

Relational Algebra

Question 1

$R_1 := \sigma_{\text{Department_Name} = \text{"Cardiology"} \wedge \text{Hospital} = \text{"Bellevue General Hospital"} \vee \text{"Grand Oak Hospital"}} (\text{Department})$

$R_2 := \pi_{\text{Department_ID}}(R_1)$

$R_3 := (\text{Employee}) \bowtie (R_2)$

$R_4 := \pi_{\text{Employee_ID}, \text{Role}}(R_3)$

$\pi_{\text{Employee_ID}, \text{Role}} ((\text{Employee}) \bowtie (\pi_{\text{Department_ID}}(\sigma_{\text{Department_Name} = \text{"Cardiology"} \wedge \text{Hospital} = \text{"Bellevue General Hospital"} \vee \text{"Grand Oak Hospital"}} (\text{Department}))))$

Question 2

$R_1 := \sigma_{\text{Test_Name} = \text{"Blood Glucose Test"}} (\text{Test})$

$R_2 := \pi_{\text{Test_ID}}(R_1)$

$R_3 := (\text{Contain}) \bowtie (R_2)$

$R_4 := \gamma_{\text{AVG}(\text{Value}) \rightarrow \text{"Blood Glucose Average"}} (R_3)$

$\gamma_{\text{AVG}(\text{Value}) \rightarrow \text{"Blood Glucose Average"}} ((\text{Contain}) \bowtie (\pi_{\text{Test_ID}}(\sigma_{\text{Test_Name} = \text{"Blood Glucose Test"}} (\text{Test}))))$

Question 3

$R_1 := \sigma_{\text{AdmitDate} \geq \text{"2020-01-01"}} (\text{AdmissionRecord})$

$R_2 := \gamma_{\text{PatientID}, \text{COUNT}(\ast) \rightarrow \text{AdmissionCount}} (R_1)$

$R_3 := \sigma_{\text{AdmissionCount} \geq 3} (R_2)$

$\sigma_{\text{AdmissionCount} \geq 3} (\gamma_{\text{PatientID}, \text{COUNT}(\ast) \rightarrow \text{AdmissionCount}} (\sigma_{\text{AdmitDate} \geq \text{"2020-01-01"}} (\text{AdmissionRecord})))$

Question 4

$R_1 := (\text{Test}) \bowtie_{\text{Test.Test_ID} = \text{Contain.Test_ID}} (\text{Contain})$

$R_2 := \sigma_{\text{"2020-01-01"} \leq \text{Date} \leq \text{"2020-12-21"} \wedge \text{Result} = \text{"Abnormal"}} (R_1)$

$R_3 := \gamma_{\text{Type}, \text{COUNT}(\text{result}) \rightarrow \text{"Abnormal Test Count"}} (R_2)$

$\gamma_{\text{Type}, \text{COUNT}(\text{result}) \rightarrow \text{"Abnormal Test Count"}} (\sigma_{\text{"2020-01-01"} \leq \text{Date} \leq \text{"2020-12-21"} \wedge \text{Result} = \text{"Abnormal"}} ((\text{Test}) \bowtie_{\text{Test.Test_ID} = \text{Contain.Test_ID}} (\text{Contain})))$

Question 5

$R_1 := \gamma_{\text{MAX}(\text{DateOut} - \text{DateIn}) \rightarrow \text{LongestStay}} (\text{ICUStay})$

$R_2 := (\text{Person } p) \times (\text{ICUStay } i) \times (\text{AdmissionRecord } a)$

$R_3 := \sigma_{p.\text{personID} = a.\text{patientID} \wedge a.\text{adm_ID} = i.\text{adm_ID}} (R_2)$

$R_4 := (R_3) \bowtie (R_1)$

$R_5 := \pi_{a.\text{PatientID}, p.\text{Age}, p.\text{Gender}} (R_4)$

$\pi_{a.\text{PatientID}, p.\text{Age}, p.\text{Gender}} ((\sigma_{p.\text{personID} = a.\text{patientID} \wedge a.\text{adm_ID} = i.\text{adm_ID}} ((\text{Person } p) \times (\text{ICUStay } i) \times (\text{AdmissionRecord } a)))) \bowtie (\gamma_{\text{MAX}(\text{DateOut} - \text{DateIn})} (\text{ICUStay}))$

Question 6

$R_1 := (\text{Diagnosed}) \bowtie_{\text{Diagnosed.Disease_ID} = \text{Disease.Disease_ID}} (\text{Disease})$

$R_2 := (\text{Person}) \bowtie_{\text{Person.PersonID} = \text{Diagnosed.PatientID}} (R_1)$

$R_3 := \gamma_{\text{Disease.Category}, \text{AVG}(\text{Person.age}) \rightarrow \text{avgAge}} (R_2)$

$\gamma_{\text{Disease.Category}, \text{AVG}(\text{Person.age}) \rightarrow \text{avgAge}} ((\text{Person}) \bowtie_{\text{Person.PersonID} = \text{Diagnosed.PatientID}} ((\text{Diagnosed}) \bowtie_{\text{Diagnosed.Disease_ID} = \text{Disease.Disease_ID}} (\text{Disease})))$

Question 7

$R_1 := \text{Employee} \bowtie_{\text{Employee_ID} = \text{PatientID}} (\text{Diagnosed})$

$R_2 := (\text{Disease}) \bowtie_{\text{Disease_ID} = \text{Disease_ID}} (R_1)$

$R_3 := \sigma_{\text{Department_ID} \neq \text{NULL} \wedge \text{Disease_Name} \neq \text{'Food Allergy'} \vee \text{'Flu'} \vee \text{'Conjunctivitis'}} (R_2)$

$R_4 := \pi_{\text{Employee_ID}} (R_3)$

$R_5 := \delta (R_4)$

$\delta (\pi_{\text{Employee_ID}} (\sigma_{\text{Department_ID} \neq \text{NULL} \wedge \text{Disease_Name} \neq \text{'Food Allergy'} \vee \text{'Flu'} \vee \text{'Conjunctivitis'}} ((\text{Disease}) \bowtie_{\text{Disease_ID} = \text{Disease_ID}} (\text{Employee} \bowtie_{\text{Employee_ID} = \text{PatientID}} (\text{Diagnosed}))))))$

Question 8

$R_1 := \pi_{\text{Disease_ID}} (\sigma_{\text{Category} = \text{'Blood and Lymph'}} (\text{Disease}))$

$R_2 := (\text{LabRecord } lr) \bowtie_{lr.\text{PatientID} = d.\text{patientID}} (\text{Diagnosed})$

$R_3 := (\text{Contain } c) \bowtie_{lr.\text{lab_ID} = c.\text{lab_ID}} (R_2)$

$R_4 := \sigma_{c.\text{Result} = \text{'Abnormal'}} \wedge c.\text{Date} = d.\text{Date_of_Diagnosis}} (R_3)$

$R_5 := (R_4) \bowtie (R_1)$

$R_6 := \pi_{d.\text{PatientID}, c.\text{Date} \rightarrow \text{DATE}} (R_5)$

$\pi_{d.\text{PatientID}, c.\text{Date} \rightarrow \text{DATE}} ((\sigma_{c.\text{Result} = \text{'Abnormal'}} \wedge c.\text{Date} = d.\text{Date_of_Diagnosis}} ((\text{Contain } c) \bowtie_{lr.\text{lab_ID} = c.\text{lab_ID}} ((\text{LabRecord } lr) \bowtie_{lr.\text{PatientID} = d.\text{patientID}} (\text{Diagnosed})))) \bowtie (\pi_{\text{Disease_ID}} (\sigma_{\text{Category} = \text{'Blood and Lymph'}} (\text{Disease}))))$

