COMP 430
Intro. to Database Systems

ER Design Considerations

Slides use ideas from Chris Ré.
Solution to Library Activity

Publisher
- ID
- name
- address

Author
- ID
- name

Book
- ISBN
- title
- num_copies

Loan
- ISBN
- card_num
- date

Borrows
- card_num
- address

Borrower
- name

Publishes

Writes

GoesOnLoan
Relationship multiplicity

One-to-one:

Many-to-one:

One-to-many:

Many-to-many:

Recall that $X \rightarrow Y$ represents a function mapping from $X$ to $Y$.

There are a variety of ER styles, differing primarily in these edge notations.
What does this diagram say?
What’s wrong?

Product \( \rightarrow \) Purchase \( \rightarrow \) Person

Country \( \rightarrow \) President \( \rightarrow \) Person
What’s wrong?

- Product
- PersonName
- PersonAddr
- date
- Store
Weak entity sets

- Existence/meaning is dependent on another entity set(s).
- Part of their key comes from that other entity set(s)
Decide: weak or not?
Many-to-many junctions often weak
N-ary relationships

Entity sets should have primary keys. Omitted for brevity.

**Purchase** is a subset of **Person** \( \times \) **Product** \( \times \) **Store**.
Meaning: Given **Person**, then **Store** & **Product** are determined. I.e., each person can make one purchase – and thus of one product at one store.
Arrows in n-ary relationships

Meaning: Given **Product** & **Person**, then **Store** is determined.
I.e., any person can buy any given product at most once – and thus at one store.
Arrows in n-ary relationships

How to say: “Every person shops in at most one store.”?
Can convert n-ary to binary

How has the meaning changed?
Add what arrows?
Decision: n-ary or binary?

- Allows multiple purchases per Product-Store-Person combination.
- Allows attributes/constraints on Purchase.
  - “A person who shops in only one store.”
  - “How long a person has been shopping at a store.”

Best when relationship really is between multiple entities.
What’s wrong?
Decision: attribute or entity set?

Difference in meaning?
Advantages of each?
Add what arrows?
Activity – Add arrows to ER diagram

**Authors** have IDs and names. They write books.

**Books** have ISBNs and titles. The library keeps track of how many copies it has of the book. Each book is written by authors and published by a publisher. We want to know every time it is checked out by a borrower.

**Borrowers** have a library card number, name, and address. They can check out a book on a particular date.

**Publishers** have an ID, name and address. They publish books.
Partial vs. total participation

Are there products made by no company?

Each Product must be made by some Company.
Partial vs. total – alternate wording

Each product made by 0 or 1 companies.
Each company makes 0 or more products.

Each product made by 1 company.
Each company makes 0 or more products.
Total participation & weak entity sets

Recall:

![Diagram]

Weak entity set must be associated with some strong entity set.
Subclasses & inheritance

Subclasses inherit superclass attributes.

Every entity in subclass must be entity in superclass. I.e., subclasses are subsets of superclass.
ER subclasses very flexible

Default: Not disjoint
I.e., a Product can be in multiple subclasses.

Default: Partial
I.e., a Product doesn’t have to be in any subclass.
ER subclass options

disjoint
An Employee can’t be both hourly and salaried.

Total
Every Employee must be in one or more subclasses.

Every Employee must be in one or more subclasses.

An Employee can’t be both hourly and salaried.
Can have just one subclass
Hierarchy of subclasses

Figure 8.6
A specialization lattice with shared subclass ENGINEERING_MANAGER.
The need for categories/unions

Goal: “Every art piece is owned by a person or company.”

What is the problem?
Solution with categories/unions

Goal: “Every art piece is owned by a person or company.”
Partial vs. total unions

Not every Person and Company collects art.

All cars, trucks, and bicycles are vehicles.
Multiple superclasses

Each subclass entity belongs to & inherits from all superclasses.

Each subclass entity belongs to & inherits from the appropriate one superclass.
Decision: total union or subclasses?

Use if Car, Truck, Bicycle have (many) common attributes. Move those to RoadVehicle.
Figure 8.9
An EER conceptual schema for a UNIVERSITY database.
Activity – Add participation, sub/superclasses

Authors have IDs and names. They write books or chapters of book.

Books have ISBNs and titles. The library keeps track of how many copies it has of the book. Each book is written by authors and published by a publisher. We want to know every time it is checked out by a borrower.

Borrowers have a library card number, name, and address. They can check out a book on a particular date.

Publishers are typically a company with an ID, name and address. They publish books. Alternatively, authors can self-publish.