

Informatics for Economics II - Exercise 2
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Question 1

Using the Zoo database schema introduced in Exercise 1, write **SQL queries** that answer the following queries:

1. Details of animals who are younger than the average age of all animals. Use subqueries in your solution.

```
SELECT *  
FROM Animal  
WHERE age < (SELECT avg(Age) FROM Animal)
```

2. List the details of employees who are assigned to all of the available cages. Use the **EXISTS** keyword.

```
SELECT *  
FROM Employee  
WHERE NOT EXISTS (  
    SELECT *  
    FROM Cage  
    WHERE NOT EXISTS  
    (  
        SELECT *  
        FROM Employee_Cage  
        WHERE Employee.AHV = Employee_Cage.AHV  
        AND Employee_Cage.Cage_Id = Cage.Cage_Id  
    )  
)
```

Question 2

Transform the following SQL queries to Relational Algebra queries.

1. SELECT *
FROM R
WHERE A = B
AND D > 5

$$\sigma_{A=B \wedge D > 5}(R)$$

2. SELECT A, B
FROM C, D
WHERE C.X = D.Y

$$\pi_{A,B}(\sigma_{X=Y}(C \times D))$$

3. (SELECT A
FROM B)
INTERSECT
(SELECT D AS A
FROM C
WHERE D > 5)

$$\pi_A(B) \cap \rho_{(A)}(\pi_D(\sigma_{D > 5}(C)))$$

Question 3

Use the ER-to-Relational mapping algorithm to map the following ER-diagram into a relational database design.

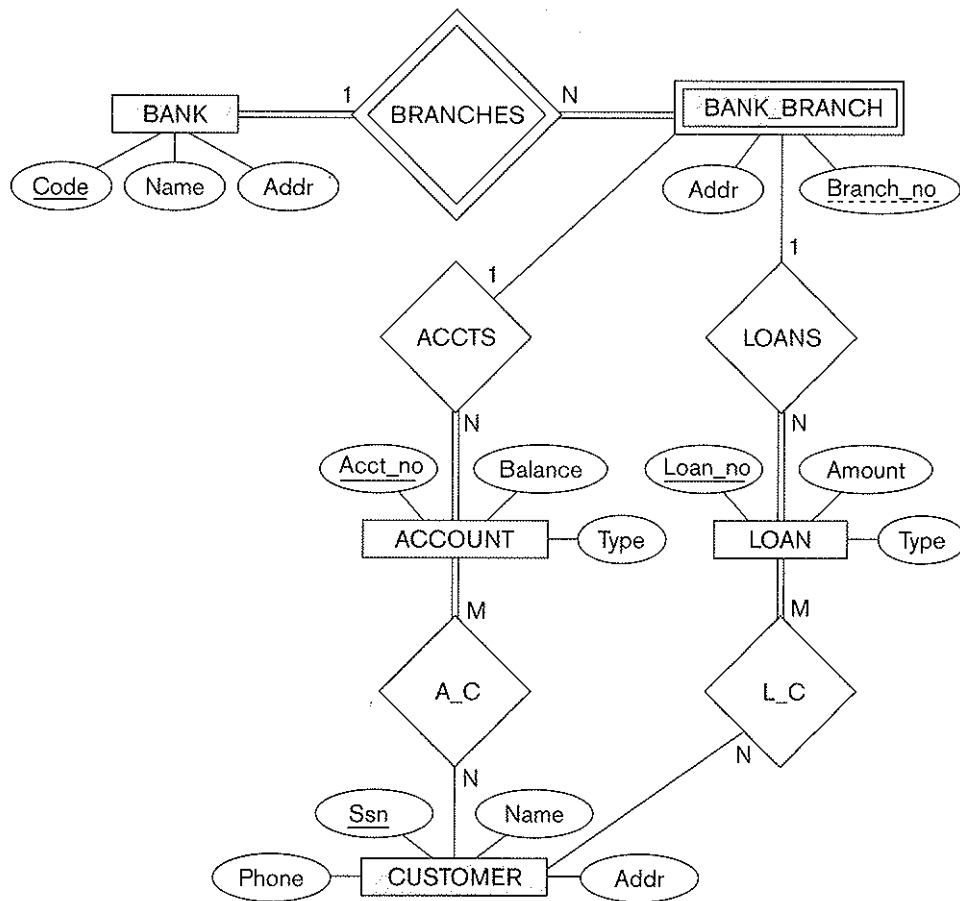


Figure 1: A Bank database schema¹

¹Elmasri, Navathe: Fundamentals of Database Systems

Solving this question requires illustrating the details of each intermediate step.

1. Mapping of Regular Entity Types

- BANK(Code, BName, BAddr)
- ACCOUNT(Acct_no, Balance, Type)
- LOAN(Loan_no, Amount, LType)
- CUSTOMER(Ssn, Phone, CName, CAddr)

2. Mapping of Weak Entity Types

- BANK(Code, BName, BAddr)
- ACCOUNT(Acct_no, Balance, Type)
- LOAN(Loan_no, Amount, LType)
- CUSTOMER(Ssn, Phone, CName, CAddr)
- BANK_BRANCH(BankCode, Branch_no, BranchAddr)

3. Mapping of Binary 1:1 Relation Types

- No 1:1 relations

4. Mapping of Binary 1:N Relationship Types

- BANK(Code, BName, BAddr)
- ACCOUNT(Acct_no, Balance, Type, BankCode, BankBranchNo)
- LOAN(Loan_no, Amount, LType, BankCode, BankBranchNo)
- CUSTOMER(Ssn, Phone, CName, CAddr)
- BANK_BRANCH(BankCode, Branch_no, BranchAddr)

5. Mapping of Binary M:N Relationship Types

- BANK(Code, BName, BAddr)
- ACCOUNT(Acct_no, Balance, Type, BankCode, BankBranchNo)
- LOAN(Loan_no, Amount, LType, BankCode, BankBranchNo)
- CUSTOMER(Ssn, Phone, CName, CAddr)
- BANK_BRANCH(BankCode, Branch_no, BranchAddr)
- A_C(AccountNumber, Ssn)
- L_C(LoanNumber, Ssn)

6. Mapping of Multivalued attributes

- No multivalued attributes

7. Mapping of N-ary Relationship Types

- No n-ary relations
- Final solution:
 - BANK(Code, BName, BAddr)
 - ACCOUNT(Acct_no, Balance, Type, BankCode, BankBranchNo)
 - LOAN(Loan_no, Amount, LType, BankCode, BankBranchNo)
 - CUSTOMER(Ssn, Phone, CName, CAddr)
 - BANK_BRANCH(BankCode, Branch_no, BranchAddr)
 - A_C(AccountNumber, Ssn)
 - L_C(LoanNumber, Ssn)