CSE 544
Constraints

Lecture #3

Friday, January 13, 2011

Announcements

- Tuesday 1/18:
  - Guest Lecturer: *Bill Howe*
- Wednesday 1/19: 9am-11:30am, *Data Models*
  - Room: CSE 403,
  - Two papers to reviews: *What goes around comes around* and *Query answering using views* (Sec. 1-3)
- Thursday 1/19: *Transactions*
  - One paper to review (Sec. 1, 2.1, 2.2, 3.1, and 3.2)
- Friday 1/21: 11:30-1pm
  - Sign up to meet with me to discuss your project

Outline and Reading Material

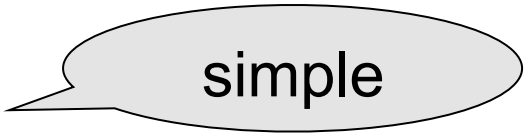
- Constraints: Book 3.2, 3.3, 5.8

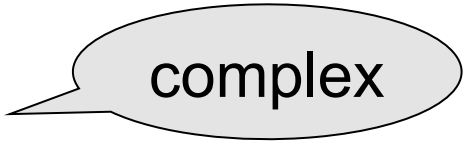
Constraints

- A constraint = a property that we'd like our database to hold
- Enforce it by taking some actions:
  - Forbid an update
  - Or perform compensating updates
- Two approaches:
  - Declarative integrity constraints
  - Triggers

Integrity Constraints in SQL

- Keys, foreign keys
- Attribute-level constraints
- Tuple-level constraints
- Global constraints: assertions





The more complex the constraint, the harder it is to check and to enforce

Keys

```
CREATE TABLE Product (
        name CHAR(30) PRIMARY KEY,
        price  INT)
```

OR:

Product(<u>name</u>, price)

```
CREATE TABLE Product (
        name CHAR(30),
        price INT,
PRIMARY KEY (name))
```

Keys with Multiple Attributes

```
CREATE TABLE Product (
    name CHAR(30),
    category VARCHAR(20),
    price INT,
  PRIMARY KEY (name, category))
```

Name	Category	Price
Gizmo	Gadget	10
Camera	Photo	20
Gizmo	Photo	30
~~Gizmo~~	~~Gadget~~	~~40~~

Product(<u>name, category</u>, price)

Other Keys

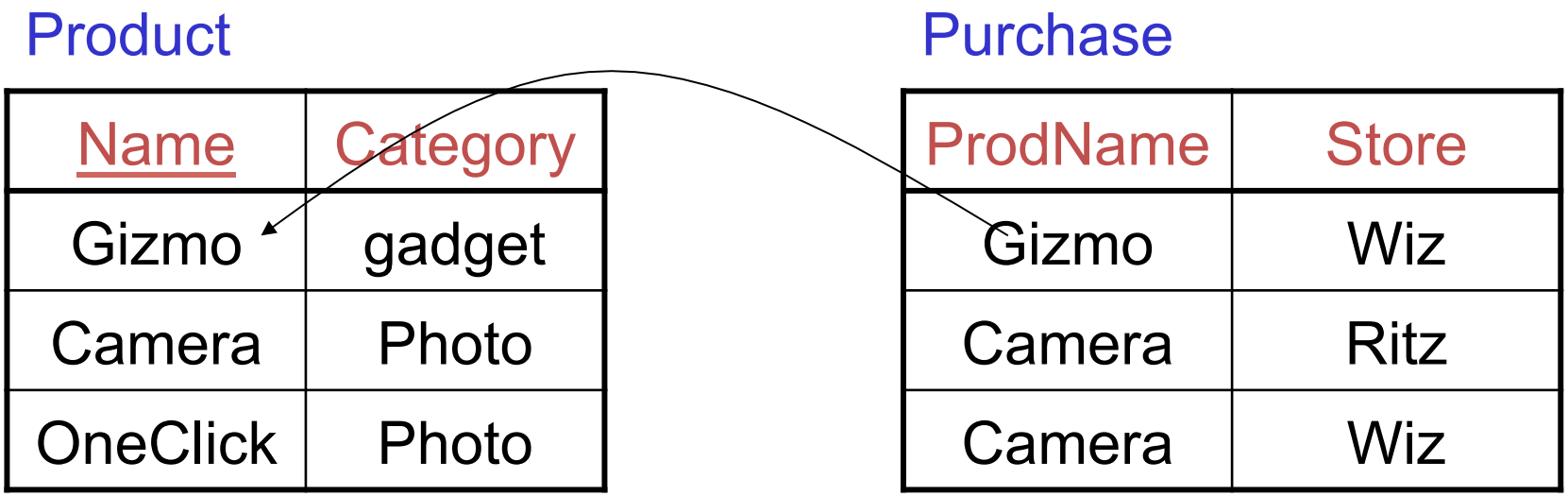
```
CREATE TABLE Product (
    productID  CHAR(10),
    name CHAR(30),
    category VARCHAR(20),
    price INT,
    PRIMARY KEY (productID),
    UNIQUE (name, category))
```

There is at most one PRIMARY KEY;
there can be many UNIQUE

Foreign Key Constraints

```
CREATE TABLE Purchase (
  buyer CHAR(30),
  seller CHAR(30),
  product CHAR(30) REFERENCES Product(name),
  store VARCHAR(30))
```

Purchase(buyer, seller, product, store)
Product(name, price)


Product
Name
Category
Gizmo
gadget
Camera
Photo
OneClick
Photo
Purchase
ProdName
Store
Gizmo
Wiz
Camera
Ritz
Camera
Wiz

Foreign Key Constraints

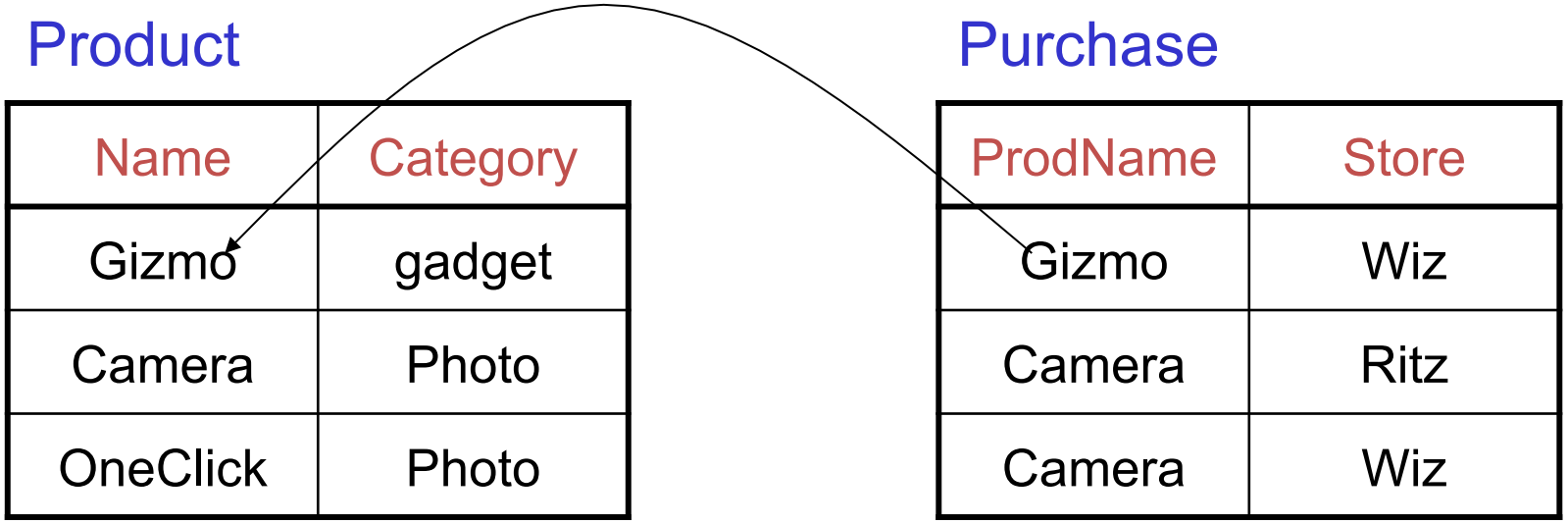
```
CREATE   TABLE Purchase(
    buyer VARCHAR(50),
    seller VARCHAR(50),
    product CHAR(20),
    category VAVRCHAR(20),
    store VARCHAR(30),
    FOREIGN KEY (product, category)
        REFERENCES Product(name, category)
  );
```

Purchase(buyer, seller, product, category, store)
Product(name, category, price)

What happens during updates ?

Types of updates:

- In Purchase: insert/update
- In Product: delete/update



What happens during updates ?

- SQL has three policies for maintaining referential integrity:
- Reject violating modifications (default)
- Cascade: after a delete/update do a delete/update
- Set-null set foreign-key field to NULL

Constraints on Attributes and Tuples

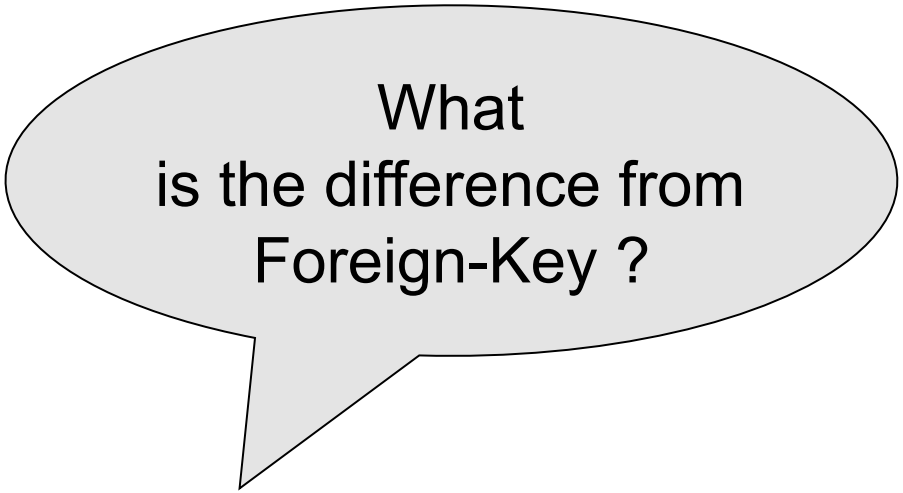
Attribute level constraints:

```
CREATE TABLE Purchase (    . . .
      store VARCHAR(30) NOT NULL,  . . .  )
```

```
CREATE TABLE Product (    . . .
      price INT  CHECK (price >0 and price < 999))
```

Tuple level constraints:

```
. . . CHECK (price * quantity < 10000) . . .
```




```
CREATE TABLE Purchase (
        prodName CHAR(30)
                CHECK (prodName IN
                        SELECT Product.name
                        FROM Product),
        date DATETIME NOT NULL)
```

General Assertions

```
CREATE ASSERTION myAssert CHECK
  NOT EXISTS(
        SELECT Product.name
        FROM Product, Purchase
        WHERE Product.name = Purchase.prodName
        GROUP BY Product.name
        HAVING count(*) > 200)
```

Comments on Constraints

- Can give them names, and alter later
- We need to understand exactly *when* they are checked
- We need to understand exactly *what* actions are taken if they fail

Semantic Optimization using Constraints

Purchase(buyer, seller, product, store)
Product(name, price)

```
SELECT Purchase.store
FROM   Product, Purchase
WHERE Product.name=Purchase.product
```

When can we rewrite the query ?

```
SELECT Purchase.store
FROM   Purchase
```

Semantic Optimization using Constraints

Purchase(buyer, seller, product, store)
Product(name, price)

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SELECT Purchase.store
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When can we rewrite the query ?

```
SELECT Purchase.store
FROM   Purchase
```

Purchase.product is foreign key AND not null