Relational Algebra Join Operations

Conceptual modeling Questions:
In the world of cats. This world **is timeless**. This means the owners own the cats at present. There is no data (information) about the past (historical data) and no future plans (reservations placed on future cats ☺)

1. Each cat has only one owner and one owner has only one cat. How do you represent the relationship between a cat and its owner?
2. Each cat may have many owners, but each owner has only one cat. How do you represent the relationship between a cat and its owner?
3. Each cat may have only one owner, but an owner may have many cats. How do you represent the relationship between a cat and its owner?
4. Owners may have many cats and cats may have many owners. How do you represent the relationship between a cat and its owner?

Use the relations below to represent 2-4.
*** Add the **temporal data**, the cats are owned for a specified period of time (FROM_DATE … TO_DATE) or from a specified date without end date (currently owned).

Cat

Cat Id	CName	Color	Age
C1			
C2			
C3			

Owner

OwnerId	OName
O1	a_3
O2	a_2

In the world of people: some people own cats some don't own cats. Represent the ownership below (without temporal data and with temporal data):
Cat

Cat Id	CName	Color	Age
C1			
C2			
C3			

People

PersonId	PName
P1	
P2	

Use the relations: Cat and People to execute the following operations:

Cat

Cat Id	CName	Color	Age	PersonId
C1	Charlie	red	5	P1
C2	Dog	black	5	P2
C3	SQL	white	16	P2

People

PersonId	PName
P1	Mila
P2	John
P3	Scarlett

People world: Some people may not have cats, some have more than one cat, and cats **have only one owner**.

Write **RA expressions** to:

A. List all cats (CatID and CName) and their owners names

B. List all people (names only) and their cats (CName only) including the people who do not own cats

Write SQL to do **A** and **B**

Syntax:
SELECT <colname,…> **FROM** <tablet1>, <table2> **WHERE <comparison>**
SELECT <colname,…> **FROM** <tablet1> **JOIN** <table2> **ON <comparison>**
SELECT <colname,…> **FROM** <tablet1> **LEFT OUTER JOIN** <table2> **ON <comparison>**

Relational Algebra Exercise

Given two relations (tables) **R** and **S:**

R

A	**B**	**C**	**D**
a_1	b_1	c_2	d_1
a_3	b_1	c_1	d_2
a_2	b_2	c_4	d_5

S

E	**A**
e_1	a_3
e_3	a_2

Answer the following questions:

1. What is the result of a Selection σ over **R** : $\sigma_{B <> b_2}$ (**R**) =
   B <> b$_2$ means that *the value in column B is not equal to* b_2

2. What is the result of a Selection over R: $\sigma_{B <> b2 \text{ and } B <> b1}$ (**R**) =

3. What is the result of a Projection over **R**: π_B (**R**) =

4. Is Union **R** $\cup$ **S** a valid operation? Explain why.

5. What is the **degree** (number of columns) of the result **R x S** (**x** – Cartesian Product)?___ What is the **cardinality** of the result?____

6. Calculate **natural join** between R and S. What is the degree of the R $\rhd\lhd$ S?

7. Calculate **Left Outer Join** between R and S.

8. What is the result of **R** $\cap$ **S** ?