Relational Data Model

• **Essential Elements**
  - **Data structure** - data are organized in the form of tables (relations) with rows and columns
  - **Data integrity** - Facilities are included to specify (business) rules that maintain the integrity of the data when they are manipulated.
  - **Data manipulation** - Powerful operations (using the SQL language) are used to manipulate data stored in the relations

• **How will this help you?**
A relation is a named, two-dimensional table of data. Each relation (or table) consists of a set of named columns and an arbitrary number of unnamed rows. Each row of a relation corresponds to a record that contains data (attribute) values for a single entity.

- **RECORD**: a row of a relation, data for single entity
- Unique to relational database?

**Representing Relations**

**TEXT:**
Employee1 (Emp_ID, Name, Dept, Salary)

**GRAPHICAL:**

<table>
<thead>
<tr>
<th>Emp_ID</th>
<th>Name</th>
<th>Dept</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Relational Keys

• Setting the Stage:
  – Observation: Databases can have tens/hundreds of relations,
    Relations can have thousands of records
  – Challenge: Retrieving data, Capturing relationships among data

• Primary Key - Attribute that uniquely identifies each row/record in a relation
  Employee1 (Emp_ID, Name, DeptName, Salary)
  Department (DeptName, Location, Fax)
  – Question: Can 2 relations have same primary key?
  – Question: Can 2 records in a relation have same primary key?
  – Question: How are “key” and “keyword” related (from classroom prep, “Key is similar to a keyword when doing a
    search. It is a word or attribute that represents the context of a
    particular article/table/information at the highest level of
    significance.”) Is this correct?
  – Question: Why important?

• Foreign Key - Attribute in a relation of a database that serves
  as the primary key of another relation in the same database.
  Employee1 (Emp_ID, Name, DeptName, Salary)
  – Question: Why important?

NOTE: This terminology is embedded in relational database software!
Integrity Constraints

• **Perspectives**
  – **From the book:**
    • Facilitate maintaining the accuracy / integrity of data in database.
  – **From class prep:**
    • ensure data have same nature throughout the system,
    • keep data from being inaccurate (bad),
    • prevents errors from occurring,
    • a rule that helps maintain the quality of data.
  – **Integrity (from Merriam-Webster)**
    • 1) firm adherence to a code (Incorruptibility)
    • 2) an unimpaired condition (Soundness)
    • 3) the quality or state of being complete or undivided (Completeness)

• **Important Types**
  – **Defined as constraints**
    • What are constraints on data to ensure “integrity”?
  – **Domain Constraints**
    • Clarifies allowable attribute values
    • Includes data type, length, allowable values
  – **Entity Constraints**
    • No primary key attribute may be null
    • Null is not the same as empty!
  – **Referential Constraints**
    • If there is a foreign key in one relation, either each foreign key value must match a primary key value in the other relation of else the foreign key value must be null.

➔ **Bottom Line:** Integrity constraints ensure certain types of “accuracy” or soundness (domain, entity, referential) in data. However, just as a spell checker or grammar checker cannot ensure perfection in a document, integrity constraints cannot ensure accuracy in data (you can still enter inaccurate information and make mistakes). At the same time, integrity constraints ensure that certain rules are followed!