Database Design

2-2

Entities, Instances, Attributes, and Identifiers
Objectives

This lesson covers the following objectives:

• Define and give an example of an entity
• Distinguish between an entity and an instance of an entity
• Name and describe attributes for a given entity
• Distinguish between an attribute and its value
• Distinguish between mandatory and optional attributes, and between volatile and nonvolatile attributes
• Select and justify a unique identifier (UID) for an entity
Purpose of Entities

• Knowing how to organize and classify data makes it possible to draw useful conclusions about seemingly random facts.

• Our technology-rich world produces vast quantities of facts in need of structure and order.

• It is important to learn about entities because they are the things about which we store data.

• For example:

  – A school needs to store data about (as a minimum): STUDENTs, TEACHERs, COURSEs, ROOMs, GRADEs.
Purpose of Attributes

• It is important to learn about attributes because they provide more specific information about an entity.

• Attributes help you distinguish between one instance and another by providing greater detail for the entity.

• For example:
  – In a restaurant, you need to list the individual items on a customer’s order so that you can calculate the bill.
  – When building several sales reports, you must be able to identify a specific report from the list of reports.
Purpose Unique Identifiers

• What about unique identifiers? It is important to learn about unique identifiers because they distinguish one instance of an entity from another.

• For example:
  – In a classroom, you need to distinguish between one student and another.
  – When classifying your CD collection, you need to distinguish between one CD and another.
  – When listing transactions on a financial statement, you need to distinguish between one transaction and another.
Identifying Purpose

• Look at the magazine advertisements and the Internet sites identified by the teacher.
• What is the “main thing” that each ad or website is about?
Entity Defined

An entity is:

• “Something” of significance to the business about which data must be known
• A name for a set of similar things that you can list
• Usually a noun
• Examples: objects, events, people
• Entities have instances.
• An instance is a single occurrence of an entity.
# Entities and Instances

<table>
<thead>
<tr>
<th>Entities</th>
<th>Instances</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERSON</td>
<td>Mahatma Gandhi, George Washington</td>
</tr>
<tr>
<td>PRODUCT</td>
<td>Nike Air Jordan, Gibson Les Paul Custom</td>
</tr>
<tr>
<td>PRODUCT TYPE</td>
<td>Shoe, Video Game</td>
</tr>
<tr>
<td>JOB</td>
<td>Electrician, IT Technician</td>
</tr>
<tr>
<td>SKILL LEVEL</td>
<td>Beginner, Expert</td>
</tr>
<tr>
<td>CONCERT</td>
<td>U2 at the Palladium, Beyoncé at the Greek Theatre L.A.</td>
</tr>
<tr>
<td>ANIMAL</td>
<td>Dog, Cat</td>
</tr>
<tr>
<td>CAR</td>
<td>Volkswagen Beetle, Toyota Corolla</td>
</tr>
</tbody>
</table>
Entities and Instances

• A Dalmatian, a Siamese cat, a cow and a pig are instances of ANIMAL
• A convertible, a sedan and a station wagon are instances of CAR
• Some entities have many instances and some have only a few
• Entities can be:
  – Tangible, like PERSON or PRODUCT
  – Intangible, like SKILL LEVEL
  – An event, like CONCERT
Entities and Instances

• Is DOG an instance or an entity?
• It depends:
  – If we consider many different kinds of animals, it makes sense to think of the entity ANIMAL to include instances DOG, CAT, HORSE and so on.
  – But what if we run a dog-breeding business? We will need to keep data on many different breeds of dog, but not on other species of animal.
  – For a dog-breeder, it is more natural to think of an entity DOG to include instances TERRIER, POODLE, LABRADOR and so on.
What is an Attribute?

• Like an entity, an attribute represents something of significance to the business.

• An attribute is a specific piece of information that helps:
  – Describe an entity
  – Quantify an entity
  – Qualify an entity
  – Classify an entity
  – Specify an entity

• An attribute has a single value.
Attributes

- Attributes have values. An attribute value can be a number, a character string, a date, an image, a sound, etc.
- These are called "data types" or "formats." Every attribute stores one piece of data of one specific data type.

<table>
<thead>
<tr>
<th>Entities</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSTOMER</td>
<td>family name, age, shoe size, town of residence, email</td>
</tr>
<tr>
<td>CAR</td>
<td>model, weight, catalog price</td>
</tr>
<tr>
<td>ORDER</td>
<td>order date, ship date</td>
</tr>
<tr>
<td>JOB</td>
<td>title, description</td>
</tr>
<tr>
<td>TRANSACTION</td>
<td>amount, transaction date</td>
</tr>
<tr>
<td>EMPLOYMENT CONTRACT</td>
<td>start date, salary</td>
</tr>
</tbody>
</table>
Attributes

• What is the data type of each attribute in CUSTOMER?
• For example: family name is a character string. Attributes are single-valued. Each attribute can have only one value (at any point in time) for each instance of the entity.

<table>
<thead>
<tr>
<th>Entities</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSTOMER</td>
<td>family name, age, shoe size, town of residence, email</td>
</tr>
<tr>
<td>CAR</td>
<td>model, weight, catalog price</td>
</tr>
<tr>
<td>ORDER</td>
<td>order date, ship date</td>
</tr>
<tr>
<td>JOB</td>
<td>title, description</td>
</tr>
<tr>
<td>TRANSACTION</td>
<td>amount, transaction date</td>
</tr>
<tr>
<td>EMPLOYMENT CONTRACT</td>
<td>start date, salary</td>
</tr>
</tbody>
</table>
Attributes

- Some attributes (such as age) have values that constantly change.
- These are called volatile attributes.
- Other attributes (such as order date) will rarely change, if ever.
- These are nonvolatile attributes.
- If given a choice, select the nonvolatile attribute.
- For example, use birth date instead of age.
Attributes

• Some attributes must contain a value—these are mandatory attributes.

• For example: in most businesses that track personal information, name is required.

• Other attributes may either contain a value or be left null—these are optional attributes.

• For example: cell phone number is often optional except in mobile or wireless applications.
Attributes

• Example: Email address could be a mandatory attribute for EMPLOYEE in an email application, but an optional attribute for CUSTOMER in an online catalog.
Attributes

• If we were to model a Human Resource system, we would have an entity to store data for each worker called EMPLOYEE.

• What attributes does EMPLOYEE have?

• Give one or two examples of the values that each EMPLOYEE attribute might contain.
Identifiers

• An EMPLOYEE has a unique identifier (UID).
• A UID is either a single attribute or a combination of multiple attributes that distinguishes one employee from another.
• How do you find a specific employee that works for the company?
• What information uniquely identifies one EMPLOYEE?
Identifiers

• Think about all the students in the classroom.
• Each student is described by several traits or attributes.
• Which attribute or attributes allow you to pick a single student from the rest of the class?
• That is the student’s UID.
Terminology

Key terms used in this lesson included:

• Attribute
• Data type
• Entity
• Instance
• Mandatory
• Intangible
Terminology

Key terms used in this lesson included:

- Null
- Optional
- Single valued
- Tangible
- Unique identifier (UID)
- Volatile
Summary

In this lesson, you should have learned how to:

- Define and give an example of an entity
- Distinguish between an entity and an instance of an entity
- Name and describe attributes for a given entity
- Distinguish between an attribute and its value
- Distinguish between mandatory and optional attributes, and between volatile and nonvolatile attributes
- Select and justify a unique identifier (UID) for an entity