Lecture 8: Database Design

Monday, February 16, 2015

Announcements

- HW 2 is available through Canvas and will be due next Monday (one week from today)
- This week we will continue and finish our discussion on database design
- Next week we will cover the basics of Python and how to connect to Oracle from Python
- HW 3 will be a Python programming assignment and will be available on 03/02 and due a week later
- See our course web page for week-by-week topics and schedule: http://www.cs.utexas.edu/~scohen/cs327e.html

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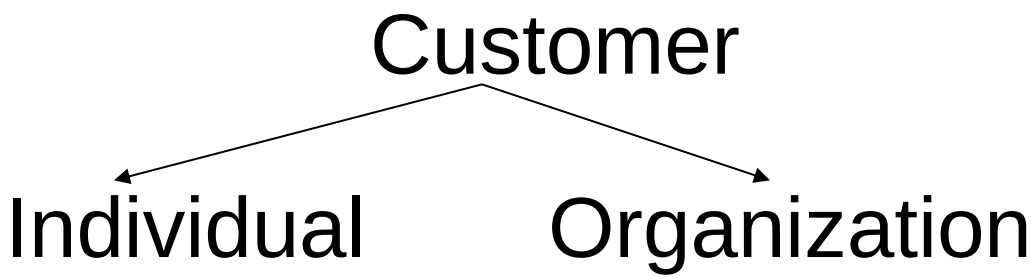
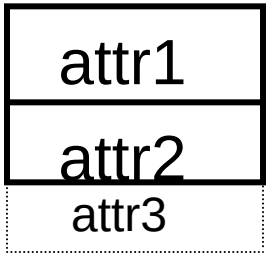
Inheritance



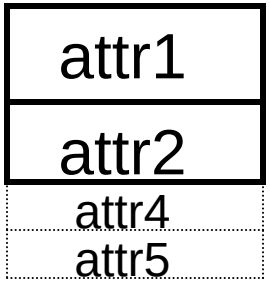
Representing Inheritance

– Customer

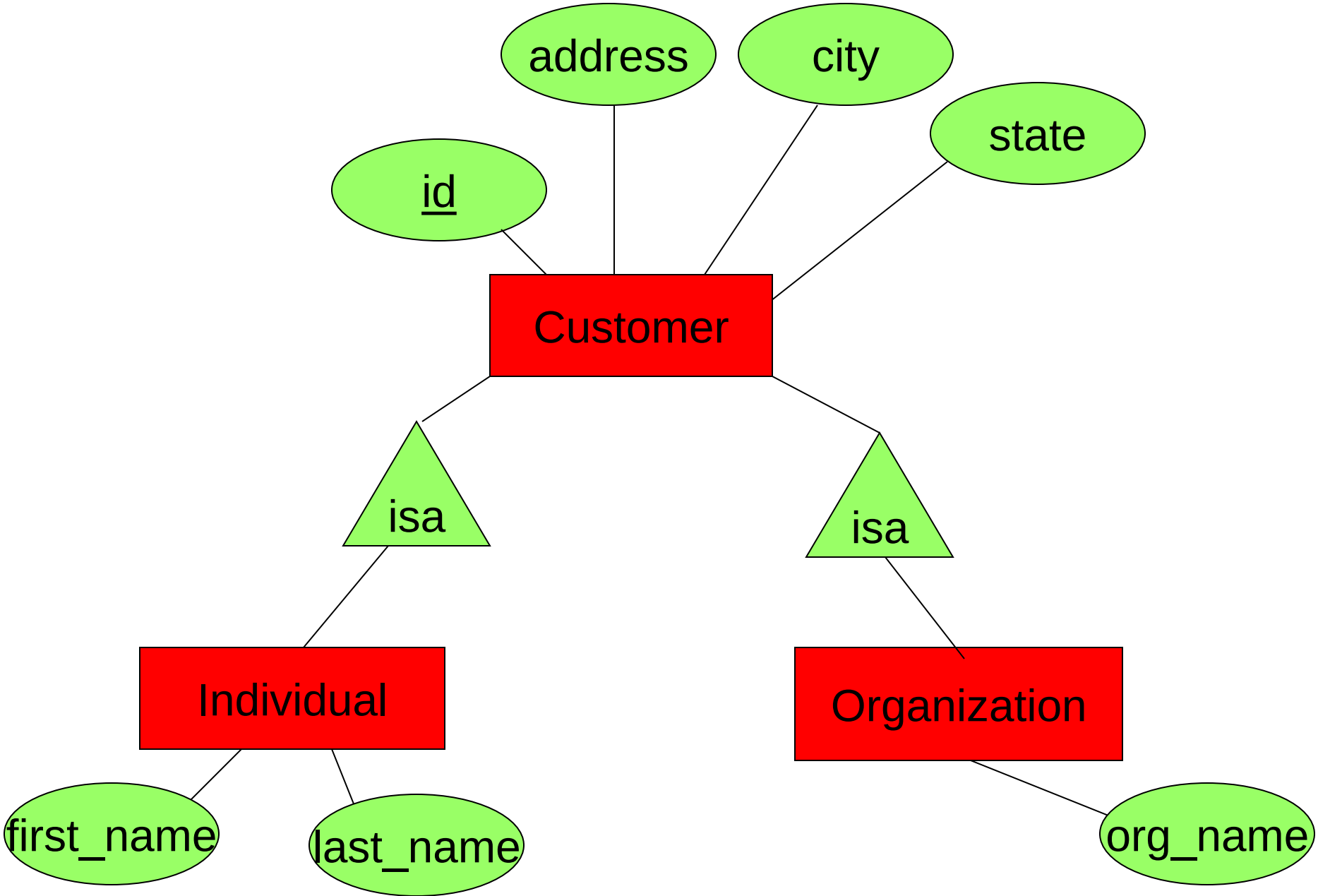
– Individual



– Organization



Inheritance ERD



Solution 1: Create Table Statement

```
CREATE TABLE Customer (
    id NUMBER(8) PRIMARY KEY,
    address VARCHAR(50) NOT NULL,
    city VARCHAR(30) NOT NULL,
    state CHAR(2) NOT NULL,
    zip CHAR(5) NOT NULL,
    phone CHAR(10) NOT NULL,
    individual_id NUMBER(8),
    organization_id NUMBER(8),
    FOREIGN KEY (individual_id) REFERENCES  Individual(id),
    FOREIGN KEY (organization_id) REFERENCES  Organization(id)
)
```

Solution 1: Create Table Statements

```
CREATE TABLE Individual (
    id NUMBER(8) PRIMARY KEY,
    first_name VARCHAR(50) NOT NULL,
    last_name VARCHAR(50) NOT NULL,
    suffix CHAR(2),
    dob DATE
)
CREATE TABLE Organization (
    id NUMBER(8) PRIMARY KEY,
    org_name VARCHAR(50) NOT NULL,
    org_category CHAR(2),
    org_size NUMBER(6)
)
```

Solution 2: Create Table Statement

```
CREATE TABLE Customer (
    id NUMBER(8) PRIMARY KEY,
    address VARCHAR(50) NOT NULL,
    city VARCHAR(30) NOT NULL,
    state CHAR(2) NOT NULL,
    zip CHAR(5) NOT NULL,
    phone CHAR(10) NOT NULL
)
```

Solution 2: Create Table Statements

```
CREATE TABLE Individual (
    id NUMBER(8) PRIMARY KEY,
    first_name VARCHAR(50) NOT NULL,
    last_name VARCHAR(50) NOT NULL,
    suffix CHAR(2),
    dob DATE,
    customer_id NUMBER(8) NOT NULL,
    FOREIGN KEY (customer_id) REFERENCES Customer(id)
)
CREATE TABLE Organization (
    id NUMBER(8) PRIMARY KEY,
    org_name VARCHAR(50) NOT NULL,
    org_category CHAR(2),
    org_size NUMBER(6),
    customer_id NUMBER(8) NOT NULL,
    FOREIGN KEY (customer_id) REFERENCES Customer(id)
)
```

Solution 3: Create Table Statements

```
CREATE TABLE Individual (
    id NUMBER(8) PRIMARY KEY,
    first_name VARCHAR(50) NOT NULL,
    last_name VARCHAR(50) NOT NULL,
    name_suffix CHAR(3) CHECK (name_suffix IN ('Jr.', 'Sr.', 'Dr.', 'MD')),
    dob DATE CHECK (dob between '01-JAN-1900' and '01-JAN-2000'),
    customer_id NUMBER (8) NOT NULL,
    CONSTRAINT customer_id_fk FOREIGN KEY (customer_id)
    REFERENCES Customer(id) ON DELETE CASCADE
)
CREATE TABLE Organization (
    id NUMBER(8) PRIMARY KEY,
    org_name VARCHAR(50) NOT NULL,
    org_category VARCHAR(20) NOT NULL,
    CONSTRAINT customer_id_fk2 FOREIGN KEY (customer_id)
    REFERENCES Customer(id) ON DELETE CASCADE,
    CONSTRAINT org_name_cat_un UNIQUE (org_name, org_category)
)
```

Solution 3: Create Table Statement

```
CREATE TABLE Customer (
    id NUMBER(8) PRIMARY KEY,
    address VARCHAR(50) NOT NULL,
    city VARCHAR(30) NOT NULL,
    state CHAR(2) NOT NULL,
    zip CHAR(5) NOT NULL,
    phone CHAR(10) NOT NULL,
    customer_type CHAR(1),
    customer_type_id NUMBER(8),
    CONSTRAINT cust_type_un UNIQUE (customer_type,
    customer_type_id)
)
```

Alter Table Statements

```
ALTER TABLE Individual
    ADD CONSTRAINT ck_name_suffix
    CHECK (name_suffix IN ('Jr.', 'Sr.', 'Dr.', 'MD'));
```

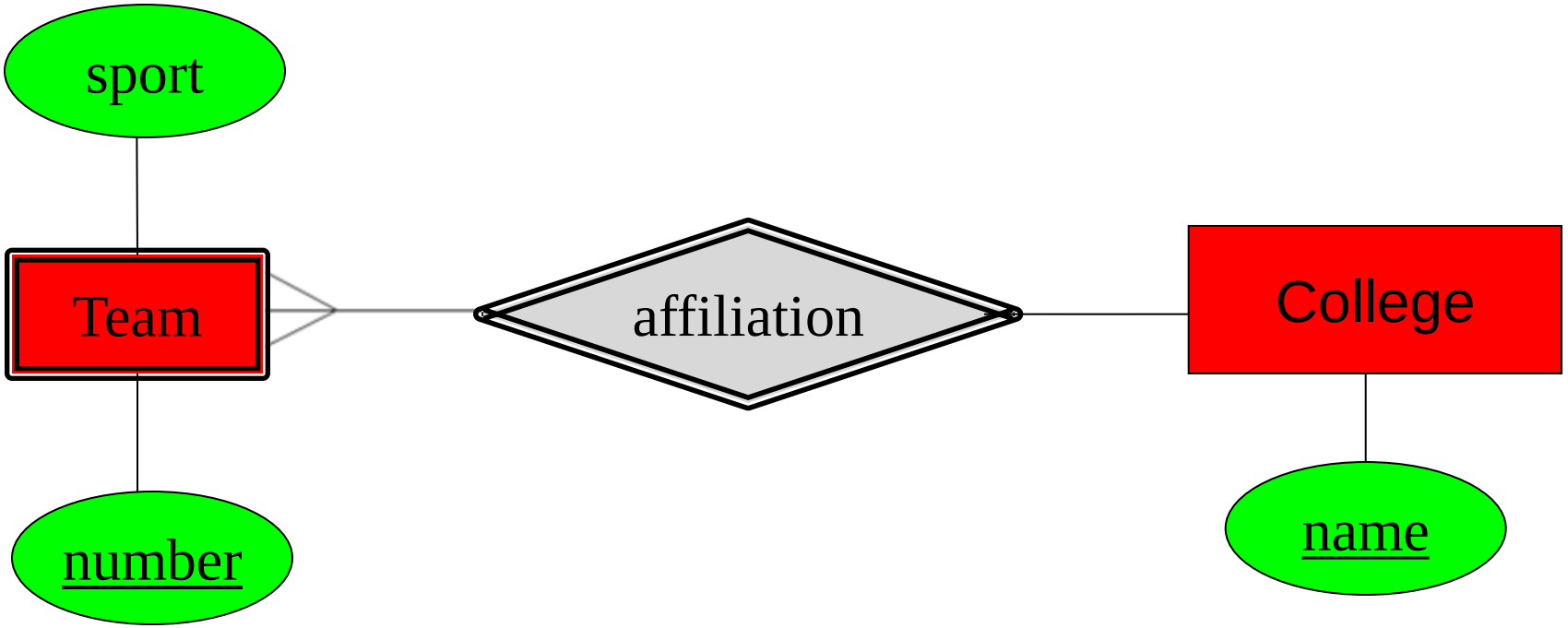
```
ALTER TABLE Individual
    DROP CONSTRAINT customer_id_fk;
```

```
ALTER TABLE Customer
    RENAME COLUMN address TO street;
```

```
ALTER TABLE Individual
    ADD COLUMN middle_initial CHAR(1);
```

Weak Entities

Weak entity = entity where part of the key comes from another entity



How do we convert this to a relational schema?

Database Constraints

- Database constraints = logical statements that must hold at all times
- Finding them is part of the database design
- Can be represented in SQL and sometimes ER diagram

Types of constraints:

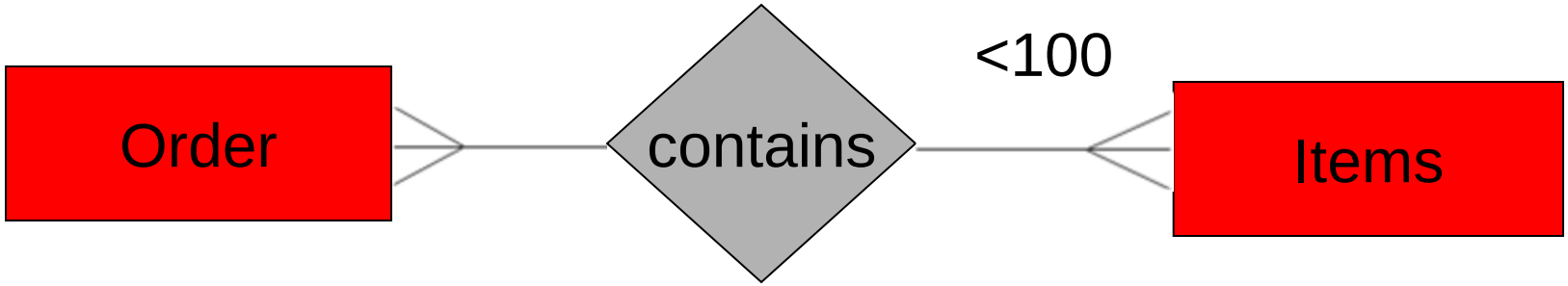
Primary key: an EID uniquely identifies a person who is affiliated with UT.

Unique: an item's category and name.

Referential integrity: an item must exist before it can be ordered.

Check: a person's age is between 0 and 120.

Constraint Example



How do we enforce this type of constraint?

What can go wrong with the database design?

When a database is poorly designed we get
data anomalies:

Types of anomalies:

- Redundancy = data is repeated
- Update anomalies = need to change in several places
- Delete anomalies = may lose data unintentionally

Data Anomalies Example

Employees(SSN, Name, Phone, City)

SSN	Name	Phone	City
123-45-6789	Alice	512-555-1234	Austin
123-45-6789	Alice	512-555-6543	Austin
987-65-4321	Bob	201-555-2121	San Antonio

One person may have multiple phones, but lives in only one city

Data Anomalies:

- Redundancy = repeated data
- Update anomalies = Alice moves to San Marcos
- Deletion anomalies = Bob deletes his phone number