Inf1 Data and Analysis
Tutorial 3

Week 5, Semester 2, 2011

- Please answer all questions on this worksheet in advance of the tutorial, and bring with you all work. Tutorials cannot function properly unless you do the work in advance.

- Data & Analysis tutorial exercises are not assessed, but are a compulsory and important part of the course. If you do not do the exercises then you are unlikely to pass the exam.

- Attendance at tutorials is obligatory; please let your tutor know if you cannot attend.

- *Related Reading:* Chapter 4 (Relational Algebra and Calculus) of 'Database Management Systems' (Raghu Ramakrishnan and Johannes Gehrke, 2003).

Introduction

In this tutorial, you will learn how to construct queries in Relational Algebra and Tuple-relational Calculus as introduced in the lectures. You will work on tables in the context of Air Travel. For the sake of simplicity, date and time of travel information are omitted. This tutorial is a bit more difficult than the previous ones. Should you need any help, please ask the drop-in lab demonstrators. If you are stuck with any question, please move on to the next one.

A Relational Model for the Air Travel Domain

Consider the following DDL declarations describing tables associated with the air travel domain:

```
create table Airport (
       airportId        char(3),
       name             char(50),
```

```
        city            char(30),
        primary key (airportId)
)

create table Flight (
        flightNo        char(6),
        flightCompany   char(20),
        depAirport      char(3),
        arrAirport      char(3),
        primary key (flightNo),
        foreign key (depAirport) references Airport,
        foreign key (arrAirport) references Airport
)

create table Passenger (
        ticketNo        char(9),
        name            char(20),
        nationality     char(20),
        flightNo        char(6),
        seatNo          char(3),
        primary key (ticketNo),
        foreign key (flightNo) references Flight,
        foregin key (seatNo) references Seat
)

create table Seat (
        seatNo          char(3),
        flightNo        char(6),
        class           char(10),
        primary key (seatNo, flightNo),
        foreign key (flightNo) references Flight
)
```

Example data

The following example data may help you to construct your queries.

Airport

airportId	name	city
LHR	Heathrow	London
LGW	Gatwick	London
CDG	Charles de Gaulle	Paris
ORY	Orly	Paris

Flight

flightNo	flightCompany	depAirport	arrAirport
AF1231	Air France	LHR	CDG
AF1232	Air France	CDG	LHR
AF1234	Air France	LGW	CDG
AF1235	Air France	CDG	LGW
BA2943	British Airways	LGW	ORY
BA2944	British Airways	ORY	LGW
BA4059	British Airways	LHR	CDG
BA4060	British Airways	CDG	LHR

Passenger

ticketNo	name	nationality	flightNo	seatNo
EAG129489	John Jones	British	AF1232	12D
EAF123456	Fraser McEwan	British	AF1232	30E
ABS958332	Jane Smith	French	BA2944	10A
ORE394895	Fiona Stewart	British	BA4060	5D
EYR149583	Tom Woods	British	BA4059	14B
EAG348595	John Smith	French	BA2944	30D

Seat

seatNo	flightNo	class
12D	AF1232	Business
30E	AF1232	Economy
10A	BA2944	Business
5D	BA4060	Business
14B	BA4059	Economy
30D	BA2944	Economy

Question 1 - Understanding queries in Relational Algebra

For each of the following queries in Relational Algebra, construct the output table and provide the corresponding question in English.

(a) $\sigma_{class='Business'}(Seat)$

(b) $\sigma_{nationality='French'}(Passenger) \times \sigma_{class='Business'}(Seat)$

(c) $Passenger \bowtie Seat$

(d) $\pi_{name}(\sigma_{class='Business'}(Passenger \bowtie Seat))$

(e) $Airport \cup Seat$

Question 2 - Constructing queries in Relational Algebra and Tuple-relational Calculus

For each of the following questions, formulate the specified queries both in Relational Algebra and Tuple-relational calculus.

(a) Retrieve all the rows in Airport table for all the airports in London city. The schema of the output table should be same as that of the Airport table.

(b) Retrieve all British and French passengers. The schema of the output table should be same as that of the Passenger table.

(c) Retrieve the names of all the passengers.

(d) Retrieve the flight number, Departure and Arrival airports of all British Airways flights.

(e) Retrieve the name of every passenger together with their flight number and the associated flight company.

(f) *Optional for additional practice:* Retrieve all flights from all airports in London. The output schema should be same as that of Flight table.

(g) *Optional for additional practice:* Retrieve the ticket numbers and names of all passengers departing from London.

(h) *Optional for additional practice:* Retrieve the flight number and flight company of all flights from London to Paris.