

Relational Algebra

Exercise1:

Consider an instance of the relation “Series”. Note that each series has multiple seasons.

Name	Season	Numb_of_episodes	Genre	Rating_over_five
Game of thrones	1	9	Adventure	4.5
The 100	1	4	scifi	4
How to get away with murder	1	10	thriller	4
The 100	2	17	scifi	4.5
How to get away with murder	2	14	thriller	4.5
Game of thrones	2	11	Adventure	4
Game of thrones	3	16	Adventure	3.5
Game of thrones	4	19	Adventure	4.5

1- A good primary key for the entire relation series can be:

- a) Name
- b) Name, Season
- c) Numb_of_episodes
- d) Season, Genre

2- What does this query produce: $\Pi_{Name}\{\sigma_{Season=2 \text{ AND } Season=3}(Series)\}$ if it was applied to the above instance?

- a) Game of thrones
- b) The 100
- c) How to get away with murder
- d) {Empty set}

3- What does this query produce: $\{Name \text{ } \mathcal{F} \text{ } SUM(Season) \rightarrow S(Series)\}$ if it was applied to the above instance?

- a)

Name	S
Game of thrones	4
The 100	2
How to get away with murder	2

- b)

Name	S
Game of thrones	10
The 100	3
How to get away with murder	3

- c) {Empty Set}
- d) None of the above.

4- What does this query produce: $\{\Pi_{Season}(Series)\} \cap \{\Pi_{Numb_of_episodes}(Series)\}$ if it was applied to the above instance?

- a) 4
b)

4
4

- c) Illegal (ambiguous) expression.
d) None of the above.

5- How many tuples appear after applying $\{\delta(\Pi_{Season, Rating_over_five}(Series))\}$ to the above instance? $\delta = \text{distinct}$

- a) 6
b) 5
c) 8
d) 9

Exercise2:

Schema:

Consider the following airline database schema:

- Flights (flightNumber, from, to, distance, departs)
- Aircraft (aircraft_ID, aircraft_Name, range)
- Certified (emp_ID, aircraft_ID)
- Employees (emp_ID, emp_name, salary)

Note that:

- Pilots are the employees certified on at least one aircraft.
- An aircraft can be used for any flight provided it has sufficient range.
- Pilots can take any flight provided that are certified on an aircraft having sufficient range.

Using relational algebra, express each of the following queries:

1. Find all the names of the aircrafts in your database.
2. Find all the employees with salary more than 3000\$
3. Find the numbers of all the flights that are flying from Cairo to Beirut.
4. Find the emp_ID(s) of pilots who are certified on Boeing (pay attention that Boeing is the name and not the ID of the aircraft).
5. Write the above relational algebra statement in another way
6. Assume the table resulting from the query in question (4) is renamed R. state in an English sentence what does the following expression perform. $\pi_{emp_name}(Employees \bowtie R)$
7. Find the aircraft IDs that can fly non stop from LA to NY.
8. Find names of pilots who can operate planes with a range greater than 3,000 miles.
9. Find names of pilots who can operate planes with a range greater than 3,000 miles, but are not certified on any Boeing.

Flights

FlightNbr	from	to	Distance	Departs
ME309	Beirut	Cairo	500	1:00
ME307	Beirut	Dubai	1100	2:00
AF340	Paris	NY	4000	3:00
AF550	Paris	Madrid	800	4:00
DL110	LA	NY	7000	4:30

Certified

Emp_id	Aircraft_id
100	1
100	3
200	1
200	4
300	4
400	3

Employees

Emp_id	Emp_name	Salary
100	John	6000
200	Steve	7000
300	Mary	6500
400	Karim	5000
500	Samir	4500

Aircraft

Aircraft_ID	name	range
1	Boeing	8000
2	Airbus	5000
3	Saab	8000
4	Embroer	1000

Exercise3:

Schema:

Consider the following Pizzeria database schema:

- Person (name, age, gender): key (name)
- Frequents (name, pizzeria): key (name, pizzeria)
- Eats (name, pizza): key (name, pizza)
- Serves (pizzeria, pizza, price): key (pizzeria, pizza)

Using relational algebra, express each of the following queries:

- Find the names of all the persons in your database.
- Find all the Pizzas in your database.
- Find all the pizzas offered by Dominos.
- Find the names and the ages of the persons who eat Pizza
- Find all the pizzas eaten by female persons
- Find all pizzerias frequented by at least one person under the age of 18.
- Find the names of all females who eat either mushroom or pepperoni pizza (or both).

- h. Find the names of all females who eat both mushroom and pepperoni pizza.
- i. Find all pizzerias that serve at least one pizza that Amy eats for less than \$10.00.
- j. Find all pizzerias that are frequented by only females or only males.
- k. For each person, find all pizzas the person eats that are not served by any pizzeria the person frequents. Return all such person (name) / pizza pairs.

Person						Serves		
name	age	gender				Pizzeria	pizza	price
Amy	19	F				pizza Hut	cheese	9
Sara	17	F				pizza Hut	mushroom	12
Reem	20	F				Napoli	peperoni	11
kamil	19	M				Napoli	mushroom	8
Sam	16	M				Una Pizza	cheese	12
John	22	M				Una Pizza	peperoni	14

Frequents		Eats	
name	pizzeria	name	Pizza
Amy	Pizza Hut	Amy	Cheese
Amy	Napoli	Amy	Peperoni
Reem	Napoli	Reem	Peperoni
Reem	Pizza Hut	Reem	Mushroom
Sara	Pizza Hut	Sara	Cheese
John	Napoli	John	Cheese
Kamil	Una Pizza	Kamil	Peperoni
Kamil	Napoli	Kamil	Mushroom
Sam	Una Pizza	Sam	Mushroom