

## COMP9120 Database Management Systems

### Tutorial Week 9: Schema Refinement and Normalisation

#### Exercise 1. Interpreting Functional Dependencies

Consider the following schema regarding the transport of important passengers directly from a specified pickup point at the airport entrance to the appropriate departure gate for their flights:

VipTransfers(destination,departs,airline,gate,name,contact,pickup)

A tuple such as ('Berlin', '11:25 01/06/2012', 'Lufthansa', 3, 'Justin Thyme', '0413456789', 1) means that Justin Thyme has a flight to Berlin at 11:25 on June 1, 2012, with Lufthansa Airlines, departing from Gate 3, and must be taken there from pickup point 1, and Justin can be contacted by phone on his number 0413456789. The schema has the following functional dependencies:

destination, departs, airline  $\rightarrow$  gate

gate  $\rightarrow$  airline

contact  $\rightarrow$  name

name, departs  $\rightarrow$  gate, pickup

gate, departs  $\rightarrow$  destination

- Express the above functional dependencies in simple English
- Consider the following collection of tuples. Why is this instance not a legal state for the database?

Destination	Departs	Airline	Gate	Name	Contact	Pickup
Berlin	1/06/2012 11:25	Lufthansa	3	Justin Thyme	0416594563	1
Madrid	1/07/2012 14:30	Iberian	4	Willy Makit	0497699256	2
London	3/05/2012 6:10	British Airways	7	Hugo First	0433574387	5
Moscow	1/07/2012 17:50	Aeroflot	6	Rick OhChet	0416594563	7
Berlin	1/06/2012 11:25	Qantas	1	Dick Taite	0469254233	4
Kuala Lumpur	1/08/2012 14:30	Cathay	7	Hugo First	0433574387	2
Singapore	1/08/2012 14:30	Qantas	2	Hugo First	0433574387	2
London	1/07/2012 17:50	Lufthansa	3	Justin Thyme	0413456789	4

**Exercise 2. Candidate keys and Normal Forms**

- a) Is (contact, departs, airline) a candidate key from the above functional dependencies. Can you find an alternative?
- b) Is the relation in 3NF?
- c) Explain whether it is a lossless-join decomposition to decompose the relation into the following:  
R1(destination, departs, gate)  
R2(contact, departs, pickup)  
R3(gate, airline)  
R4(contact, name)
- d) Give a lossless-join decomposition of the original relation into BCNF relations.

**Exercise 3. Relation Decomposition**

Download the vip\_transfers.sql file from Canvas which contains a schema for the above relation, along with example data. Execute the statements within this file. You can insert projections of this original relation into decomposed relations. For instance, the relation Example(contact, name) can be created as follows:

```
CREATE TABLE Example (  
    contact VARCHAR(10),  
    name VARCHAR(30)  
);  
INSERT INTO Example SELECT DISTINCT contact, name FROM VipTransfers;  
COMMIT;
```

For your proposed decomposition, try creating the decomposed relations and a query to reconstruct the whole relation. Is the query result identical to the original relation?