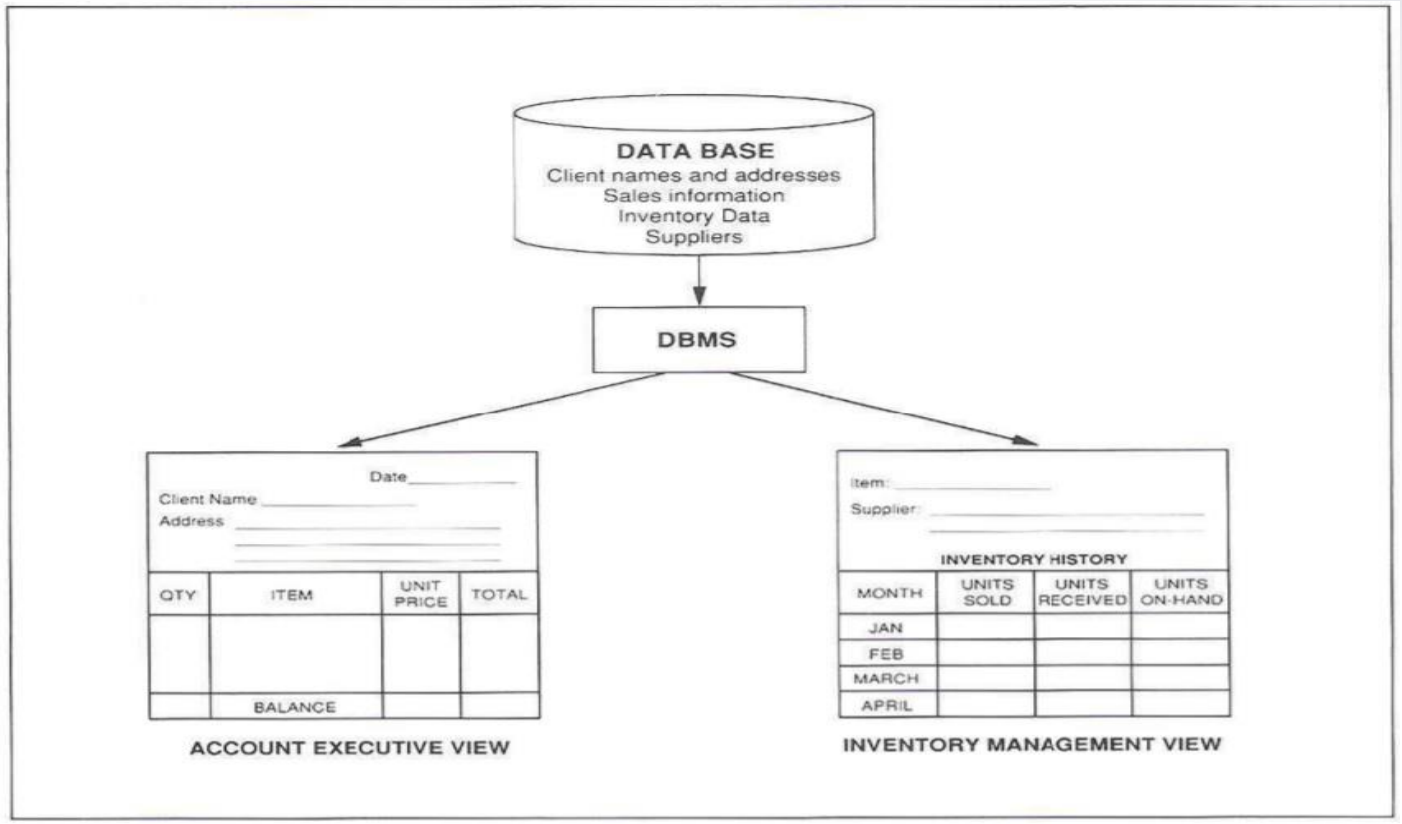
File Processing Vs DBMS





Views & the DBMS

- By providing different views , the D BMS tailors the database to each user group — a very valuable function — without storing multiple copies o f all the data.



Advantages Of The Database Approach

- Centralized Control. A single DBMS under the control of one person or group can ensure that data quality standards are maintained.
- Data Can Be Shared Efficiently. Using a DBMS , the information in a database can b e shared in a flexible yet controlled manner.
- Data Independence. Application programs are independent of the physical form in which the data are stored .
- Easier Implementation of New Data Base Applications. New application programs and unique database searches can be easily implemented using the services provided by a DBMS.

Advantages Of The Database Approach cont.

- Direct User Access. Database systems provide a user interface so that non -programmers can perform sophisticated analyses.
- Redundancy Can Be Controlled. In a file processing environment, separate data files are used for each application and data redundancy may result.
- User Views. A DBMS can provide a convenient user interface to create and maintain multiple user views.

Disadvantages Of The Database Approach cont.

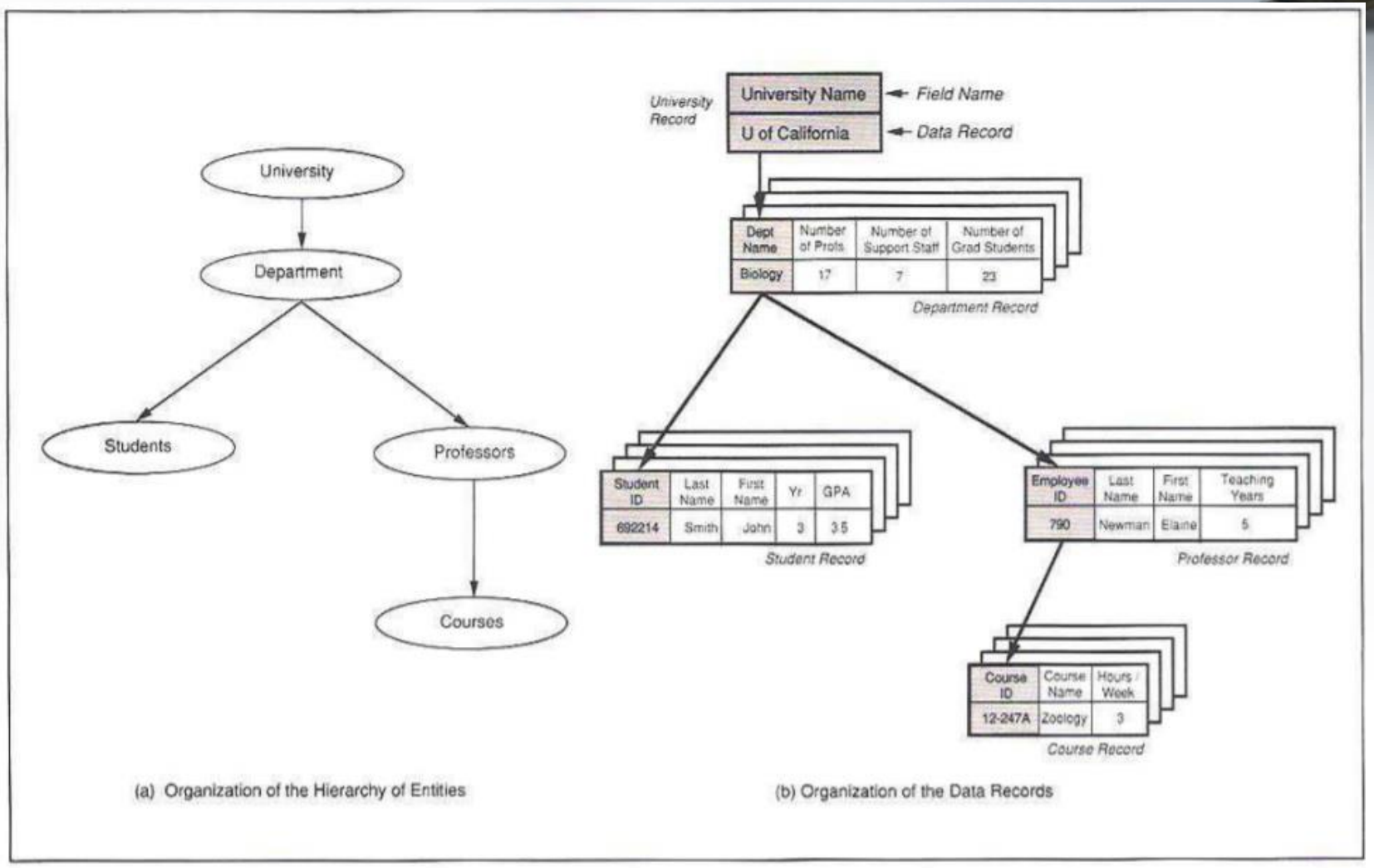
- Cost. The database system software and any associated hardware can be expensive.
- Added Complexity. A database system is more complex than a file processing system.
- Centralized Risk. In centralizing the location of data and reducing data redundancy, there is a greater risk of loss or corruption of data. However, the backup and recovery procedures normally provided in a DBMS minimize these risks.

Three Classic Database Models

- The conceptual organization o f a database is termed the data model.
- There are three classic data models that are used to organize electronic databases :

  - The Hierarchical Model.
  - The Network Model.
  - The Relational Models .

The Hierarchical Model



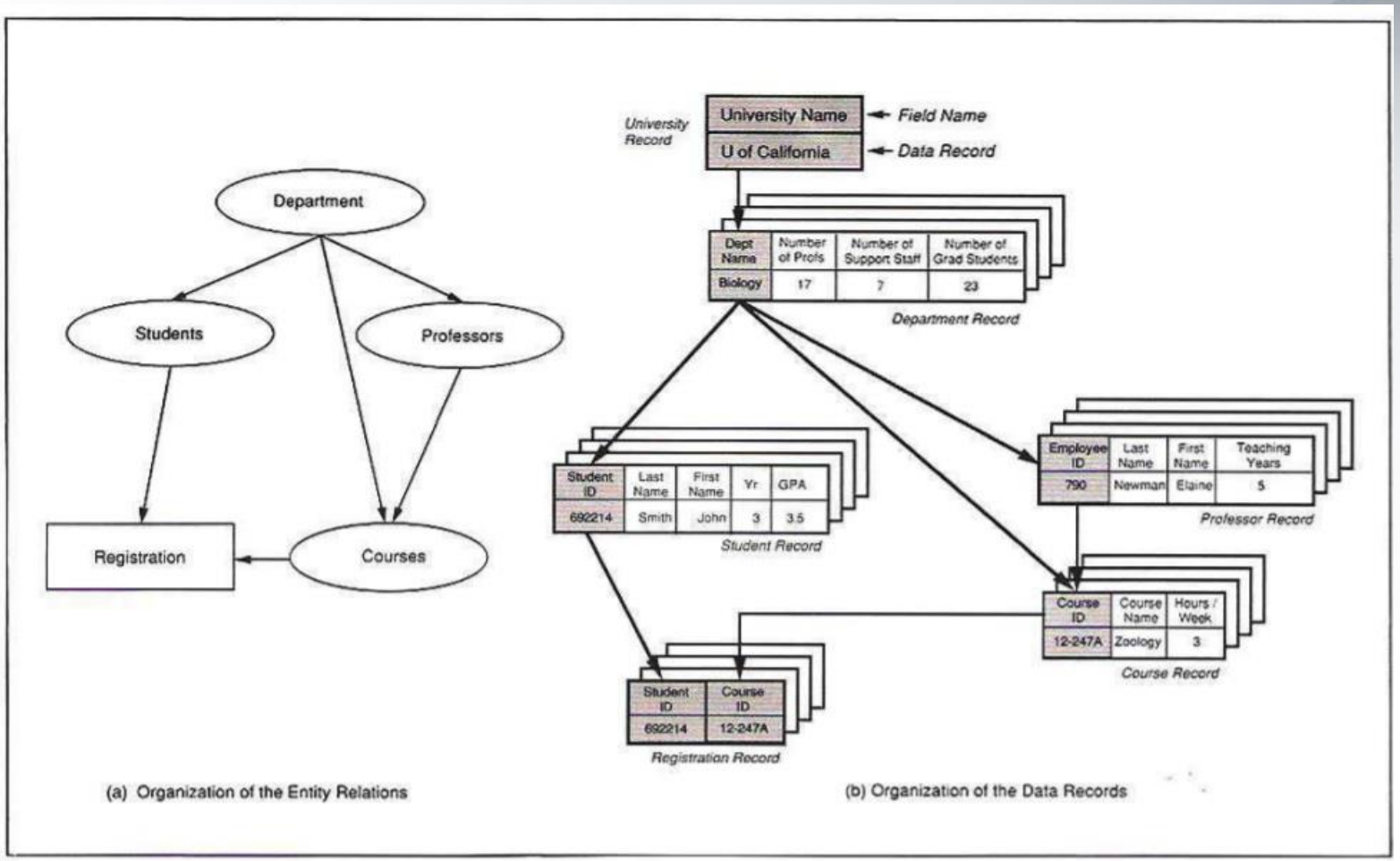
(a) Organization of the Hierarchy of Entities

(b) Organization of the Data Records

The Hierarchical Model

- The data are organized in a tree structure
- The top of the hierarchy is termed the **root.**
- Every element has one higher level element related to it, termed its **parent,** and one or more subordinate elements, termed **children.**
- Every relation is a many-to-one relation or a one-to-one relation.
- In a hierarchical data model, information is retrieved by traversing the tree structure.

The Network Model



The Network Model

- The network data model overcomes some of the inflexibility of the hierarchical model.
- In the network data model, an entity can have multiple parents as well as multiple child relations and no root is required.
- As a result, data records can be directly searched without traversing the entire hierarchy above that record.
- While the network model does not allow many-to-many relations, this relation can be handled indirectly by using an intermediate relation, often termed **an intersection record.**

The Relational Data Model

1. Course Information

Professor ID	Course Dept	Course Name	Course Hours	Course ID
790	Biology	Zoology	3	12-247A
745	Chemistry	Organic	4	14-200A
807	Chemistry	Organic	4	14-200B
642	Chemistry	Biochem	5	14-280A
689	English	Medieval	3	17-340A

2. Registration Information

Course ID	Student ID
12-247A	692214
14-200B	692214
17-340A	692214
17-340A	728437
14-200B	728437
14-280A	728437
14-200B	745870

3. Student Information

Student ID	Last Name	First Name	Yr	GPA	Dept
692214	Smith	John	3	3.5	Biology
728437	Green	John	2	2.4	English
745870	Thomas	Randy	4	3.7	Physics

4. Department Information

Dept Name	Number of Professors	Number of Support Staff	Number of Graduate Students
Biology	17	7	23
Chemistry	10	8	7
English	11	3	20
French	5	1	15
Physics	6	3	8

5. Professor Information

Professor ID	Last Name	First Name	Teaching Years	Dept
745	Brown	Al	5	Chemistry
790	Newman	Elaine	5	Biology
807	Ross	Grant	4	Chemistry
642	Geist	Val	8	Biology
689	Colwell	Bob	8	English

The Relational Data Model

- In the relational data model, there is no hierarchy of data fields within a record; every data field can be used as a key.
- The data are stored as a collection of values in the form of simple records, termed **tuples.**
- Each tuple represents a fact, i.e. a set of permanently related values. The tuples are grouped together in two-dimensional tables, with each table usually stored as a separate file.
- The table as a whole represents the relationships among all the attributes it contains and so it is often termed a **relation.**
- Using the relational model, a search can be made of any single table using any of the attribute fields, singly or together.
- Searches of related attributes that are stored in different tables can be done by linking two or more tables using any attribute they share in common (**join**).

Advantages of the Relational model over the Hierarchical and Network models

- The relational model is more flexible than the other models. The way the data are stored in the relational tables does not restrict the kinds o f processing that can be done.
- The organization of the relational model is simple to understand.
- The same database can generally be represented with less redundancy using the relational model.

Thank You

Questions ??