DATABASE METHODOLOGY

Stockholm University

Relational Database Theory

The Relational Model
Part 4 – Foreign Keys
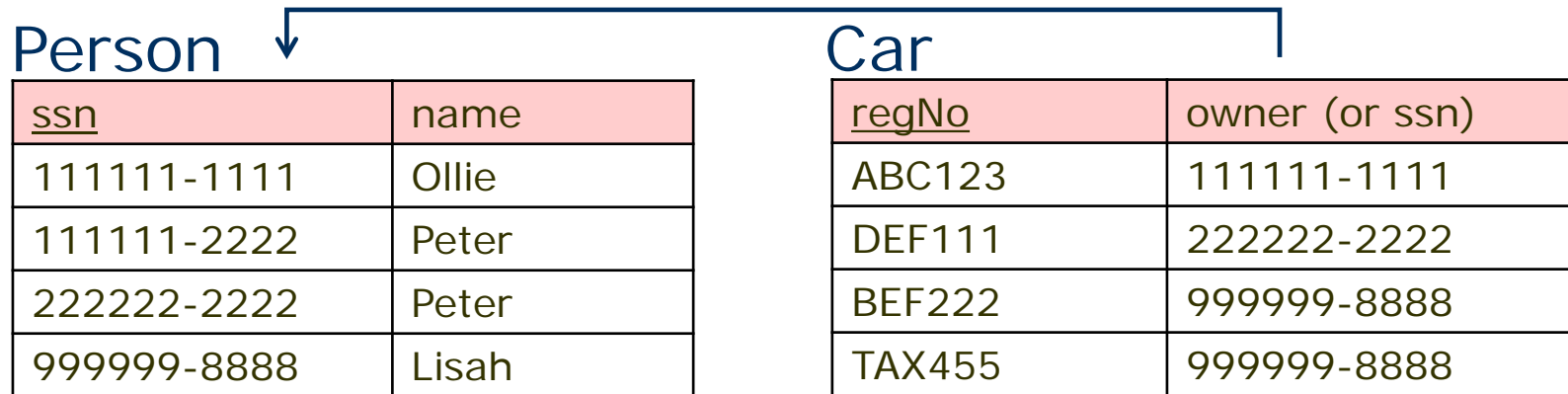
The Relational Model – Foreign Keys

- In this module you will learn more about important properties of the Relational Model:

    - Foreign keys

    - Referential integrity

Foreign Keys – The Database "Glue" 1

- There are always connections (sometimes called relationships or associations) between relations/tables in a database

  - E.g. cars have owners

    - Assume now we have tables **Car** and **Person**, where persons can be car owners.

    - So, there must be some way to connect cars to persons (owners)

- **Problem:** How to represent these connections in a relational database…?
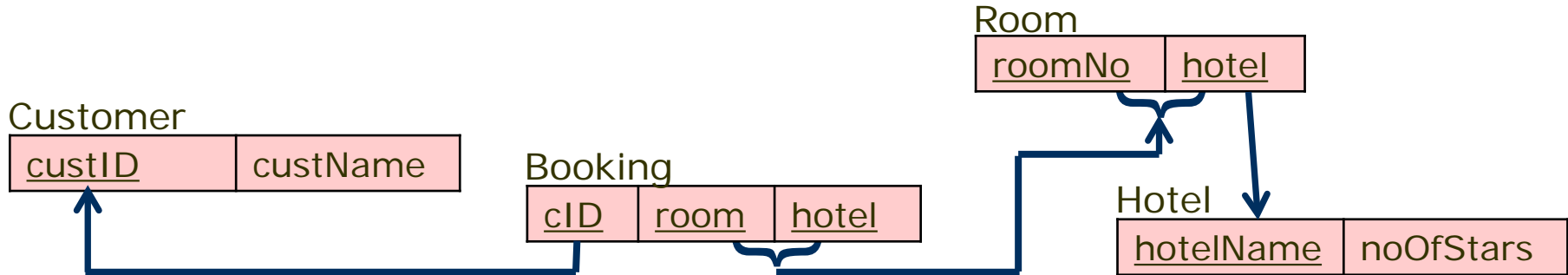
Foreign Keys – The Database "Glue" 2

- **Solution:**
  - Copy the PK in the referen*ced* relation/table (here Person)
  - Add the copy to the referen*cing* relation/table (here Car)
  - **The copy is now a connecting reference to the other table's PK**
  - The copy is called a **Foreign Key (FK)**

Person

ssn	name
111111-1111	Ollie
111111-2222	Peter
222222-2222	Peter
999999-8888	Lisah

Car

regNo	owner (or ssn)
ABC123	111111-1111
DEF111	222222-2222
BEF222	999999-8888
TAX455	999999-8888

The column Car.owner is an FK pointing to the column Person.ssn, the PK of Person.

Foreign Keys - Syntax

FKs can be shown graphically, using lines, arrows, and curly braces. The arrow then points to the attribute(s)/column(s) of the PK and from the matching FK attribute(s)/column(s). *We **do not** use graphical notation in this course!*

Room

roomNo	hotel

Customer

custID	custName

Booking

cID	room	hotel

Hotel

hotelName	noOfStars

In this course, we will define FKs using **textual notation**. The small database above is then described like this. Notice where the FK definition(s) is (are) placed.

```
Customer(custID, custName)

Hotel(hotelName, noOfStars)

Room(roomNo, hotel) Room.hotel is FK to Hotel.hotelName

Booking(cID, room, hotel) Booking.cID is FK to Customer.custID,
Booking.(room, hotel) is FK to Room.(roomNo, hotel)
```

Foreign Keys & Referential Integrity

Referential Integrity

- The values of *all* FK attributes/columns must match the values of *all* the respective attributes/columns in the referenced PK

    - **or else** *all* the FK attributes/columns must be NULL*

- **This rule is called referential integrity**

    - The rule ensures that we cannot enter non-existing references into the database

* But this is generally not recommended

Violating Referential Integrity

Person

ssn	name
111111-1111	Ollie
111111-2222	Peter
222222-2222	Peter
999999-8888	Lisah

Car

regNo	owner
ABC123	111111-1111
DEF111	222222-2222
BEF222	777777-1111
TAX455	999999-8888

What's wrong?

We are violating **referential integrity!**

The value '777777-1111' does not refer to any existing PK value!*

Under the assumption that the shown tuples/rows in Person are the only existing ones.

Foreign Keys And Referential Integrity

- This concludes the lecture about
  - Foreign Keys
  - Referential Integrity

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