CSE 344

MAY 11TH – ENTITIES
ADMINISTRIVIA

• HW6 Due next Wednesday (May 16)
  • Section 7 slides very helpful
• HW7 Out Wednesday
  • Due May 23rd
• HW8 Out May 23rd
  • Due last day of class, Jun 1
• Exam
  • Graded and on canvas tonight
  • Back in class or in OH on Monday
DATABASE DESIGN

What it is:
Starting from scratch, design the database schema: relation, attributes, keys, foreign keys, constraints etc

Why it’s hard
The database will be in operation for a very long time (years). Updating the schema while in production is very expensive (why?)
Consider issues such as:

- What entities to model
- How entities are related
- What constraints exist in the domain

Several formalisms exist:

- We discuss E/R diagrams
- UML, model-driven architecture

Reading: Sec. 4.1-4.6
DATABASE DESIGN
PROCESS

Conceptual Model:

Relational Model:
Tables + constraints
And also functional dep.

Normalization:
Eliminates anomalies

Conceptual Schema

Physical storage details
Physical Schema
ENTITY / RELATIONSHIP DIAGRAMS

Entity set = a class
  • An entity = an object

Attribute

Relationship
Every entity set must have a key
WHAT IS A RELATION?

A mathematical definition:

- if A, B are sets, then a relation R is a subset of $A \times B$

$A=\{1,2,3\}, \quad B=\{a,b,c,d\},$

$A \times B = \{(1,a),(1,b),\ldots,(3,d)\}$

$R = \{(1,a), (1,c), (3,b)\}$

makes is a subset of Product $\times$ Company:

![Diagram showing a relation between Product and Company]
MULTIPLICITY OF E/R RELATIONS

one-one:

many-one

many-many
What does this say?
ATTRIBUTES ON RELATIONSHIPS

What does this say?
MULTI-WAY RELATIONSHIPS

How do we model a purchase relationship between buyers, products and stores?

Can still model as a mathematical set (How?)

As a set of triples $\subseteq$ Person $\times$ Product $\times$ Store
Q: What does the arrow mean?

A: Any person buys a given product from at most one store.

[Fine print: Arrow pointing to E means that if we select one entity from each of the other entity sets in the relationship, those entities are related to at most one entity in E]
Q: What does the arrow mean?

A: Any person buys a given product from at most one store AND every store sells to every person at most one product.
CONVERTING MULTI-WAY RELATIONSHIPS TO BINARY

Arrows go in which direction?
CONVERTING MULTI-WAY RELATIONSHIPS TO BINARY

Make sure you understand why!
3. DESIGN PRINCIPLES

What’s wrong?

Moral: Be faithful to the specifications of the application!
DESIGN PRINCIPLES: WHAT’S WRONG?

Moral: pick the right kind of entities.
DESIGN PRINCIPLES:
WHAT’S WRONG?

Moral: don’t complicate life more than it already is.
FROM E/R DIAGRAMS TO RELATIONAL SCHEMA

Entity set → relation
Relationship → relation
**ENTITY SET TO RELATION**

**Product**

<table>
<thead>
<tr>
<th>prod-ID</th>
<th>category</th>
<th>price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gizmo55</td>
<td>Camera</td>
<td>99.99</td>
</tr>
<tr>
<td>Pokemn19</td>
<td>Toy</td>
<td>29.99</td>
</tr>
</tbody>
</table>
N-N RELATIONSHIPS TO RELATIONS

Represent this in relations
Orders\(\text{(prod-ID, cust-ID, date)}\)
Shipment\(\text{(prod-ID, cust-ID, name, date)}\)
Shipping-Co\(\text{(name, address)}\)

<table>
<thead>
<tr>
<th>prod-ID</th>
<th>cust-ID</th>
<th>name</th>
<th>date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gizmo55</td>
<td>Joe12</td>
<td>UPS</td>
<td>4/10/2011</td>
</tr>
<tr>
<td>Gizmo55</td>
<td>Joe12</td>
<td>FEDEX</td>
<td>4/9/2011</td>
</tr>
</tbody>
</table>
N-1 RELATIONSHIPS TO RELATIONS

Represent this in relations
Orders(prod-ID, cust-ID, date1, name, date2)
Shipping-Co(name, address)

Remember: no separate relations for many-one relationship
MULTI-WAY RELATIONSHIPS TO RELATIONS

Try this at home!

Purchase \( (\text{prod-ID}, \text{ssn}, \text{name}) \)