CZ2007 Tutorial 5: Relational Algebra

Week 7

Question 1

Shopper(shopperName, street, ageGroup)

Mall(mallName, street)

ShopAt(shopperName, mallName, date, time, dayOfWeek)

Question 1

Find those **shopper**(s) who shopped at all the **malls** on "Nanyang Ave" every **Thursday** between **10am to 5pm**, and find the **streets** that these shoppers live in.

Select **malls** on Nanyang Ave

$R1 := \Pi_{mallName} (\sigma_{street = \text{'Nanyang Ave'}} Mall)$

Select **shoppers** who shopped on Nanyang Ave malls on Thursday between 10am to 5pm

$R2 := \sigma_{street = \text{'Nanyang Ave'} \text{ and } dayOfWeek = \text{'Thursday'} \text{ and } time >= 10am \text{ and } time <= 5pm} (ShopAt \bowtie Mall)$

Select **shoppers** and **malls**

$R3 := \Pi_{shopperName,\ mallName} (R2)$

Find **shoppers** who shopped at ALL **malls** on Nanyang Ave

$R4 := R3 \div R1$

Find **shoppers'** streets

$R5 := R4 \bowtie Shopper$

Answer: $\Pi_{shopperName,\ street} (R5)$

Question 2

Find the **age** groups of those **shoppers**(s) who **only** shop at malls that are located on the **street** where he/she lives.

Find **shoppers** who shopped, take note of the **streets** the shoppers lived

$R1 := \Pi_{shopperName,\ mallName,\ street}\ (Shopper \bowtie_{Shopper.shopperName=ShopAt.shopperName} ShopAt)$

Find **malls** shopped by shoppers, take note of the **streets** where malls are located

$R2 := \Pi_{shopperName,\ mallName,\ street}\ (Mall \bowtie_{Mall.mallName=ShopAt.mallName} ShopAt)$

Do relation renaming for easier manipulation later

$\rho_{R3(sName,\ mName,\ sStreet}\ (R1)$

$\rho_{R4(sName,\ mName,\ mStreet}\ (R2)$

Question 2

Find **shoppers** who ever before shopped at **malls** on the same **street** they live

$R5 := \Pi_{shopperName}\ (R3 \bowtie_{R1.sName=R2.sName\ and\ R1.mName=R2.mName\ and\ sStreet<>mStreet} R4)$

Find **shoppers** who only shopped at **malls** on the same **streets** they live

$R6: \Pi_{shopperName}\ (Shopper) - R5$

Find **shoppers**' age group

$R7 := R6 \bowtie Shopper$

Answer: $\Pi_{shopperName,\ ageGroup}\ (R7)$

Question 3

Consider **Jurong Point Mall**, the shopping mall that is 3.5km south of NTU. Find those shoppers who have shopped there **more times** than anyone else does. Also find out these shoppers' **age** groups.

Find shopping activities at Jurong Point Mall

$R1 := \sigma_{\text{mallName} = \text{'Jurong Point'}} \text{ ShopAt}$

Count how many times each shopper shopped at JPM

$R2 := \gamma_{\text{shopperName, COUNT(date)} \rightarrow \text{VisitCount}} \text{ R1}$

Find out maximum count

$R3 := \gamma_{\text{MAX(VisitCount)} \rightarrow \text{MaxVisitCount}} \text{ R2}$

Find out which shopper has this max count

$R4 := \Pi_{\text{shopperName}} (R2 \bowtie_{\text{VisitCount} = \text{MaxVisitCount}} R3)$

Find out shoppers' age group

$\text{Result} := \Pi_{\text{shopperName, ageGroup}} (\text{Shopper} \bowtie R4)$

Question 4

Consider Jurong Point Mall, the shopping mall that is 3.5km south of NTU. Find those shoppers in the 20s-30s age group who have **never shopped** at Jurong Point Mall on Friday evenings between 7pm to 10pm. Also find out which streets these shoppers live in.

Find shopping activities at JPM on Friday between 7-10pm

$R1 := \sigma_{\text{mallName = 'Jurong Point' and dayOfWeek = 'Friday' and time >= 7pm and time <= 10pm}} (\text{ShopAt})$

Extract shoppers' names from these activities

$R2 := \Pi_{\text{shopperName}} (R1)$

Find shoppers in 20s-30s

$R3 := \sigma_{\text{ageGroup = '20s-30s'}} (\text{Shopper})$

Find shoppers in 20s-30s who shopped at JPM on Friday 7-10pm

$R4 := \Pi_{\text{shopperName}} (R2 \bowtie R3)$

Find all other shoppers

$R5 := (\Pi_{\text{shopperName}} R3) - R4$

Find shoppers' streets

$\text{Result} := \Pi_{\text{shopperName, street}} (\text{Shopper} \bowtie R5)$

Question 5

Find shopping **malls** that have never been visited by **shoppers** in the 40s-50s age group on Wednesday mornings between 9am to 11am. Also find out which **streets** these malls are located.

Find **shopping activities** on Wednesday between 9 to 11am.

$R1 := \sigma_{\text{dayOfWeek = 'Wednesday' and time >= 9am and time <= 11am}} (\text{ShopAt})$

Find shoppers in the **40-50s** age group.

$R2 := \sigma_{\text{ageGroup = '40s-50s'}} (\text{Shopper})$

Find those **malls** shopped by shoppers in the 40-50s age group who shopped on Wednesday mornings between 9am to 11am.

$R3 := \Pi_{\text{mallName}} (R1 \bowtie R2)$

Find out all **other malls**.

$R4 := (\Pi_{\text{mallName}} \text{Mall}) - R3$

Find the **streets** of these **other malls**.

$\text{Result} := \Pi_{\text{mallName, street}} (\text{Mall} \bowtie R4)$

Question 6

For each shopper, find **how many other shoppers** shopped at the **same malls** as him/her on the **same date**.

Extract relevant attributes.

$\rho_{R1(s1,\ mall,\ date)}\ (\Pi_{shopperName,\ mallName,\ date}\ ShopAt)$

$\rho_{R2(s2,\ mall,\ date)}\ (\Pi_{shopperName,\ mallName,\ date}\ ShopAt)$

Find shoppers who shopped at the **same malls** on the **same date**.

$R3 := R1 \bowtie_{s1<>s2\ and\ R1.mall=R2.mall\ and\ R1.date=R2.date}\ R2$

Extract just shoppers' **names**.

$R4 := \Pi_{s1,\ s2}\ (R3)$

For each shopper, count **how many other shoppers** shopped at the same malls on the same date.

$Result := \gamma_{s1,\ COUNT(s2)\rightarrow numS2}\ R4$

Question 7

Find the mall(s) that is/are shopped by the **largest number** of **repeat shoppers** in the 20s-30s age group. Repeat shoppers of a mall are shoppers who have shopped **more than once** in the mall.

For each mall, find **how many times** shoppers shopped there.

$R1 := \gamma_{\text{mallName, shopperName, COUNT(date)}\rightarrow\text{numTimes}}(\text{ShopAt})$

Find those **malls** being shopped by the **same shoppers** more than once.

$R2 := \sigma_{\text{numTimes} > 1}(R1)$

These are the **repeat shoppers**.

$\rho_{\text{RepeatShoppers}(\textbf{shopperName}, \textbf{mallName}, \text{numTimes})}\ R2$

From these repeat shoppers, select those in the **20-30s** age group.

$R3 := \sigma_{\text{ageGroup} = \text{“20s-30s”}}(\text{Shopper} \bowtie \text{RepeatShopper})$

Question 7

For each mall, find **how many times** it is shopped by repeat shoppers.

$R4 := \gamma_{\text{mallName, COUNT(shopperName)}\rightarrow\text{NumShoppers}}(R3)$

Find **max count**.

$R5 := \gamma_{\text{MAX(NumShoppers)}\rightarrow\text{MaxNum}}(R4)$

Find those malls with max repeat shoppers.

Result: $\Pi_{\text{mallName}}\ (R3 \bowtie_{\text{R1.NumShoppers} = \text{R2.MaxNum}}\ R5)$