Database Management Systems

- Design and Creation

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Database Creation

- Design is very important
  - Long lasting implications
- How is our data being stored again?
  - How do we manipulate data?

Example

- We wish to create a database for the following:
  - We have a company that is organized into departments
    - Name, number, employee
    - May have several locations
  - Each department controls a number of projects
    - Name, number, single location
  - Each department as a number of employees
    - Each employee can work for one department, but may have many projects
    - Number, name, address, salary
  - Each employee may have a number of dependents
    - Name, birthdate, relationship

Creating a Database

- First step:
  - Define your entities and attributes
    - Simple vs. Composite attributes

Key Attributes

- Key attributes are values that must be unique for an entity
  - What would qualify in this example?

Design

- Let's start drawing a diagram to represent our design

Relationships

- Identifying relationships is important
  - Why?
- What types of relationships exist?
- What relationships exist in our example?
- Recursive Relationships
- Let's update our design

Normalization

- Goal: reduce data redundancy
  - Data stored in exactly one place
- Accomplished by applying forms
  - Seven forms total
  - Three is sufficient

Normalization

- First normal form
  - The value stored at the intersection of each row and column must be scalar
  - A table must not contain any repeating column

- Will still likely have repeating values in rows

Normalization

	VendorName	InvoiceNumber	ItemDescription
1	Cahners Publishing	112897	VB ad, SQL ad, Library directory
2	Zylka Design	97/522	Catalogs, SQL flyer
3	Zylka Design	97/533B	Card revision

	VendorName	InvoiceNumber	ItemDescription1	ItemDescription2	ItemDescription3
1	Cahners Publishing	112897	VB ad	SQL ad	Library directory
2	Zylka Design	97/522	Catalogs	SQL flyer	NULL
3	Zylka Design	97/533B	Card revision	NULL	NULL

Normalization

	VendorName	InvoiceNumber	ItemDescription
1	Cahners Publishing	112897	VB ad
2	Cahners Publishing	112897	SQL ad
3	Cahners Publishing	112897	Library directory
4	Zylka Design	97/522	Catalogs
5	Zylka Design	97/522	SQL flyer
6	Zylka Design	97/533B	Card revision

Normalization

- Second Normal Form
  - Every non-key column must depend on the entire primary key
  - If the above is false it indicates there are multiple entities within the table
- Application
  - Move columns that don't depend on the entire key to a different table
  - Establish a relationship between the tables
- The step removes redundant row data

Normalization

	InvoiceID	VendorName	InvoiceNumber	InvoiceSequence	ItemDescription
1	1	Cahners Publishing	112897	1	VB ad
2	2	Cahners Publishing	112897	2	SQL ad
3	3	Cahners Publishing	112897	3	Library directory
4	4	Zylka Design	97/522	1	Catalogs
5	5	Zylka Design	97/522	2	SQL flyer
6	6	Zylka Design	97/533B	1	Card revision

Normalization

	InvoiceNumber	VendorName	InvoiceID
1	112897	Cahners Publishing	1
2	97/522	Zylka Design	2
3	97/533B	Zylka Design	3

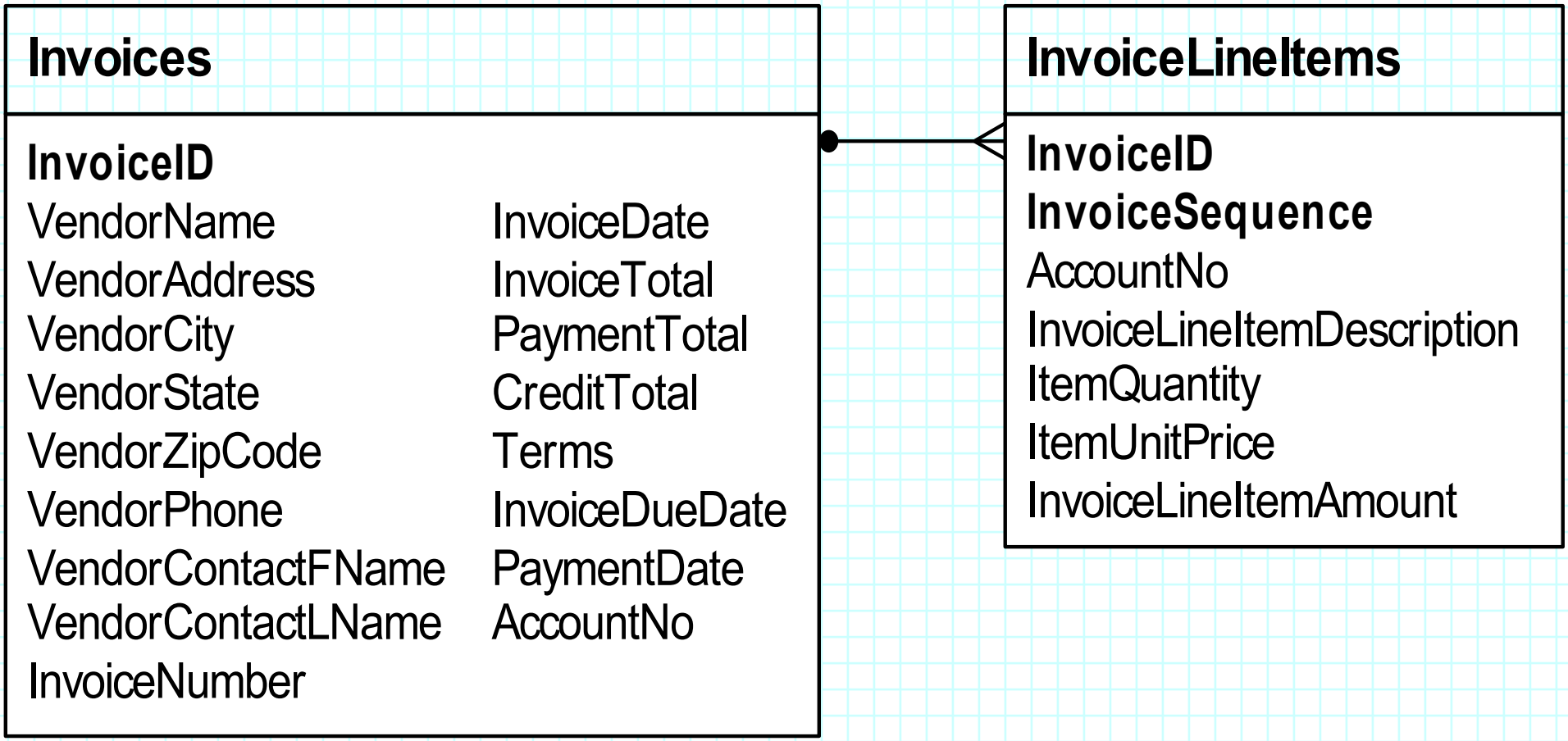
	InvoiceID	InvoiceSequence	ItemDescription
1	1	1	VB ad
2	1	2	SQL ad
3	1	3	Library directory
4	2	1	Catalogs
5	2	2	SQL flyer
6	3	1	Card revision

Normalization

- Third Normal Form
  - Each non-key column must depend only on the primary key

- If a column does not depend only on the primary key
  - Assigned to the wrong table
  - Can be computed from other columns
    - Derived data

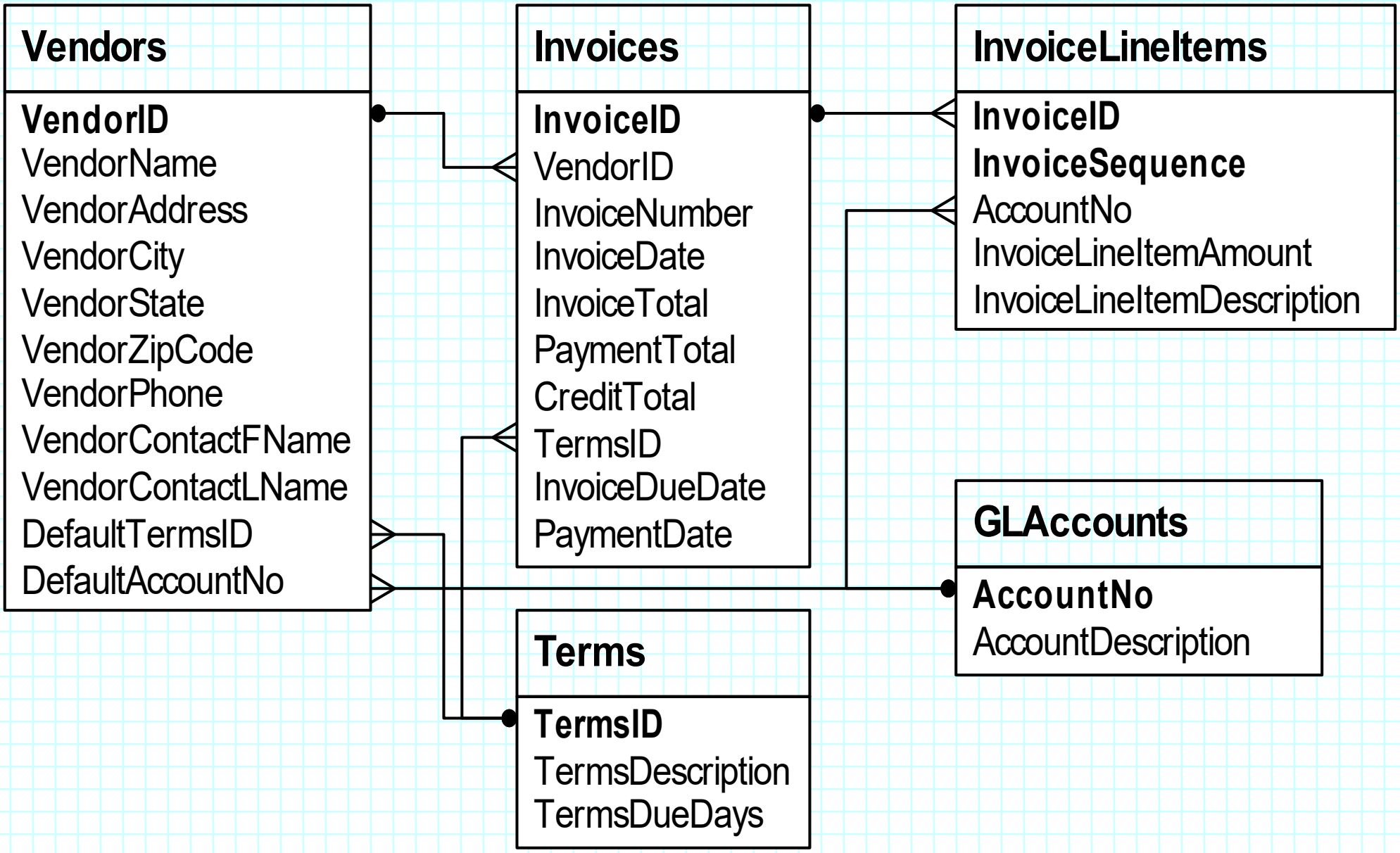
Normalization



Normalization

- Does the vendor information depend only on the InvoiceID column?
- Does the Terms column depend only on the InvoiceID column?
- Does the AccountNo column depend only on the InvoiceID column?
- Can the InvoiceDueDate and InvoiceLineItemAmount columns be derived from other data?

Normalization



Implementation

- How can we turn this into an actual database?
  - What are we missing?

Creating Databases

- Each table must be contained in a separate database
- CREATE DATABASE company;
- What happens when we run this query?

Create Tables

- When we create tables, we must specify column names and types
  - Primary key?
  - Foreign key?

- CREATE TABLE pet (name VARCHAR(20), owner VARCHAR(20), species VARCHAR(20), sex CHAR(1), birth DATE);

- NULL, AUTO_INCREMENT

- What happens when we run this query?

INSERT

- Enters a new row
  - Must specify values
  - NULL?
  - AUTO_INCREMENT?
  - Data types?

```
INSERT INTO pet(name, owner, species, sex,
birthdate) VALUES ('Seth', 'Doug Shook', 'Cat',
'M', '2007-04-03');
```

UPDATE

- Used to modify existing values

```
UPDATE pet
SET name = 'Franklin'
WHERE name = 'Seth';
```

- Order of operations?

DELETE

- Removes a row

```
DELETE FROM pet
WHERE name = 'Franklin';
```

- Careful!

Exercises

- Practice creating the remaining tables from our employees example
- Practice inserting, updating, and deleting values from the tables you created