Objectives

- The basic concepts associated with the Entity-Relationship (ER) model, a high-level conceptual data model.
- A diagrammatic technique for displaying an ER model.
- How to identify problems called connection traps, which may occur when creating an ER model.

Entity-Relationship Modeling

Concepts of the ER Model

- Entity types
- Relationship types
- Attributes

Entity Type

- Entity Type
  - An object or concept that is identified by the enterprise as having an independent existence.

- Entity
  - An object or concept that is uniquely identifiable.

Examples of Entity Types

<table>
<thead>
<tr>
<th>Physical existence</th>
<th>Conceptual existence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff</td>
<td>Part</td>
</tr>
<tr>
<td>Property</td>
<td>Supplier</td>
</tr>
<tr>
<td>Customer</td>
<td>Product</td>
</tr>
<tr>
<td>Viewing</td>
<td>Sale</td>
</tr>
<tr>
<td>Inspection</td>
<td>Work experience</td>
</tr>
</tbody>
</table>

Examples of Entity

<table>
<thead>
<tr>
<th>Staff_No</th>
<th>SName</th>
<th>SAddress</th>
<th>Position</th>
<th>Salary</th>
<th>Branch_No</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL21</td>
<td>John White</td>
<td>19 Taylor St, London</td>
<td>Manager</td>
<td>50000</td>
<td>B5</td>
</tr>
<tr>
<td>SG37</td>
<td>Ann Rees</td>
<td>81 George St, Glasgow</td>
<td>Sr. Asst</td>
<td>12000</td>
<td>B3</td>
</tr>
<tr>
<td>SG14</td>
<td>David Ford</td>
<td>63 Ashby St, Glasgow</td>
<td>Deputy</td>
<td>18000</td>
<td>B3</td>
</tr>
<tr>
<td>S49</td>
<td>Mary Howe</td>
<td>2 Elm Pl, Aberdeen</td>
<td>Asst.</td>
<td>9000</td>
<td>B7</td>
</tr>
<tr>
<td>SG5</td>
<td>Susan Brand</td>
<td>5 Gr. Western Rd, Glasgow</td>
<td>Manager</td>
<td>21000</td>
<td>B3</td>
</tr>
<tr>
<td>SL41</td>
<td>Julie Lee</td>
<td>28 Malvern St, Kilburn</td>
<td>Asst.</td>
<td>9000</td>
<td>B5</td>
</tr>
</tbody>
</table>
**Entity Type**

- **Strong Entity Type (parent, owner, dominant)**
  - An entity type that is not existence-dependent on some other entity type.
- **Weak Entity Type (child, dependent, subordinate)**
  - An entity type that is existence-dependent on some other entity type.

**Relationship Types**

- **Relationship Type**
  - A meaningful association among entity types.
- **Relationship**
  - An association of entities where the association includes one entity from each participating entity type.

**Diagrammatic Representation of Strong and Weak Entity Types**

**Diagrammatic Representation of Relationship Type**

**Diagrammatic Representation of Weak Relationship Type**

**Degree of a Relationship**

- **Degree of a Relationship**
  - The number of participating entities in a relationship.
  - The entities involved in a particular relationship are referred to as participants.
  - The number of participants in a relationship is called the degree.
Binary Relationship called Owns

Ternary Relationship called SetsUp

Quaternary Relationship called Arranges

Recursive (Unary) Relationship

- Recursive Relationship
  - A relationship where the same entity participates more than once in a different roles.

Recursive Relationship called Supervises

Recursive (Unary) Relationship

- Role name
  - To indicate the purpose that each participating entity play in a relationship
Entities associated through two distinct Relationships

Attributes

- Attribute

  - A property of an entity or a relationship type.

Examples of Attribute

<table>
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<tr>
<th>Staff_No</th>
<th>SName</th>
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<td>B3</td>
</tr>
<tr>
<td>SA9</td>
<td>Mary How</td>
<td>2 Elm Pl, Aberdeen</td>
<td>Assistant</td>
<td>9000</td>
<td>B7</td>
</tr>
<tr>
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<td>Susan Brand</td>
<td>5 Gr Western Rd, Glasgow</td>
<td>Manager</td>
<td>21000</td>
<td>B3</td>
</tr>
<tr>
<td>SLA1</td>
<td>Julie Lee</td>
<td>28 Malvern St, Kilburn</td>
<td>Assistant</td>
<td>9000</td>
<td>B5</td>
</tr>
</tbody>
</table>

Examples of Attribute Domain

<table>
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Types of Attributes

- Simple Attribute vs. Composite Attribute
- Single-Valued Attribute vs. Multi-Valued Attribute
- Derived Attribute
Attributes

▶ Simple Attribute
  - An attribute composed of a single component with an independent existence.
  - Cannot be further subdivided as a meaningful information.
  - Ex. Sex, Salary

▶ Composite Attribute
  - An attribute composed of multiple components each with an independent existence.
  - Can be further divides.
  - Ex. Address can be divided into Street#, City, State, Zip

▶ Single-valued Attribute
  - An attribute that holds a single-value for a single entity.
  - Customer#, Branch#

▶ Multi-valued Attribute
  - An attribute that holds multiple values for a single entity.
  - Tel_No: 234-5678 and 456-7839

▶ Derived Attribute
  - An attribute that represents a value that is derivable from the value of a related attribute or set of attributes, not necessarily in the same entity.
  - Age attribute might be derived from DOB (Date of Birth) attribute
Types of Key

- Candidate Key
- Primary Key
- Composite Key

Keys

- Candidate Key
  - An attribute or set of attributes that uniquely identifies individual occurrences of an entity type.
  - Staff: Staff_No, >>>>>

Diagrammatic Representation of Attributes

Keys

- Primary Key
  - The candidate key selected to be a primary key
  - The consideration is based on:
    - attribute length (minimal)
    - current and future certainty of uniqueness
  - Staff_No

Keys

- Composite Key
  - A candidate key that consists of two or more attributes.
  - Staff: SName+Tel_No, SName+DOB
A relationship can also have its own attribute. The presence of one or more attributes assigned to a relationship may indicate that the relationship conceals an unidentified entity.

For example, the presence of the Date_View and Comments attributes on the Views relationship may indicate the presence of an entity called Viewing.