Entity Relationship Diagrams

SEEM 3430 Tutorial
What we cover today?

- What is ERD?
  - Definition
  - Building blocks
- How to draw ERDs
  - An exercise
Definition

• An approach for data modeling

• A database is divided into two logical parts:
  • Entities
  • Relationships

• Diagrams created to design entities and relationships are called entity-relationship diagrams
They look like this
They look like this
Building Blocks

- Entities
  - Real-world objects, e.g., student, book
  - Entity instance: a particular entity, e.g., Harry Potter
  - Represented by a named rectangle
  - Attributes and identifiers
- Relationships
Example of Entities
Attributes of Entities

• Entity characteristics

• Listed in the rectangles in Crow’s

• Derived attributes: can be reasoned/calculated from other attributes
  • Should they be put into the ERD?
Example of Entities

Employee Table:
- EMPLOYEE
- PK: EMP_NUM
- EMP_LNAME
- EMP_FNAME
- EMP_INITIAL
- EMP_DOB
- EMP_AGE

Instructor Table:
- Instructor
- PK: instructor_number
- instructor_name
- instructor_faculty
Identifiers

• Primary keys (PK):
  • Unique attributes
  • Distinguish characteristic of entities
  • Can be based on single or multiple attributes

• Foreign keys (FK):
  • Attributes that are primary keys of other entities
Example of Entities
Building Blocks

• Entities

• Relationships
  • An association among entities
  • Drawn as lines connecting entities
  • Example: an “owns” relationship between a company and a computer
  • Can you give more examples?
Examples of Relationships
Strong and Weak Relationships

• Strong Relationships: the FK of the related table is also involved in its PK, along with being the PK of another table
  - Drawn as solid lines in Crow’s

• Weak Relationships: the relationship is not strong
  - Sales had the Agent's ID (the Agent PK) as a FK, which is not its PK
  - Drawn as a dashed line in a Crow's Foot ERD
Examples of Relationships

Weak Relationship

Strong Relationships
Cardinalities of Relationships

- Cardinality specifies how many instances of an entity relate to one instance of another entity.
  - 1:1 relationship: one instance of the parent entity is associated with one instance of the child entity.
  - 1:M relationship: a single instance of a parent entity is associated with many instances of a child entity.
  - M:N relationship: many instances of a parent entity can relate to many instances of a child entity.
Cardinalities of Relationships

• Optional: When the 'parent' does not require a 'child' to be present
  • In Crow's Foot a circle is added to the related entity's end
  • It allows some entities not to involve in the relationship

• Mandatory: There is an entity required on each end for the relationship to make sense
  • In Crow's Foot no circle is assumed mandatory
  • All entities are required to involve in the relationship
How to draw?

<table>
<thead>
<tr>
<th>CROW'S FOOT SYMBOL</th>
<th>CARDINALITY</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Symbol" /></td>
<td>(0,N)</td>
<td>Zero or many. Many side is optional.</td>
</tr>
<tr>
<td><img src="image2" alt="Symbol" /></td>
<td>(1,N)</td>
<td>One or many. Many side is mandatory.</td>
</tr>
<tr>
<td><img src="image3" alt="Symbol" /></td>
<td>(1,1)</td>
<td>One and only one. 1 side is mandatory.</td>
</tr>
<tr>
<td><img src="image4" alt="Symbol" /></td>
<td>(0,1)</td>
<td>Zero or one. 1 side is optional.</td>
</tr>
</tbody>
</table>
Example of Relationship Cardinalities

- One course can have multiple classes.
- Some courses may not have classes.
Example of Relationship Cardinalities

- One course can have multiple classes.
- Each course must have at least one class.
Exercise

• Prof. McGonagall found that the modern student information management system convenient

• She would like to build up one for students in Hogwarts too. But she has been in the magic world for too long. Can you help her draw the ERD?

• Basic entities:
  
  • Students (SID, SNAME, HOUSE, COURSE, GRADE)
  
  • Courses (CID, CNAME, TEACHER)
  
  • Houses (HNAME, HEAD)
Solution

Student

<table>
<thead>
<tr>
<th>PK</th>
<th>SNAME</th>
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<tbody>
<tr>
<td></td>
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<table>
<thead>
<tr>
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<th>HNAME</th>
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House

<table>
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<tr>
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<th>HNAME</th>
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<table>
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Enrollment

<table>
<thead>
<tr>
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<th>SID</th>
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</table>

<table>
<thead>
<tr>
<th>PK, FK</th>
<th>CID</th>
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<table>
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<table>
<thead>
<tr>
<th>CID</th>
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Course

<table>
<thead>
<tr>
<th>PK</th>
<th>CNAME</th>
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<table>
<thead>
<tr>
<th>TEACHER</th>
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Enrolls

Has

Is assigned to