CZ2007 Tutorial 5: Relational Algebra

Week 7

Question 1

Shopper(<u>shopperName</u>, street, ageGroup)

Mall(<u>mallName</u>, street)

ShopAt(<u>shopperName, mallName, date, time</u>, 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
$R1 := \Pi_{\text{mallName}} (\sigma_{\text{street = 'Nanyang Ave'}} \text{Mall})$
R1: MallName

Select **shoppers** who shopped on **Nanyang Ave malls** on **Thursday between 10am to 5pm**
$R2 := \sigma_{\text{street = 'Nanyang Ave' and dayOfWeek = 'Thursday' and time >= 10am and time <= 5pm}} (\text{ShopAt} \bowtie \text{Mall})$
R2: shoppername, mallName, date, time, dayofWeek, street

Select **shoppers** and **malls**
$R3 := \Pi_{\text{shopperName, mallName}} (R2)$
R3: shoppername, mallName

Find **shoppers** who shopped at **ALL malls** on **Nanyang Ave**
$R4 := R3 \div R1$
R4: shoppername

Find **shoppers'** streets
$R5 := R4 \bowtie \text{Shopper}$
R5: shoppername, street, agegroup

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

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

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

R1: shoppername, street, mallname

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

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

R2: shoppername, mallname, street

Do relation renaming for easier manipulation later

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

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

Question 2

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

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

R5: shoppername

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

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

R6: shoppername

Find **shoppers**' age group

$R7 := R6 \bowtie \text{Shopper}$

R7: shoppername, street, agegroup

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

Ans: shoppername, agegroup

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

R1: shoppername, mallname, date, time, dayofweek

Count how many **times each shopper** shopped at JPM
$R2 := \gamma_{\text{shopperName, COUNT(date)} \rightarrow \text{VisitCount}} R1$

R2: shoppername, visitcount

Find out **maximum count**
$R3 := \gamma_{\text{MAX(VisitCount)} \rightarrow \text{MaxVisitCount}} R2$

R3: maxvisitcount

Find out which **shopper** has this **max count**
$R4 := \Pi_{\text{shopperName}} (R2 \bowtie_{\text{VisitCount = MaxVisitCount}} R3)$

R4: shoppername

Find out shoppers' age group
$\text{Result} := \Pi_{\text{shopperName, ageGroup}} (\text{Shopper} \bowtie R4)$

Ans: shoppername, agegroup

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

R1: shoppername,mallname,date,time, dayofweek

Extract shoppers' names from these activities
$R2 := \Pi_{\text{shopperName}}$ (R1)   R2: shoppername

Find shoppers in 20s-30s
$R3 := \sigma_{\text{ageGroup = '20s-30s'}}$ (Shopper)   R3: shoppername, street, agegroup

Find shoppers in 20s-30s who shopped at JPM on Friday 7-10pm
$R4 := \Pi_{\text{shopperName}}$ (R2 ⋈ R3)

R4: shoppername

Find all other shoppers
$R5 := (\Pi_{\text{shopperName}}\ R3) - R4$ R5: shoppername

Find shoppers' streets
$\text{Result} := \Pi_{\text{shopperName, street}}$ (Shopper ⋈ R5)

Ans: shoppername, street

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.

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

R1: shoppername, mallname, date, time, dayofweek

Find shoppers in the 40-50s age group.

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

R2: shoppername,street,agegroup

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

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

R3: mallname

Find out all other malls.

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

R4: mallname

Find the streets of these other malls.

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

Ans: mallname,street

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.

$\rho_{R1(s1, \text{mall}, \text{date})}$ $(\Pi_{\text{shopperName, mallName, date}}$ ShopAt) $\quad$ R1 & R2: shoppername,mallname, date

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

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

R3 := R1 $\bowtie_{s1<>s2 \text{ and } R1.\text{mall}=R2.\text{mall and } R1.\text{date}=R2.\text{date}}$ R2 $\quad$ R3: shoppername, mallname, date

Extract just shoppers' names.

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

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

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

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

Find those malls being shopped by the same shoppers more than once.
$$R2 := \sigma_{\text{numTimes} > 1}(R1)$$
R2: mallname, shoppername, numTimes

These are the repeat shoppers.

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

From these repeat shoppers, select those in the 20-30s age group.
$$R3 := \sigma_{\text{ageGroup} = \text{``20s-30s''}}(\text{Shopper} \bowtie \text{RepeatShopper})$$

R3: mallname, shoppername, numTimes

Question 7

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

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

R4: mallname,numshoppers

Find **max count**.

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

R5: maxnum

Find those malls with max repeat shoppers.

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

Ans: mallname