The structure of a data base inside the computer and the apparent structure of the data base as “seen” by the users that interact with it can be different, and in most cases should be different. These are the physical and logical views of the data base.

- A data base is a set of tables
- The tables are sets of records composed of fields each which has values that are primitive data types
- The tables must store the information in a way that avoids redundancy, so as to prevent the possibility that repeated instances of the same data become inconsistent
- But the best structure for storage may not be the best structure for users … synthesize a view for users
Terminology

- The structure of a data base is called a data base schema.
- The schema specifies:
  - The list of table names forming the database
  - For each table, the fields of its records
  - For each field, its attributes or properties, i.e. data type, key or not key, default value, etc.
- A data base as the word is normally used, i.e. tables with specific contents, is known as a data base instance (of a data base schema)
- There can be many instances of a single data base schema.

Designing A Data Base Schema

- Suppose a college wants a data base of their students, faculty, courses taught, student transcripts, and so forth, what things should go into a design and how should it be organized?
  - Students: first name, last name, home address, transcript …
  - Faculty: first name, last name, SS#, home address, rank …
  - Courses: class name, number, students attending, grades …
- Deciding on the schema is called “data base design” and it takes a little study to do right … but it’s easy to see the principles in action.
Go To Access ...

- Using the Access Data Base System, use the wizard to create a Students and Class data base

An Example Data Base Schema

- Consider the Students & Classes DB from Access

Tables of the Students and Classes data base ... click on the [Design] button to show the record structure and field properties

Switchboard is special table constructed by Access to navigate the user interface. Ignore it in the following discussion
More Of The S&C DB Schema

The Design windows give the remaining structural information for the database schema ... notice how Classes, Students etc have unique IDs.

The User’s View

A database system gives users a view of the DB that is meaningful to them, but may be synthesized from tables actually forming the data base.
Consider A Student's List Of Classes

Though the admin information at the top comes from the Classes table, the class list at the bottom is not stored explicitly in any table. It is synthesized.

Synthesizing The Class List

- One table -- Students And Classes -- contains records that associate students with classes

By listing all records with CSE100's ClassID, a table is created of the students in CSE100 by StudentID

By looking up each student using StudentID, the other fields of the class list can be located
**Why Use This Schema?**

- Associating a student with a class is the logical idea behind registering for a class, so Students & Classes corresponds to a real phenomenon -- a plus
- Having classes listed in the student record violates the fixed length record condition, and makes it cumbersome to create a class list -- minuses
- Having students listed in the class record violates the fixed length record condition, and makes it cumbersome to create a registration list for each student -- minuses
- “Registering students” -- what STAR does -- can be done without touching either Students or Classes tables -- a plus

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**Not All Views Are Synthesized**

- Most tables will be of interest on their own, too

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**Instructors Table**

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor</td>
<td>Text</td>
</tr>
<tr>
<td>PhoneNumber</td>
<td>Text</td>
</tr>
<tr>
<td>Extension</td>
<td>Text</td>
</tr>
</tbody>
</table>

---

**Instructors**

- Instructor III
- Instructor: Snyder
- Phone Number: (000) 543-9205
- Extension

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Another Example

The personal information in this form comes from the Students table, but how is the class schedule created?

How Was Access Created?

That's right! Its Visual Basic … The Access data base application differs from your programming by being larger and more complex.