THE UNIVERSITY OF SYDNEY

School of Information Technologies

COMP9120 Database Management Systems **Semester 2, 2016**

Tutorial Week 7: Design Theory 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 → gate
gate → airline
contact → name
name, departs → gate, pickup
gate, departs → destination
```

a) Express the above functional dependencies in simple English.

b) 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?

(Hint: what is the closure of the suggested key?).

b) What normal form is the relation in, and why? Looking at the restrictions imposed by 2NF, 3NF and BCNF on functional dependencies will help you decide.

c) Explain whether it be a good idea to decompose the relation into the following:

R1(destination, departs, gate)

R2(gate, airline)

R3(contact, name)

R4(contact, departs, pickup)

d) Give a lossless-join, dependency-preserving decomposition of the original relation in the highest normal form relations possible. Is the decomposition 3NF or BCNF?

Exercise 3. Relation Decomposition

Only attempt this exercise once you have completed Exercises 1 and 2, otherwise this exercise should be completed for homework.

Download the `vip_transfers.sql` file, (from the Schemas page on eLearning), 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?