Introduction to Database Systems: CS312 Foreign Keys and Query Structure

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Simple PRIMARY KEY constraint demo

Only one primary key in a table; UNIQUE Identifiers

Spot the integrity constraint's influence

```
/*Create table*/
DROP TABLE IF EXISTS company;
CREATE TABLE company(
   ID INT PRIMARY KEY NOT NULL,
   NAME TEXT NOT NULL,
   AGE INT NOT NULL ,
   ADDRESS CHAR,
   SALARY REAL DEFAULT 50000.00 );
```

PRIMARY KEY

Simple PRIMARY KEY constraint demo

Only one primary key in a table; UNIQUE Identifiers

```
/*Good insert command: complete tuple allowed*/
INSERT INTO COMPANY
  VALUES  (221, "Sherlock", 25, "10, Rue du fleur",100000);
```

Query

```
sqlite> select * from company;
221|Sherlock|25|10, Rue du fleur|100000.0
```

Key not unique failure

```
/* Try to reinsert same values again.*/
INSERT INTO COMPANY
  VALUES  (221, "Sherlock", 25, "10, Rue du fleur",100000);
```

What are the types of keys in databases?

- **Primary Keys**:
  - Ensures *uniqueness* in a table.
  - All entries in an attribute-primary never repeat
  - Is a unique identifier (i.e., social security number, telephone number, etc)

What are the types of keys in databases?

- **Foreign Keys**:
  - A constraint to *enforce* the relationships between tables.
  - Create a reference to specific information from another table.
  - Foreign key constraints allow checking the referential integrity between tables.
  - Only values that are *supposed* to appear in a particular table are permitted

Primary and Foreign Keys in Two Tables

Two tables: *Employees* and *Orders*

EMPLOYEES

Primary Key

"Employee No"

Unique Column Acting as a Foregn Key In "Orders"

SSecurityNo	Employee No	First Name	Last Name	DateOfBirth	Date Employed
AF-23432334	1	Manny	Tomanny	12 Apr 1966	01 May 1999
DQ-65444444	2	Rosanne	Kolumns	21 Mar 1977	01 Jan 2000
GF-54354543	3	Cas	Kade	01 May 1977	01 Apr 2002
JK-34333432	4	Norma	Lyzation	03 Apr 1966	01 Apr 2002
VB-48565444	5	Juan	Tomani	12 Apr 1966	01 Apr 2002
FG-23566553	6	Del	Eats	01 May 1967	01 May 2004

Foreign Key

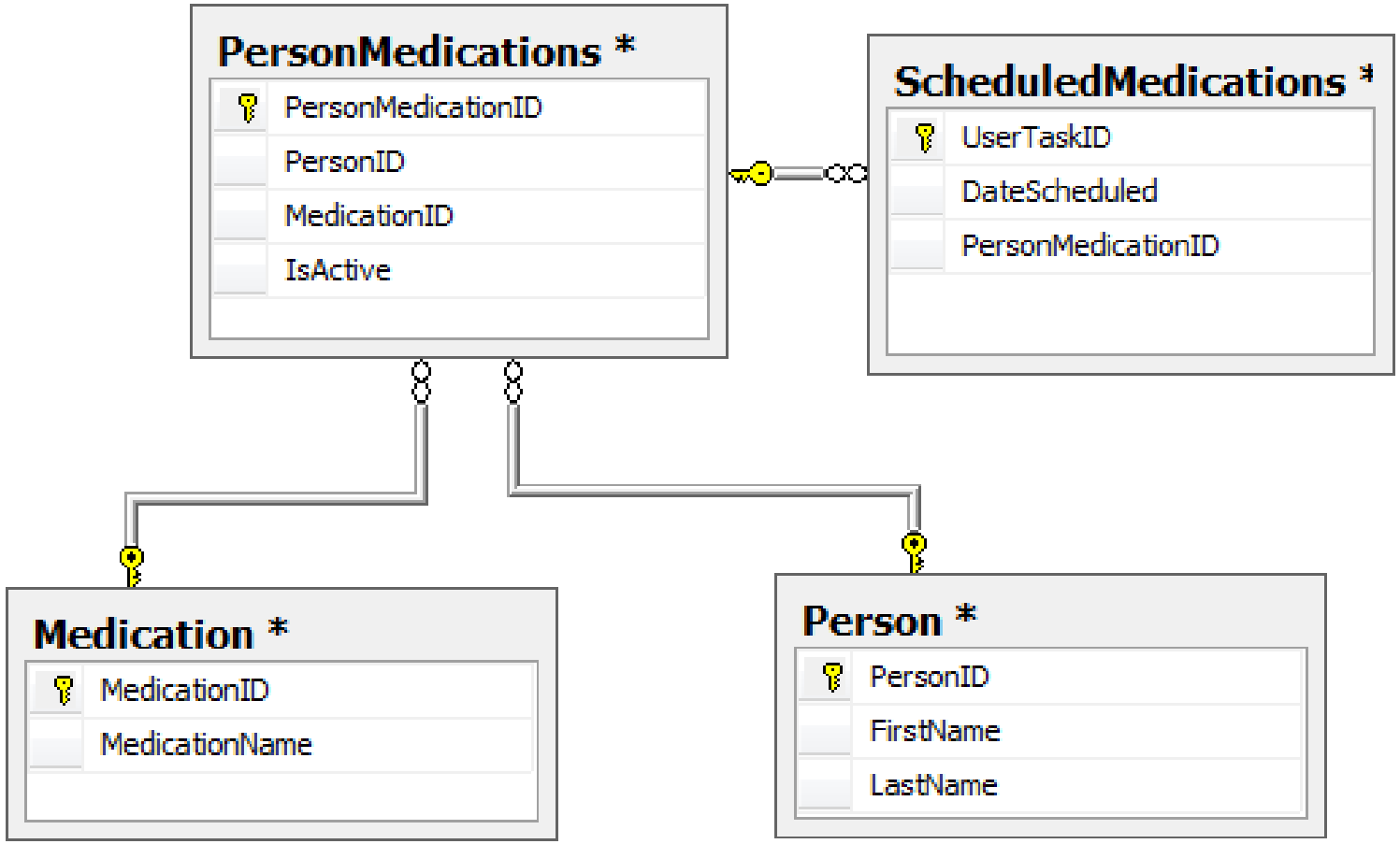
ORDERS

Primary Key

OrderNo	EmployeeNo	CustomerNo	Supplier	Price	Item
1	1	42	Harrison	$235	Desk
2	4	1	Ford	$234	Chair
3	1	68	Harrison	$415	Table
4	2	112	Ford	$350	Lamp
5	3	42	Ford	$234	Chair
6	2	112	Ford	$350	Lamp
7	2	42	Harrison	$235	Desk

Another Example of the Keys

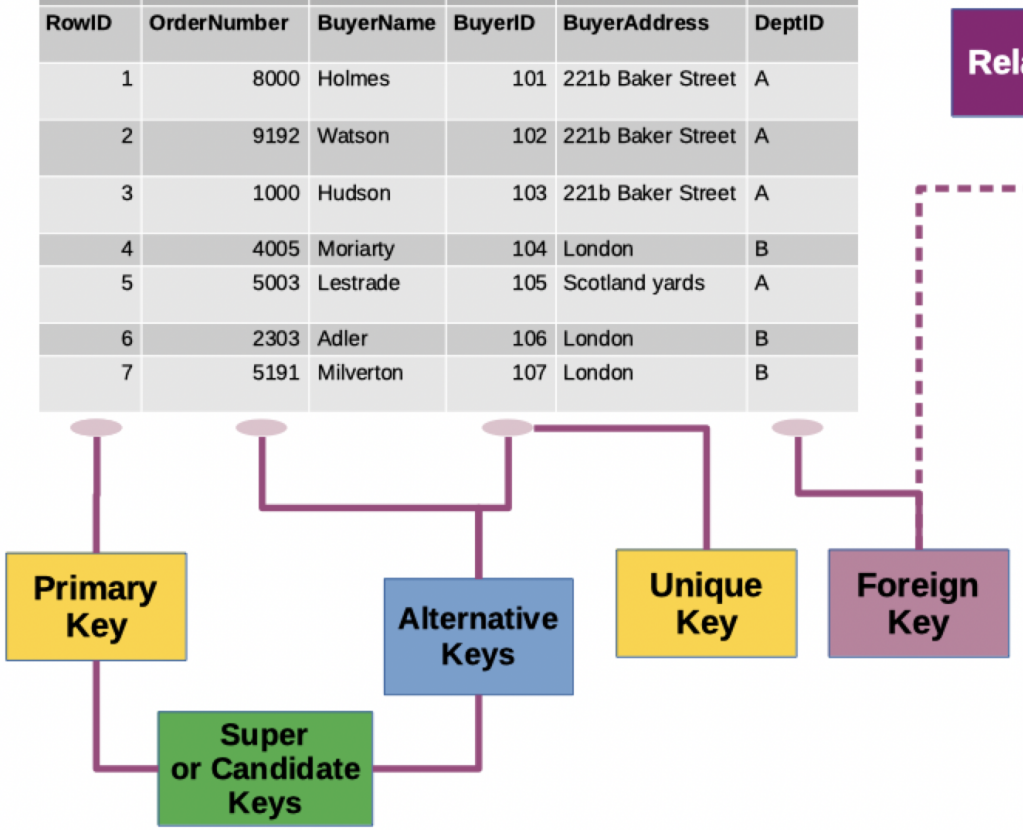
Primary keys indicated by a key icon



Yet Another Example of the Keys!

RowID	OrderNumber	BuyerName	BuyerID	BuyerAddress	DeptID
1	8000	Holmes	101	221b Baker Street	A
2	9192	Watson	102	221b Baker Street	A
3	1000	Hudson	103	221b Baker Street	A
4	4005	Moriarty	104	London	B
5	5003	Lestrade	105	Scotland yards	A
6	2303	Adler	106	London	B
7	5191	Milverton	107	London	B

DeptID	Type	Address
A	Detective	London
B	Criminal	London



The Theory of Foreign Keys

- Unless you have *already made* a reservation in restaurant, you cannot book a table
- If you have not *already booked* a hotel room in advance, you cannot get a room

Foreign Keys

Code in sandbox/foreignKeyDemo.txt

- Foreign Keys
  - *A foreign key is a way to enforce referential integrity within your SQLite database. A foreign key means that values in one table must also appear in another table. The referenced table is called the* **parent** *table while the table with the foreign key is called the* **child** *table*
  - An *enforced* relationship between two tables.
  - Information cannot be added unless it *behaves* according to the established relationship between two or more tables.

Add a primary key

Add the table with primary key code

```
/* Enable foreign keys */
/* Turn off maintainance of foreign  */
/* key constraints to allow table alterations. */

PRAGMA foreign_keys = OFF;

DROP TABLE IF EXISTS Cars;

CREATE TABLE Cars (
  carMake VARCHAR PRIMARY KEY,
  registration VARCHAR,
  capacity INT,
  topSpeed INT );
```

The attribute *carMake* ensures uniqueness for a forced relationship from *Agents.vehicleMake*

Now, add a foreign key

Add the table with foreign key code

```
DROP TABLE IF EXISTS Agents;

CREATE TABLE Agents (
  id INT PRIMARY KEY,
  lastName VARCHAR,
  vehicleMake VARCHAR,
  worksFor VARCHAR,
  FOREIGN KEY(vehicleMake) REFERENCES Cars(carMake) );

/* Turn on maintenance of foreign key constraints */
PRAGMA foreign_keys = ON;
```

The attribute *vehicleMake* associates this table to *Cars.carMake*

Populate Cars.carMake → *AstonMartin*

First, handle the primary key of the Cars table

We add the vehicle brand *AstonMartin* to *Cars.carMake*

```
INSERT INTO Cars values ('AstonMartin', 'MI6', 2, 130);
```

Now, populate the Agents table

Since the *carMake* attribute is "registered" we can add associated data

```
INSERT INTO Agents values (1007, 'Bond', 'AstonMartin', 'MI6');
INSERT INTO Agents values (1008, 'Wayne', 'AstonMartin', 'MI6');
INSERT INTO Agents values (1009, 'Smith', 'AstonMartin', 'MI6');
INSERT INTO Agents values (1010, 'Jones', 'AstonMartin', 'MI6');
INSERT INTO Agents values (1011, 'Nicholson', 'AstonMartin', 'MI6');
INSERT INTO Agents values (1012, 'Luxon', 'AstonMartin', 'MI6');
INSERT INTO Agents values (1013, 'Churchill', 'AstonMartin', 'MI6');
```

```
SELECT * FROM Cars;
SELECT * FROM Agents;
```

Populate Cars.carMake → *Buick*

First, handle the primary key of the Cars table

We add the vehicle brand *Buick* to *Cars.carMake*

...

Now, populate the Agents table again

If we add a *carMake* attribute is not "registered" then we get an error!

```
/* Error! Oh no! */
INSERT INTO Agents values(2008, 'Billy', 'Buick', 'MI6');
/* Error: need to first add "Buick" to the Cars table! */
```

Only *AstonMartin* drivers here ...

```
SELECT * FROM Cars;
SELECT * FROM Agents;
```

Populate Cars.carMake → *Buick*

First, handle the primary key of the Cars table

We add the vehicle brand *Buick* to *Cars.carMake*

```
INSERT INTO Cars values ('Buick', 'MI6', 5, 60);
```

Now, populate the Agents table

Since the *carMake* attribute is "registered" we can add associated data

```
INSERT INTO Agents values (2008, 'Billy', 'Buick', 'MI6');
INSERT INTO Agents values (2011, 'E-jay', 'Buick', 'MI6');
INSERT INTO Agents values (2012, 'Brick', 'Buick', 'MI6');
INSERT INTO Agents values (2013, 'Wedge', 'Buick', 'MI6');
INSERT INTO Agents values (2014, 'Orville', 'Buick', 'MI6');
INSERT INTO Agents values (2015, 'Lester', 'Buick', 'MI6');
INSERT INTO Agents values (2016, 'Wilbur', 'Buick', 'MI6');
INSERT INTO Agents values (2017, 'Rufus', 'Buick', 'MI6');
```

```
SELECT * FROM Cars;
SELECT * FROM Agents;
```

Populate Cars.carMake → *Buick*

First, handle the primary key of the Cars table

We write a query where we link *Cars.carMake* to *Agents.vehicleMake*

```
SELECT
  Agents.id, Agents.lastname, Cars.carMake, Agents.vehicleMake
FROM
  Cars, Agents
WHERE
  Cars.carMake == Agents.vehicleMake;
```

```
1007|Bond|AstonMartin|AstonMartin
1008|Wayne|AstonMartin|AstonMartin
1009|Smith|AstonMartin|AstonMartin
1010|Jones|AstonMartin|AstonMartin
1011|Luxon|AstonMartin|AstonMartin
2008|Billy|Buick|Buick
2011|E-jay|Buick|Buick
2012|Brick|Buick|Buick
2013|Wedge|Buick|Buick
2014|Orville|Buick|Buick
2015|Lester|Buick|Buick
2016|Wilbur|Buick|Buick
2017|Rufus|Buick|Buick
```

Consider this...

Please see the *sandbox* file for helpful code

- Can you create a similar base where a foreign key governs the data of another table?
- Can you write a query to show how the foreign key works?