CSC343 Worksheet 2 Solution

June 11, 2020

1. **Exercise 2.4.1:**

   a) $\sigma_{speed \geq 3.0}(\text{Movies})$

   Models 1005, 1006, 1013 have speed greater than 3.0

model	*speed*	*ram*	*hd*	*price*
1001	2.66	1024	250	2114
1002	2.10	512	250	995
1003	1.42	512	80	478
1004	2.80	1024	250	649
→ 1005	3.20	512	250	630
→ 1006	3.20	1024	320	1049
1007	2.20	1024	200	510
1008	2.20	2048	250	770
1009	2.00	1024	250	650
1010	2.80	2048	300	770
1011	1.86	2048	160	959
1012	2.80	1024	160	649
→ 1013	3.06	512	80	529

Notes:

- Select
  - Is indicated by σ
  - **Syntax:** σ_{QUERY}SCHEMA_NAME
  - e.g $\sigma_{length \geq 100}$ **AND** $studioName = \text{'}Fox\text{'}$(Movies)

Relation - Movies

title	*year*	*length*	*inColor*	*studioName*	*producerC#*
Star Wars	1977	124	sciFi	Fox	12345
Galaxy Quest	1999	104	comedy	DreamWorks	67890

b) $\pi_{maker}(\sigma_{hd \geq 100}(\text{Product} \bowtie \text{Laptop}))$

Makers A, E, F, G make laptops with hard-disk of at least 100GB.

maker	model	type
A	1001	pc
A	1002	pc
A	1003	pc
A	2004	laptop
A	2005	laptop
A	2006	laptop
B	1004	pc
B	1005	pc
B	1006	pc
B	2007	laptop
C	1007	pc
D	1008	pc
D	1009	pc
D	1010	pc
D	3004	printer
D	3005	printer
E	1011	pc
E	1012	pc
E	1013	pc
E	2001	laptop
E	2002	laptop
E	2003	laptop
E	3001	printer
E	3002	printer
E	3003	printer
F	2008	laptop
F	2009	laptop
G	2010	laptop
H	3006	printer
H	3007	printer

Figure 2.20: Sample data for Product

model	speed	ram	hd	screen	price
2001	2.00	2048	240	20.1	3673
2002	1.73	1024	80	17.0	949
2003	1.80	512	60	15.4	549
2004	2.00	512	60	13.3	1150
2005	2.16	1024	120	17.0	2500
2006	2.00	2048	80	15.4	1700
2007	1.83	1024	120	13.3	1429
2008	1.60	1024	100	15.4	900
2009	1.60	512	80	14.1	680
2010	2.00	2048	160	15.4	2300

(b) Sample data for relation Laptop

Notes:

- Project
  - **Syntax:** $\pi_{A_1, A_2, \cdots, A_n}(\text{Rel})$
    - $A_1, \cdots, A_n$ represents attributes
  - Picks certain columns
  - e.g

    What are the titles and years of movies made by Fox that are at least 100 minutes long?

    $$\pi_{title,year}(\sigma_{length \geq 100 \text{ AND } studioName = \text{'Fox'}})(\text{Movies})$$

- Cross-Product / Cartesian Product

- Combines two relations
- **Syntax:** Relation 1 × Relation 2
- e.g. Names and GPAs of students with $HS > 1000$ who applied to CS and were rejected

$\pi_{sName,GPA}(\sigma_{Student.sID=Apply.sID}$ **AND** $HS{>}1000$ **AND** $major{=}'cs'$ **AND** $dec{=}'R')$(Student × Apply)

College

cName	state	enr

Student

sID	sName	GPA	HS

Apply

sID	cName	major	dec

- Natural Join
  - Enforce equality on all attributes with the same name
  - Eliminiate one copy of duplicate attributes
  - Is symbolized by ⋈
  - **Syntax:** Relation 1 ⋈ Relation 2
  - e.g.

    Names and GPAs of students with $HS > 1000$ who applied to CS and were rejected.

$\pi_{sName,GPA}(\sigma_{HS>1000}$ **AND** $major{=}'cs'$ **AND** $dec{=}'R'$(Student ⋈ Apply))

Student

sID	sName	GPA	HS

+

Apply

sID	cName	major	dec

합체!!

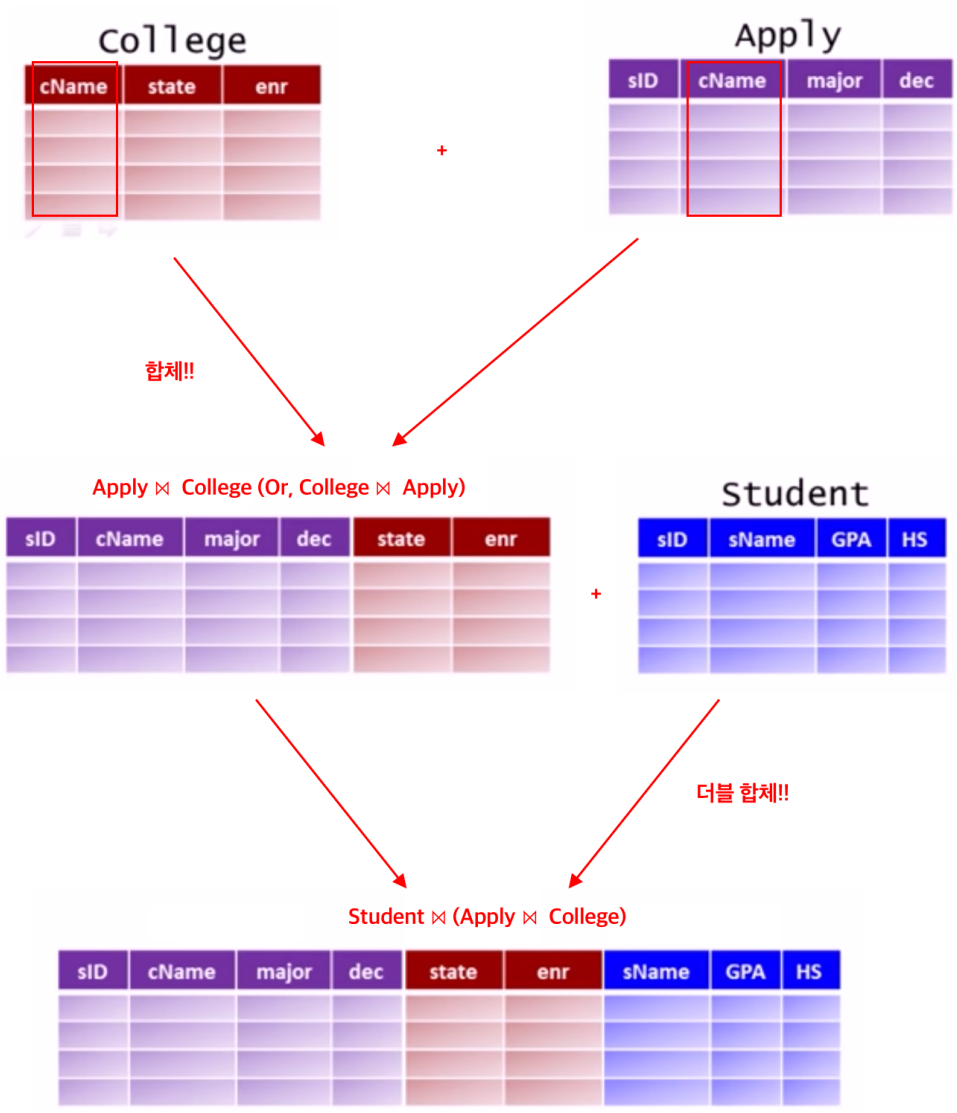
Student ⋈ Apply

sID	sName	GPA	HS	cName	major	dec

– e.g.2.

Names and GPAs of students with $HS > 1000$ who applied to CS at college with $enr > 20,000$ and were rejected

$\pi_{sName,GPA}($
$\sigma_{HS>1000 \textbf{ AND } enr>20000 \textbf{ AND } major='cs' \textbf{ AND } dec='R'}(\text{Student} \bowtie (\text{Apply} \bowtie \text{College}))$
$)$



- Union Operator
  - **Syntax** R ∪ S
  - Is the set of elements that are in R or S or both.

  - An element appears only once in the union even if it is present in both R and S.
  - Is like **UNION** keyword in SQL
  - e.g.

    List of college and student names

$$\pi_{cName}(\text{College}) \cup \pi_{sName}(\text{Student})$$

- Difference Operator
  - **Syntax:** $R - S$
  - Is also called the *difference* of R and S
  - is the set of elements that are in R but not in S.
  - Is like **EXCEPT** keyword in SQL
  - e.g.

    IDs and names of students who didn't apply anywhere

$$\pi_{sID}(\text{Student}) - \pi_{sID}(\text{Apply})$$

- Intersection Operator
  - **Syntax:** $R \cap S$
  - Is also canned the *intersection* of R and S
  - Is the set of elements that are in both R and S
  - e.g.

    Names that are both a college name and a student name

$$\pi_{cName}(\text{College}) - \pi_{sName}(\text{Student})$$

c)

$$\pi_{model,price}(\sigma_{maker=\text{'B'}}(\text{Product} \bowtie (\pi_{model,price}(\text{Laptop}) \cup \pi_{model,price}(\text{PC}) \cup \pi_{model,price}(\text{Printer}))) \quad (1)$$

The price and model number of all products made by manufacturer B are

1. model 1004, price 649
2. model 1005, price 630
3. model 1006, price 1049

4. model 2007, price 1429

maker	*model*	*type*
A	1001	pc
A	1002	pc
A	1003	pc
A	2004	laptop
A	2005	laptop
A	2006	laptop
B	1004	pc
B	1005	pc
B	1006	pc
B	2007	laptop
C	1007	pc
D	1008	pc
D	1009	pc
D	1010	pc
D	3004	printer
D	3005	printer
E	1011	pc
E	1012	pc
E	1013	pc
E	2001	laptop
E	2002	laptop
E	2003	laptop
E	3001	printer
E	3002	printer
E	3003	printer
F	2008	laptop
F	2009	laptop
G	2010	laptop
H	3006	printer
H	3007	printer

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1013	3.06	512	80	529

(a) Sample data for relation PC

d) $\pi_{model}(\sigma_{color=\text{true}}$ **AND** $_{type=\text{'laser'}}(\text{Printer}))$

Model 3003, and 3007 are color laster printers

model	*color*	*type*	*price*
3001	true	ink-jet	99
3002	false	laser	239
3003	true	laser	899
3004	true	ink-jet	120
3005	false	laser	120
3006	true	ink-jet	100
3007	true	laser	200

(c) Sample data for relation Printer