

Databases

Exercise set 3

Relation schemas

Some of the exercises contained in this exercise set relate to the *music* database. The schemas for the relations in the database are shown here. Primary key attributes are italicised. The saleXY relation has multiple instances. One for each calendar year.

customer(*custID* int, fname varchar(255), lname varchar(255), houseNum varchar(255), postCode varchar(255))
album(*albumID* int, artist varchar(255), title varchar(255), label varchar(255), year numeric(255),
genre varchar(255), price decimal(6, 2))
artist(*artistID* int, name varchar(255), countryOfOrigin varchar(255))
label(*name* varchar(255), *region* varchar(255), country varchar(255))
genre(*name* varchar(255), description varchar(255))
saleXY(*salesRef* int, *custID* int, *albumID* int, *saleDate* date)
review(*albumID*, *custID*, rating numeric, text varchar(1024))

Relational Algebra

Consider two relations T_1 and T_2 .

V	W	X	Y	Z
1	a	x	15	e
2	a	x	10	f
2	b	x	15	g
2	b	y	15	h

T_1

C	D	X	W
4	p	x	b
5	t	x	b
6	p	y	a
7	a	y	a

T_2

For each of the following exercises, compute the result of the relational algebra expression. Think about the results of intermediate operations (where applicable) and how they combine to form the final result (you could write them down, unless they involve the Cross Product). Where applicable, think about the order in which the operations are applied and if a less computationally expensive alternative might exist. You may wish to create the above tables in your own database so that you can check your results.

To create the tables use the SQL command

```
CREATE TABLE <table_name>  
(Attribute_name_1 domain_1, ..., Attribute_name_n domain_n);
```

The domains you can use for this are int for numbers and varchar(1) or char(1) for characters.

To insert the data into the tables use the SQL command

```
INSERT INTO <table_name>
(VALUES(value, ..., value),(value, ..., value));
```

Where the number of values entered in each element of the list is the same as the number of attributes and where the value domains match the domains specified in the CREATE TABLE command.

Exercise 1

$$\sigma_{Y>12 \wedge V \neq 2}(T_1)$$

Exercise 2

$$\Pi_{X,Y}(\sigma_{W \neq b}(T_1))$$

Exercise 3

$$\sigma_{D=p}(\Pi_{X,Y}(T_1) \bowtie \Pi_{X,D}(T_2))$$

Exercise 4

$$\Pi_D(\sigma_{V=1 \wedge c \leq 5}(T_1 \times T_2))$$

Exercise 5

Write SQL queries for all of the above expressions.

More relational algebra

With reference to the ‘music’ database, put each of these relational algebra expressions into your own words.

Exercise 6

$$\Pi_{title}(\sigma_{artist='DavidBowie' \wedge price \leq 7}(Album))$$

Exercise 7

$$\Pi_{Customer.custid}(\sigma_{Album.price \geq 8}(Customer \bowtie Album \bowtie Sale15))$$

More SQL

Exercise 8

Write SQL queries for the expressions in Exercises 6 and 7.

Exercise 9

Write a relational algebra expression for this query:

```
SELECT rating, customer.custid
FROM customer, review
WHERE customer.custid = review.custid AND rating = 5;
```

Exercise 10

Write a relational algebra expression for this query:

```
SELECT album.title
FROM album NATURAL JOIN sale15 NATURAL JOIN customer
WHERE customer.lname = 'Matlock';
```

Exercise 11

Write a relational algebra expression for this query:

```
SELECT albumid
FROM
((SELECT albumid, artist FROM album WHERE artist = 'The Cure') AS temp1
NATURAL JOIN
(SELECT albumid FROM review WHERE rating = 1) AS temp2);
```