

## An Example Relational Model for Flight Bookings

The following DDL declarations and table data describe a relational model for air travel bookings. This is a very simplified model — in particular, we don't deal with times or dates of individual flights. Notice that we are taking advantage of SQL's case insensitivity for keywords, with **create table** and **primary key** instead of **CREATE TABLE** and **PRIMARY KEY**.

```
create table Airport (  
    airportId varchar(3),  
    name      varchar(50),  
    city      varchar(30),  
    primary key (airportId)  
)
```

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

```
create table Booking (  
    ticketNo  varchar(9),  
    name      varchar(20),  
    nationality varchar(20),  
    flightNo  varchar(6),  
    seatNo    varchar(3),  
    primary key (ticketNo),  
    foreign key (flightNo) references Flight,  
    foreign key (seatNo, flightNo) references Seat  
)
```

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

### 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

## Booking

ticketNo	name	nationality	flightNo	seatNo
EAG129489	John Jones	British	AF1232	12D
EAF123456	Fraser McEwan	British	AF1232	30E
ABS958332	Mathilde Duval	French	BA2944	10A
ORE394895	Fiona Stewart	British	BA4060	5D
EYR149583	Karen Woods	British	BA4059	14B
EAG348595	Pierre Fontaine	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: Operations in Relational Algebra

For each of the following queries in relational algebra, calculate the output table and give a brief statement of what query it answers.

- (a)  $\sigma_{\text{class}='Business'}(\text{Seat})$
- (b)  $\pi_{\text{nationality}}(\text{Booking})$
- (c)  $\sigma_{\text{nationality}='French'}(\text{Booking}) \times \sigma_{\text{class}='Business'}(\text{Seat})$
- (d)  $\text{Booking} \bowtie \text{Seat}$
- (e)  $\pi_{\text{name}}(\sigma_{\text{class}='Business'}(\text{Booking} \bowtie \text{Seat}))$
- (f)  $\text{Airport} \cup \text{Seat}$

## Question 2: Constructing Queries

For each of the following questions, formulate the specified queries in tuple-relational calculus and as a computation in relational algebra.

- (a) Retrieve all information about airports in London. The schema of the output table should be same as that of the Airport table.
- (b) Retrieve details of all bookings by British and French passengers. The schema of the output table should be same as that of the Booking table.