

Relational Algebra's of all queries in Assignment 1.

1) $P \leftarrow \pi (\text{PatientID}, \text{PatientName}, \text{Gender}, \text{contactDetails}) (P_1)$

$P_1 \leftarrow \sigma (\text{Gender} = 'Female' \wedge (\text{contactDetails like '59'} \vee \text{contactDetails like '6'}))$

$PAM \leftarrow P_1 \bowtie_{\text{PatientID} = \text{PatientID}} \text{Appointments} \bowtie_{\text{staffID} = \text{staffID}} \text{Medical staff}$

$\text{Result} \leftarrow \sigma (\text{DoctorGender} = 'Female' \wedge \text{DoctorName} = 'Sarah') (PAM)$

2) $M \leftarrow \sigma (\text{Role} = 'Nurse' \wedge (\text{Date of Birth} - \text{currentDate}) < 30) (\text{Medical staff})$

$\text{Result} \leftarrow \pi (\text{staffName}) (M)$

3) $PA \leftarrow \text{Patients} \bowtie_{\text{PatientID} = \text{PatientID}} \text{Appointments}$

$PA_1 \leftarrow \sigma (\text{Gender} = \text{Male}) (PA)$

$PA_2 \leftarrow (\text{AppointmentDate Time } \int (PA_1))$

$\text{Result} \leftarrow \pi (\text{AppointmentID}) (PA_2)$

4) $T \leftarrow \pi (\text{TestID}, \text{cost}) (\text{Tests})$

$\text{Result} \leftarrow (\text{cost } \int (T))$

5) $\sigma (\text{AppointmentDate time} > \text{currentDate}) (\text{Appointments})$

6) $PM \leftarrow \text{Patients} \bowtie_{\text{LastName} = \text{LastName}} \text{Medical staff}$

$\text{Result} \leftarrow (\text{LastName } \int (PM))$

7) $PB \leftarrow \text{Patients} \bowtie_{\text{PatientID} = \text{PatientID}} \text{Billing}$

$\text{Result} \leftarrow \sigma (\text{PatientID} = \text{NULL}) (PB)$

8) $\text{Result} \leftarrow \pi (\text{MedicationName}, \text{Dosage}, \text{Instructions}) (\text{Medications})$

9) $PB \leftarrow \text{Billing} \bowtie_{\text{PatientID} = \text{PatientID}} \text{Patients}$

Result $\leftarrow \sigma_{(PatientID = NULL)} (PB)$

10) (PAM) \leftarrow Patients \bowtie Appointments \bowtie MedicalRecords
 $PatientID = PatientID$ $PatientID = PatientID$

Results $\leftarrow \sigma_{(RecordID \text{ is NULL})} (PAM)$

11) T \leftarrow Patients \bowtie Appointments
 $PatientID = PatientID$

T₁ \leftarrow T \bowtie MedicalRecords
 $PatientID = PatientID$

T₂ \leftarrow T₁ \bowtie Billing
 $PatientID = PatientID$

T₃ $\leftarrow \sigma_{(AppointmentID \text{ is NOT NULL} \wedge RecordID \text{ is NOT NULL} \wedge BillingID \text{ is NOT NULL})} (T_2)$

Result $\leftarrow \pi_{(PatientID, PatientName)} (T_3)$

12) T \leftarrow Patients \bowtie Appointments
 $PatientID = PatientID$

T₁ \leftarrow T \bowtie MedicalStaff
 $staffID = staffID$

T₂ \leftarrow T₁ \bowtie Departments
 $DepartmentID = DepartmentID$

T₃ $\leftarrow \sigma_{(DepartmentName = cardiology)} (T_2)$

Result $\leftarrow \pi_{(PatientID, PatientName)} (T_3)$

13) T \leftarrow MedicalStaff \bowtie MedicalRecords
 $staffID = staffID$

T₁ \leftarrow T \bowtie Patients
 $PatientID = PatientID$

T₂ \leftarrow T₁ \bowtie Billing
 $PatientID = PatientID$

T₃ $\leftarrow \sigma_{(DateofBirth > 1990-01-01 \wedge PaymentStatus = Paid)} (T_2)$

Result $\leftarrow \bar{\pi}_{(\text{staffName})}(T_3)$

14) $T \leftarrow \text{Patients} \bowtie \text{Appointments}$

PatientID = PatientID

$T_1 \leftarrow \sigma_{(\text{status} = \text{scheduled} \vee \text{status} = \text{completed})}(T)$

Result $\leftarrow \bar{\pi}_{(\text{PatientID}, \text{PatientName})}(T_1)$

15) $T \leftarrow \text{Patients} \bowtie \text{MedicalRecords} \bowtie \text{Billing}$

PatientID = PatientID

PatientID = PatientID

Result $\leftarrow \bar{\pi}_{(\text{PatientID}, \text{PatientName})}(T)$

16) $T \leftarrow \text{Patients} \bowtie \text{MedicalRecords}$

PatientID = PatientID

$T_1 \leftarrow T \bowtie \text{Tests}$

TestResults like 'xray' \vee TestName = 'xray'

$T_2 \leftarrow T_1 \bowtie \text{Appointments}$

PatientID = PatientID

$T_3 \leftarrow T_2 \bowtie \text{Medical staff}$

staffID = staffID

$T_4 \leftarrow \sigma_{(\text{staffName} = \text{Lisa Wang})}(T_3)$

Result $\leftarrow \bar{\pi}_{(\text{PatientID}, \text{PatientName})}(T_4)$

17) $T \leftarrow \text{Medical staff} \bowtie \text{Appointments}$

staffID = staffID

$T_1 \leftarrow T \bowtie \text{Patients}$

PatientID = PatientID

$C_1 \leftarrow \gamma_{(\text{count}(\text{DeptID}))}(T_1)$

$C_2 \leftarrow \gamma_{(\text{count}(\text{DeptID}))}(\text{Departments})$

$$F \leftarrow C_1 = C_2$$

$$\text{Result} \leftarrow \pi(\text{PatientID}, \text{PatientName})(F)$$

$$18) T \leftarrow \text{Medications} \bowtie \text{Patients}$$

PatientID = PatientID

$$T_1 \leftarrow \sigma_{\text{PatientID} = (\text{PatientID} \int (\text{count}(\text{MedicationName}) \geq 2))}(T)$$

$$\text{Result} \leftarrow \pi(\text{PatientID}, \text{PatientName}, \text{MedicationName})(T_1)$$

$$19) T \leftarrow \text{Patients} \bowtie \text{Appointments}$$

PatientID = PatientID

$$T_1 \leftarrow T \bowtie \text{MedicalStaff}$$

PatientID = PatientID

$$T_2 \leftarrow T_1 \bowtie \text{Departments}$$

DeptID = DeptID

$$T_3 \leftarrow \sigma_{\text{status} = \text{scheduled}}(T_2)$$

$$\text{Result} \leftarrow \pi(\text{PatientID}, \text{PatientName}, \text{DepartmentName})(T_3)$$

$$20) T \leftarrow \text{Patients} \bowtie \text{MedicalRecords}$$

PatientID = PatientID

$$T_1 \leftarrow T \bowtie \text{Appointments}$$

StaffID = StaffID

$$T_2 \leftarrow T_1 \bowtie \text{MedicalStaff}$$

staffID = staffID

$$\text{Result} \leftarrow \pi(\text{PatientName}, \text{Diagnosis}, \text{Treatment}, \text{staffName})(T_2)$$

Relational Algebra for all queries in Assignment 2.Q2

$$1) \quad T \leftarrow \text{Users} \bowtie_{\text{userID} = \text{userID}} \text{UserCard}$$

$$T_1 \leftarrow T \bowtie_{\text{CardNum} = \text{CardNum}} \text{Cards}$$

$$T_2 \leftarrow \sigma_{\text{CardNum} = (\text{CardNum} \uparrow (\text{MAX}(\text{Balance}))(\text{Cards}))}(T_1)$$

$$\text{Result} \leftarrow \pi_{(\text{userID}, \text{Name})}(T_2)$$

$$2) \quad T \leftarrow \text{Cards} \bowtie_{\text{CardTypeID} = \text{CardTypeID}} \text{CardType}$$

$$T_1 \leftarrow T \bowtie_{\text{CardNum} = \text{CardNum}} \text{UserCard}$$

$$T_2 \leftarrow \sigma_{\text{userID} = 1}(T_1)$$

$$\text{Result} \leftarrow \pi_{(\text{CardTypeID}, \text{Name})}(T_2)$$

$$3) \quad T \leftarrow \text{Cards} \bowtie_{\text{CardTypeID} = \text{CardTypeID}} \text{CardType}$$

$$T_1 \leftarrow T \bowtie_{\text{CardNum} = \text{CardNum}} \text{UserCard}$$

$$T_2 \leftarrow T_1 \bowtie_{\text{userID} = \text{userID}} \text{Users}$$

$$T_3 \leftarrow \sigma_{\text{city} = \text{Dublin}}(T_2)$$

$$\text{Result} \leftarrow \pi_{(\text{CardTypeID}, \text{Name})}(T_3)$$

4) $T \leftarrow \text{Cards} \bowtie_{\text{CardNum} = \text{cardNum}} \text{UserCard}$

$\text{CardNum} = \text{cardNum}$

$T_1 \leftarrow T \bowtie_{\text{userID} = \text{userID}} \text{Users}$

$\text{userID} = \text{userID}$

$T_2 \leftarrow \sigma_{\text{city} = \text{Moscow}}(T_1)$

~~$T_3 \leftarrow \sigma_{\text{Max(Balance)}}(T_2)$~~

~~$\sigma_{\text{Max(Balance), CardNum}}$~~

$T_3 \leftarrow \sigma_{\text{userID} = (\exists (\text{Max(Balance)})(\text{Cards}))}(T_2)$

$T_4 \leftarrow \pi_{\text{userID, Balance}}(T_3)$

$\text{Result} \leftarrow f_{\text{Total Balance}}(\exists (\text{SUM(Balance)})(T_4))$

5) $T \leftarrow \text{Cards} \bowtie_{\text{CardTypeID} = \text{cardTypeID}} \text{CardType}$

$\text{CardTypeID} = \text{cardTypeID}$

$T_1 \leftarrow T \bowtie_{\text{CardNum} = \text{CardNum}} \text{UserCard}$

$\text{CardNum} = \text{CardNum}$

$T_2 \leftarrow T_1 \bowtie_{\text{userID} = \text{userID}} \text{Users}$

$\text{userID} = \text{userID}$

$T_3 \leftarrow \sigma_{\text{CardName} = \text{debit} \wedge \text{Balance} > (\exists (\text{Avg(Balance)})(\text{Cards}))}(T_2)$

$\text{Result} \leftarrow \pi_{\text{userName}}(T_3)$

$$6) \quad T \leftarrow \text{Cards} \bowtie_{\text{cardType.ID} = \text{cardType.ID}} \text{CardType}$$

$$T_1 \leftarrow T \bowtie_{\text{cardNum} = \text{cardNum}} \text{UserCard}$$

$$T_2 \leftarrow T_1 \bowtie_{\text{userID} = \text{userID}} \text{Users}$$

$$T_3 \leftarrow \sigma_{(\text{cardName} = \text{Debit})}(T_2)$$

$$T_4 \leftarrow \sigma_{(\text{cardName} = \text{Credit})}(T_2)$$

$$T_5 \leftarrow (T_3 \cap T_4)$$

$$\text{Result} \leftarrow \pi_{(\text{userName})}(T_5)$$

$$7) \quad T \leftarrow \text{Cards} \bowtie_{\text{cardTypeID} = \text{cardTypeID}} \text{CardType}$$

$$T_1 \leftarrow T \bowtie_{\text{cardNum} = \text{cardNum}} \text{UserCard}$$

$$T_2 \leftarrow T_1 \bowtie_{\text{userID} = \text{userID}} \text{Users}$$

$$T_3 \leftarrow \sigma_{(\text{cardName} = \text{Debit} \wedge \text{city like 'V\%'})}(T_2)$$

$$\text{Result.} \leftarrow \rho_{(\text{AverageBalance})}(\gamma_{(\text{Avg}(\text{Balance}))}(T_3))$$