

# Assignment-1 CS303

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## 1 Problem 1

The Schema of the table is as shown below

**Branch** (branch\_name, branch\_city, assets)  
**customer** (customer\_name, customer\_street, customer\_city)  
**loan** (loan\_number, branch\_name, amount)  
**borrower** (customer\_name, loan\_number)  
**account** (account\_number, branch\_name, balance)  
**depositor** (customer\_name, account\_number)

### 1.1 Sub Question (a)

#### 1.1.1 Part (i)

To find the names of braches present in **Chicago**, we impose a condition on *branch\_city* using table **Branch**. Projection can be used to get the names.

$$\Pi_{branch\_name}(\sigma_{branch\_name="Chicago"}(Branch)) \quad (1)$$

#### 1.1.2 Part (ii)

To solve this we take the cross product of **borrower** and **loan** tables and join them based on appropriate conditions. Projection is used to select the customer names.

$$\begin{aligned} P_1 &\equiv borrower.loan\_number = loan.loan\_number \\ P_2 &\equiv loan.branch\_name = "Downtown" \\ \Pi_{borrower.customer\_name}(\sigma_{P_1 \wedge P_2}(borrower \times loan)) \end{aligned} \quad (2)$$

## 1.2 Sub Question (b)

In this question I am assuming the following

- *customer\_name* in **Customer** table are unique.
- Multiple Customers can be associated with the same loan (Joint Loans).
- One customer can take up multiple loans.
- Multiple people can open one account (Joint Account).
- One person can have only a single account number (As bank is the same in this case).

Table	Primary Key	Foreign Key
Branch	branch_name	–
customer	customer_name	–
loan	loan_number	branch_name ref. Branch
borrower	(customer_name, loan_number)	customer_name ref. customer loan_number ref. loan
account	account_number	branch_name ref. Branch
depositor	customer_name	customer_name ref. customer account_number ref. account

Table 1: Keys in the given Schema

## 1.3 Sub Question (c)

### 1.3.1 Part (i)

First use the select operator then project the *loan\_number* on **loan** table.

$$\Pi_{loan\_number}(\sigma_{amount > 10000}(loan)) \quad (3)$$

### 1.3.2 Part (ii)

We first join *account* and *depositor* tables. Then we use the select and project operator.

$$\begin{aligned}
P_1 &\equiv account.account\_number = depositor.account\_number \\
P_2 &\equiv account.balance > 6000 \\
\Pi_{depositor.customer\_name}(\sigma_{P_1 \wedge P_2}(account \times depositor))
\end{aligned} \quad (4)$$

### 1.3.3 Part (iii)

Similar to previous question, but we have another condition on `branch_name`.

$$\begin{aligned} P_1 &\equiv \text{account.account\_number} = \text{depositor.account\_number} \\ P_2 &\equiv \text{account.balance} > 6000 \\ P_3 &\equiv \text{account.branch\_name} = \text{"Uptown"} \\ \prod_{\text{depositor.customer\_name}} (\sigma_{P_1 \wedge P_2 \wedge P_3}(\text{account} \times \text{depositor})) \end{aligned} \quad (5)$$

## 2 Problem 2

### 2.1 Part (i)

Selecting users whose age is more than 25.

Name
Victor
Jane

Table 2: Output

### 2.2 Part (ii)

Select users whose Id is greater than 2 or whose age is not 31.

Id	Name	Age	Gender	OccupationId	CityId
1	John	25	Male	1	3
2	Sara	20	Female	3	4
3	Victor	31	Male	2	5
4	Jane	27	Female	1	3

Table 3: Output

### 2.3 Part (iii)

Join tables *User* and *Occupation*.

<b>Id</b>	<b>Name</b>	<b>Age</b>	<b>Gender</b>	<b>OccupationId</b>	<b>CityId</b>	<b>OccupationId</b>	<b>OccupationName</b>
1	John	25	Male	1	3	1	Software Engineer
2	Sara	20	Female	3	4	3	Pharmacist
3	Victor	31	Male	2	5	2	Accountant
4	Jane	27	Female	1	3	3	Software Engineer

Table 4: Output

### 2.4 Part (iv)

Natural join tables *User*, *Occupation* and *City*.

<b>Id</b>	<b>Name</b>	<b>Age</b>	<b>Gender</b>	<b>OccupationId</b>	<b>CityId</b>	<b>OccupationName</b>	<b>CityName</b>
1	John	25	Male	1	3	Software Engineer	Boston
2	Sara	20	Female	3	4	Pharmacist	New York
3	Victor	31	Male	2	5	Accountant	Toronto
4	Jane	27	Female	1	3	Software Engineer	Boston

Table 5: Output

### 2.5 Part (v)

Name and gender of users who live in Boston.

<b>Name</b>	<b>Gender</b>
John	Male
Jane	Female

Table 6: Output