Designing Relational Database Models

Daniel Zappala

CS 360 Internet Programming
Brigham Young University

Relational Databases

Relational Databases

- each database contains a collection of tables
  - each row is a unique record
  - each column is an attribute of the record

Year Table (Citizen Budget)

id	date	totalRevenue	budgetedRevenue...
1	2002	1.07857e+07	6.08307e+06
2	2003	7.6935e+06	1.55783e+07
3	2004	7.20024e+06	6.72688e+06
4	2005	7.66746e+06	8.8527e+06
5	2006	9.39535e+06	1.17699e+07
6	2007	7.97184e+06	1.50126e+07

Attributes

- attributes have data types
- primary key: one or more keys that together uniquely identify each row in a table

Year Table (Citizen Budget)

Field	Type	Options
id	Integer	primary key
date	Integer	unique
totalRevenue	Float	
budgetedRevenue	Float	
totalExpenditures	Float	
budgetedExpenditures	Float	

Relationships

- form relationships between tables using identifiers
- one-to-many, one-to-one and many-to-many relationships

Fund Table (Citizen Budget)

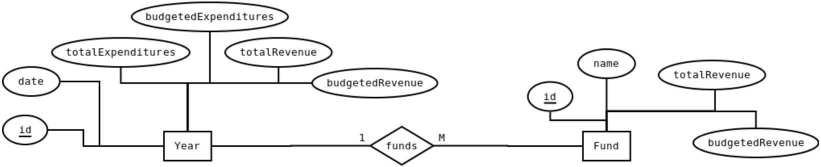
id	name	totalRevenue	budgetedRevenue	yearID
1	GENERAL FUND	2.06581e+06	2.64328e+06	1
2	CAPITAL PROJECT FUND	7.63334e+06	2.02127e+06	1
3	WATER AND SEWER FUND	1.08651e+06	1.41852e+06	1
4	GENERAL FUND	1.76936e+06	1.681e+06	2
5	CAPITAL PROJECT FUND	4.32644e+06	3.60852e+06	2
6	WATER AND SEWER FUND	1.53088e+06	1.01848e+07	2

Types of Relationships

- one-to-one
    - exactly one instance of the first entity for each instance of the second entity
    - example: customer has exactly one set of login information
- one-to-many
    - one or more instances of the second entity for each instance of the first entity
    - example: each customer can place more than one order, but each order is made by only one customer
- many-to-many
    - each entity is related to more than one instance of the other entity
    - example: a bowtie can come have more than one category (red, paisley), and a category can have more than one bowtie

Entity Relationship Modeling

Entity-Relationship Model



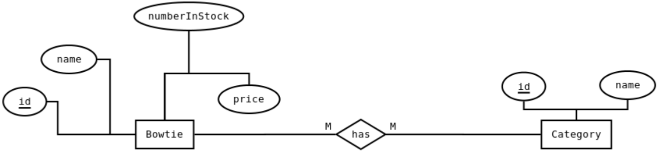
- visualizes database and its relationships
  - tables (entities): rectangles
  - attributes: ellipses
  - relationship: diamond
- primary key is underlined
- relationship is annotated with an M, showing a one-to-many relationship

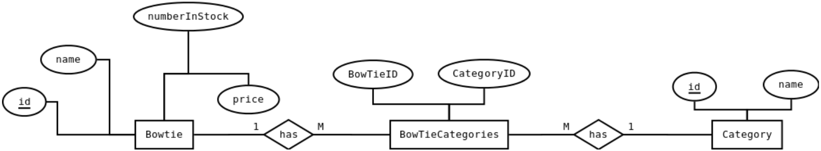
Entities and Relationships

- Citizen Budget
  - a year has many funds
  - a fund has many categories
  - a category has many items
- rules: if you delete a fund, you must delete all of its categories
- store example
  - bowties
  - customer
  - order
- purchasing action creates a relationship between customer, order, and bowtie
  - must associate one customer with each order
  - customers can make more than one order
  - each order has one or more bowties
- ▸ You should wear a bowtie!

Resolving Many-to-Many Relationships

- a bowtie can come have more than one category (red, paisley), and a category can have more than one bowtie





Normalization

Designing Tables

- customer table
  - id
  - name
  - address
- order table
  - id
  - customerID
  - bowtieID
  - quantity
- can only order one type of bowtie in a single order
  - solution: add “bowtieID2”, “bowtieID3”, “quantity2”, “quantity3” to the order table
  - must decide on a maximum number of bowties per order (horrors!)
  - must decide on empty values if an order has fewer than this

Normalization

- better solution: store the items that make up an order
- items table
  - id
  - price
  - quantity
  - bowtieID
  - orderID
- when do you add a table versus or more attributes?
  - normalize the database according to a set of rules
  - ▸ MySQL article

Example

Example

- ▸ CitizenBudget models
- uses ▸ SQLAlchemy