CSE 4125: Distributed Database Systems
Chapter – 5

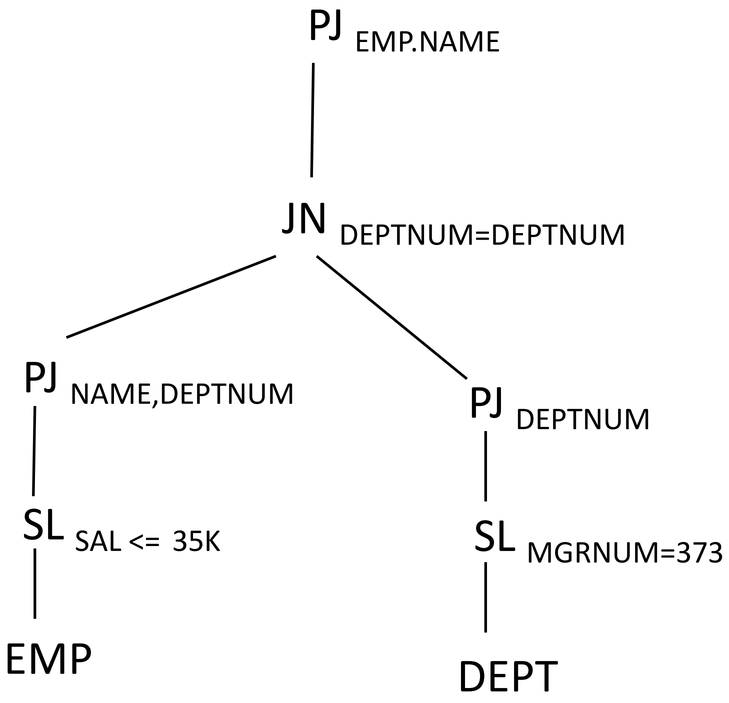
Translation of Global Queries to Fragment Queries.

(part – B)

Outline

- Qualified relations.
- Algebra of qualified relations.
- Simplification of horizontally and vertically fragmented relations.
- Simplification of joins between horizontally fragmented relations.
- Criterion – 3, 4 and 5.
- Parametric queries and their simplifications.

Qualified Relation



$\text{PJ}_{\text{EMP.NAME}}$

$\text{JN}_{\text{DEPTNUM=DEPTNUM}}$

$\text{PJ}_{\text{NAME,DEPTNUM}}$

$\text{SL}_{\text{SAL <= 35K}}$

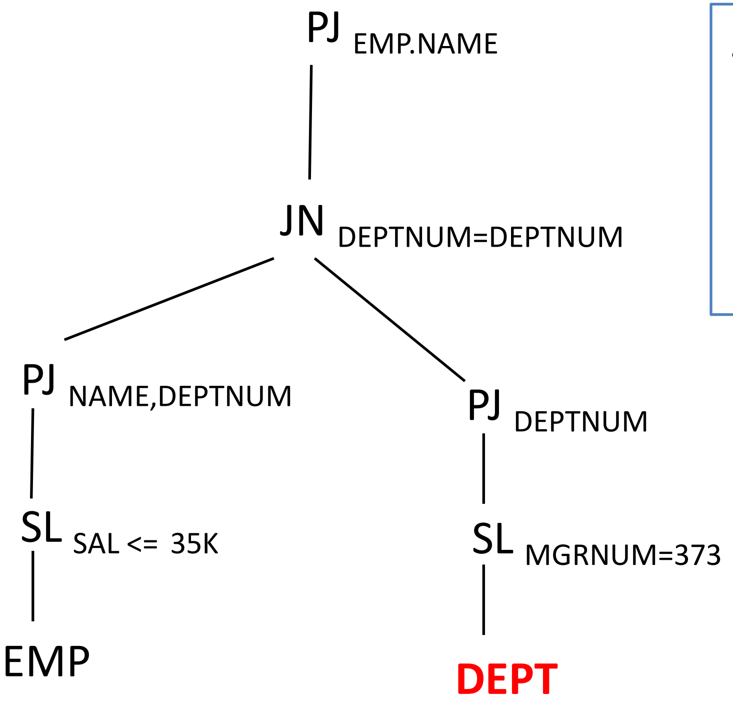
EMP

$\text{PJ}_{\text{DEPTNUM}}$

$\text{SL}_{\text{MGRNUM=373}}$

DEPT

Qualified Relation (contd.)



$PJ_{EMP.NAME}$

$JN_{DEPTNUM=DEPTNUM}$

$PJ_{NAME,DEPTNUM}$

$SL_{SAL <= 35K}$

EMP

$PJ_{DEPTNUM}$

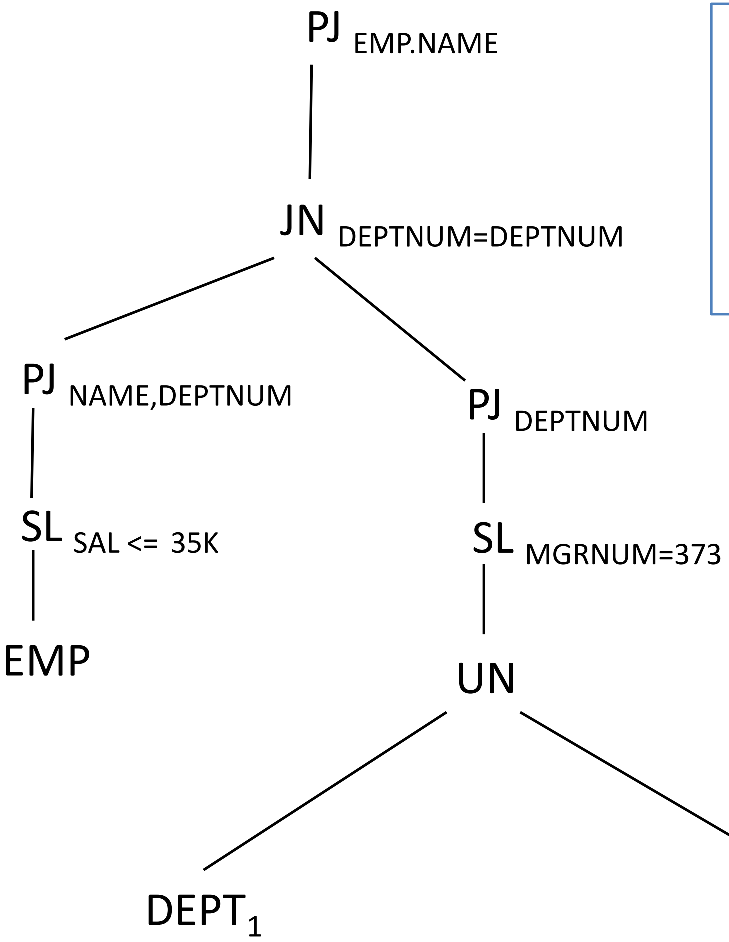
$SL_{MGRNUM=373}$

DEPT

Say, DEPT has 2 fragments: $DEPT_1$ and $DEPT_2$.

$DEPT_1$: $SL_{deptnum <= 10}$ DEPT
$DEPT_2$: $SL_{deptnum > 10}$ DEPT

Qualified Relation (contd.)



$PJ_{EMP.NAME}$

$JN_{DEPTNUM=DEPTNUM}$

$PJ_{NAME,DEPTNUM}$

$PJ_{DEPTNUM}$

$SL_{SAL <= 35K}$

$SL_{MGRNUM=373}$

EMP

UN

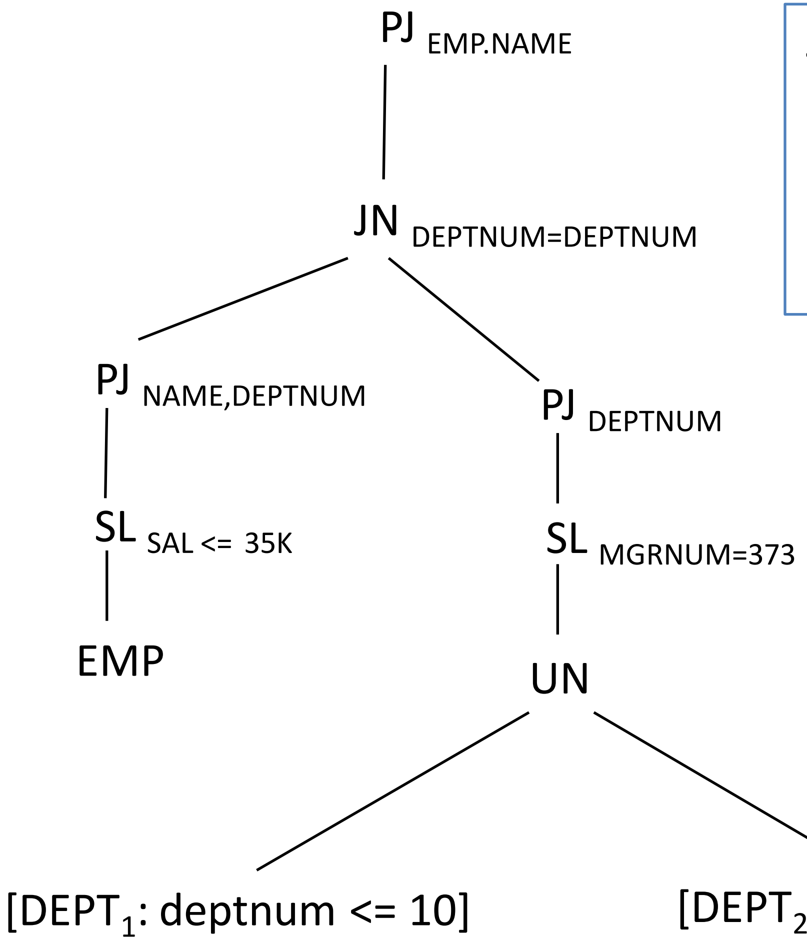
$DEPT_1$

$DEPT_2$

Say, DEPT has 2 fragments: $DEPT_1$ and $DEPT_2$.

$DEPT_1$: $SL_{deptnum <= 10}$ DEPT
$DEPT_2$: $SL_{deptnum > 10}$ DEPT

Qualified Relation (contd.)



PJ $_{\text{EMP.NAME}}$

JN $_{\text{DEPTNUM=DEPTNUM}}$

PJ $_{\text{NAME,DEPTNUM}}$

SL $_{\text{SAL <= 35K}}$

EMP

PJ $_{\text{DEPTNUM}}$

SL $_{\text{MGRNUM=373}}$

UN

[DEPT$_1$: deptnum <= 10]

[DEPT$_2$: deptnum > 10]

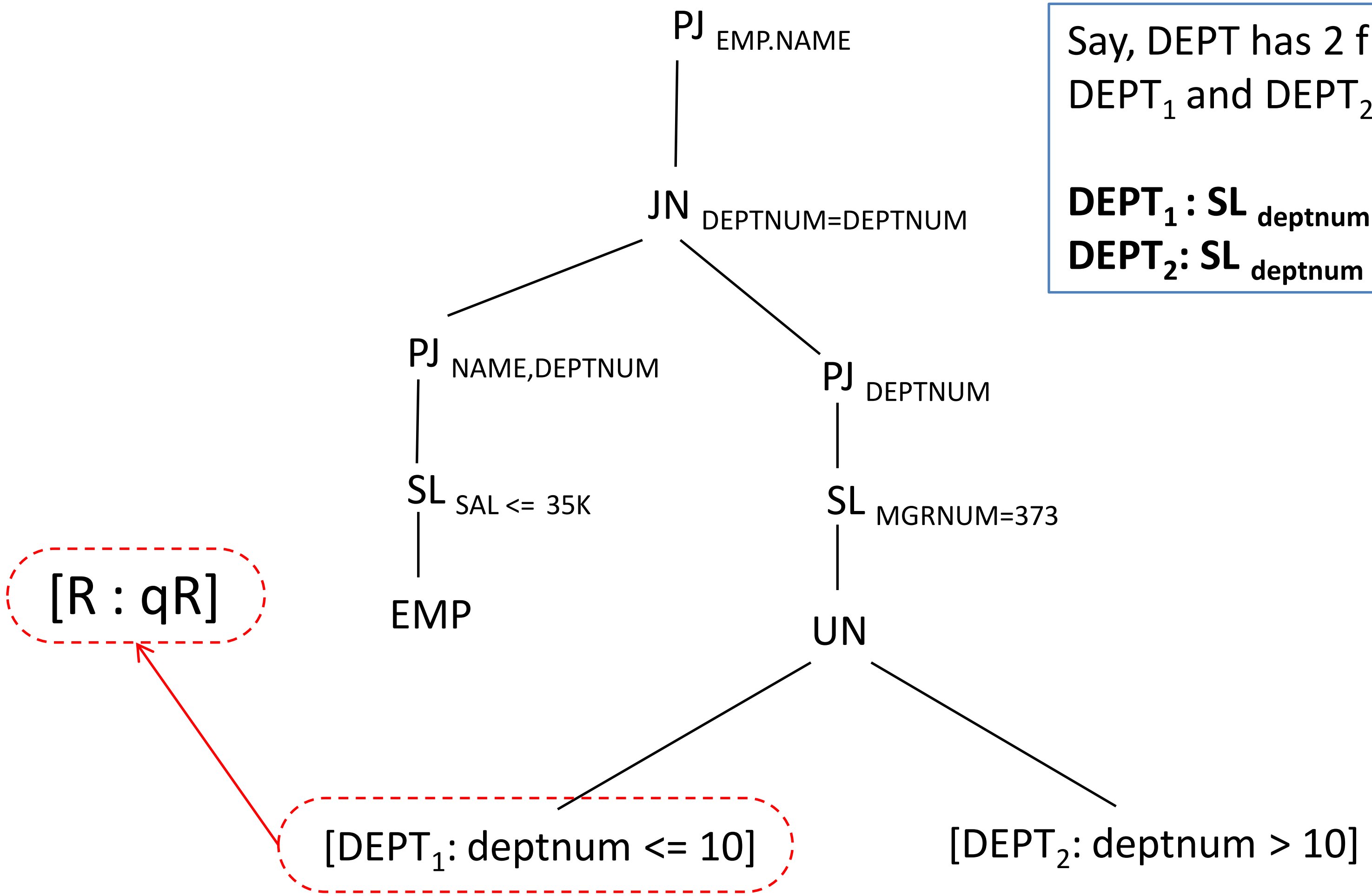
Say, DEPT has 2 fragments: DEPT$_1$ and DEPT$_2$.

DEPT$_1$: SL $_{\text{deptnum <= 10}}$ DEPT
DEPT$_2$: SL $_{\text{deptnum > 10}}$ DEPT

Qualified Relation (contd.)

Say, DEPT has 2 fragments: $DEPT_1$ and $DEPT_2$.

$DEPT_1$: SL $_{deptnum <= 10}$ DEPT
$DEPT_2$: SL $_{deptnum > 10}$ DEPT



PJ $_{EMP.NAME}$

JN $_{DEPTNUM=DEPTNUM}$

PJ $_{NAME,DEPTNUM}$

SL $_{SAL <= 35K}$

EMP

PJ $_{DEPTNUM}$

SL $_{MGRNUM=373}$

UN

[$DEPT_1$: deptnum <= 10]

[$DEPT_2$: deptnum > 10]

[R : qR]

Qualified Relation (contd.)

- A Qualified relation –
  - Is a relation extended by a qualification.
  - Is denoted as a pair **[R : qR]**, where *R* is a relation called **body** and *qR* is a predicate called **qualification**.
    - Qualifications can be seen as an intentional property possessed by all the tuples of the relation. For example all the tuples in **R** satisfies **qR**.

Algebra of Qualified Relation

- We know **relational algebra** uses **relations** as operands.
  - For example, SL_F **R**
- **Algebra of qualified relation** uses **qualified relations** as operands.
  - For example, SL_F **[R :** ***qR*****]**

Rules of Algebra of Qualified Relation

Rule 1: SL_F **[R :** *qR***]** → **[SL_F R :** *F and qR***]**

[**ACCOUNT** $_1$**:** *ID < 5*]

ID	*NAME*	*CITY*
1	a	dhk
2	b	dhk
3	c	ctg
4	d	ctg

SL $_{\text{CITY = dhk}}$ [**ACCOUNT** $_1$**:** *ID < 5*]

ID	*NAME*	*CITY*
1	a	dhk
2	b	dhk

[**SL** $_{\textbf{CITY = dhk}}$ **ACCOUNT** $_1$**:** *ID < 5 and CITY = dhk*]

ID	*NAME*	*CITY*
1	a	dhk
2	b	dhk

Rules of Algebra of Qualified Relation

Rule 1: SL_F [R : *qR*] → [SL_F R : *F and qR*]

Rule 2: PJ_A [R : *qR*] → [PJ_A R : *qR*]

Rule 3: [R : *qR*] CP [S : *qS*] → [R CP S: *qR and qS*]

Rule 4: [R : *qR*] DF [S : *qS*] → [R DF S: *qR*]

Rules of Algebra of Qualified Relation (contd.)

Rule 5: [R : *qR*] UN [S : *qS*] → [R UN S: *qR or qS*]

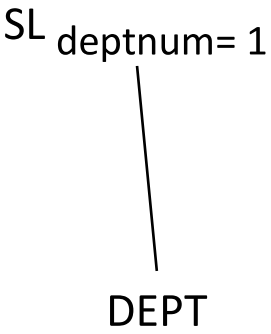
Rule 6: [R : *qR*] JN_F [S : *qS*] → [R JN_F S: *qR and qS and F*]

Rule 7: [R : *qR*] SJ_F [S : *qS*] → [R SJ_F S: *qR and qS and F*]

Simplification of Horizontally Fragmented Relations

Example

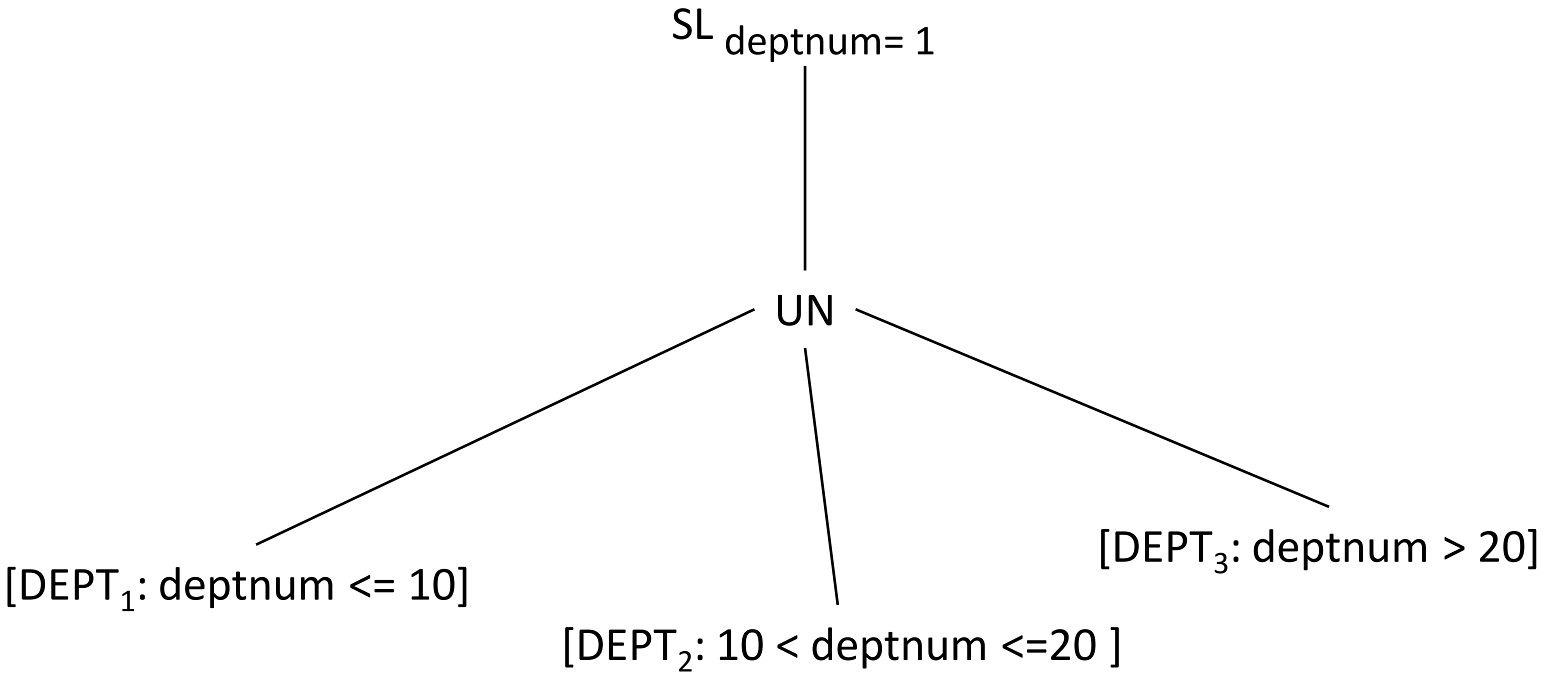
Q: $\text{SL}_{\text{deptnum = 1}}$ **DEPT**



$\text{SL}_{\text{deptnum= 1}}$

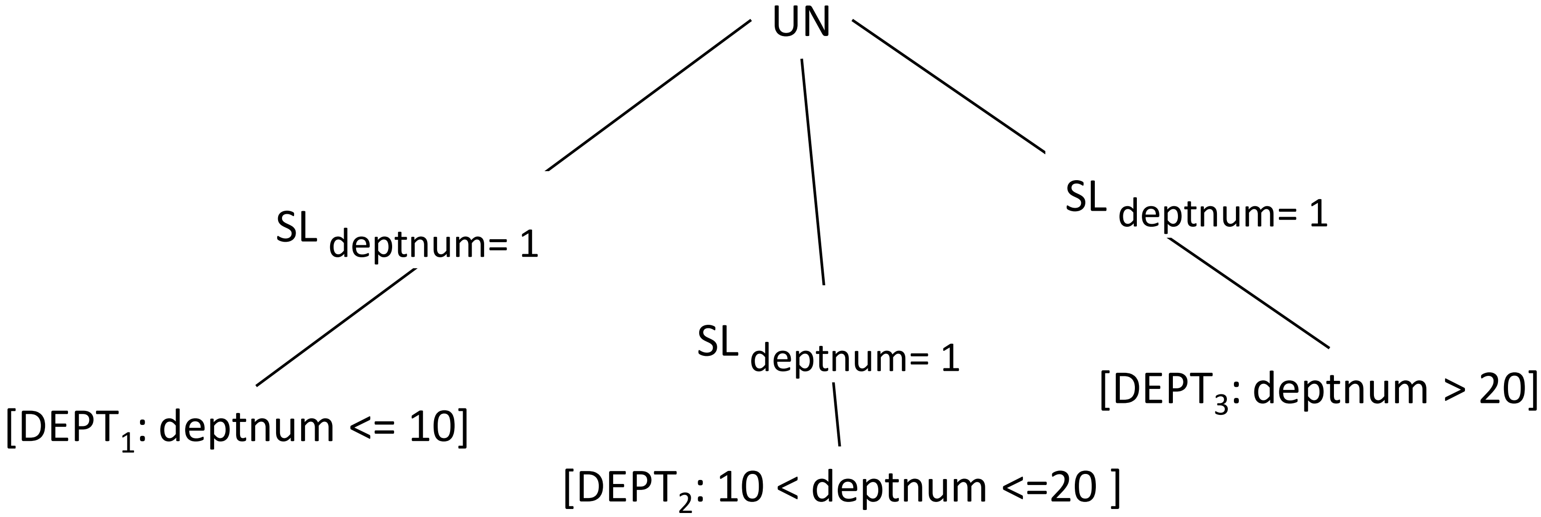
DEPT

Example (contd.)



Example (contd.)

- Now, apply algebra of qualified relation.



UN

SL $_{\text{deptnum}=1}$

SL $_{\text{deptnum}=1}$

SL $_{\text{deptnum}=1}$

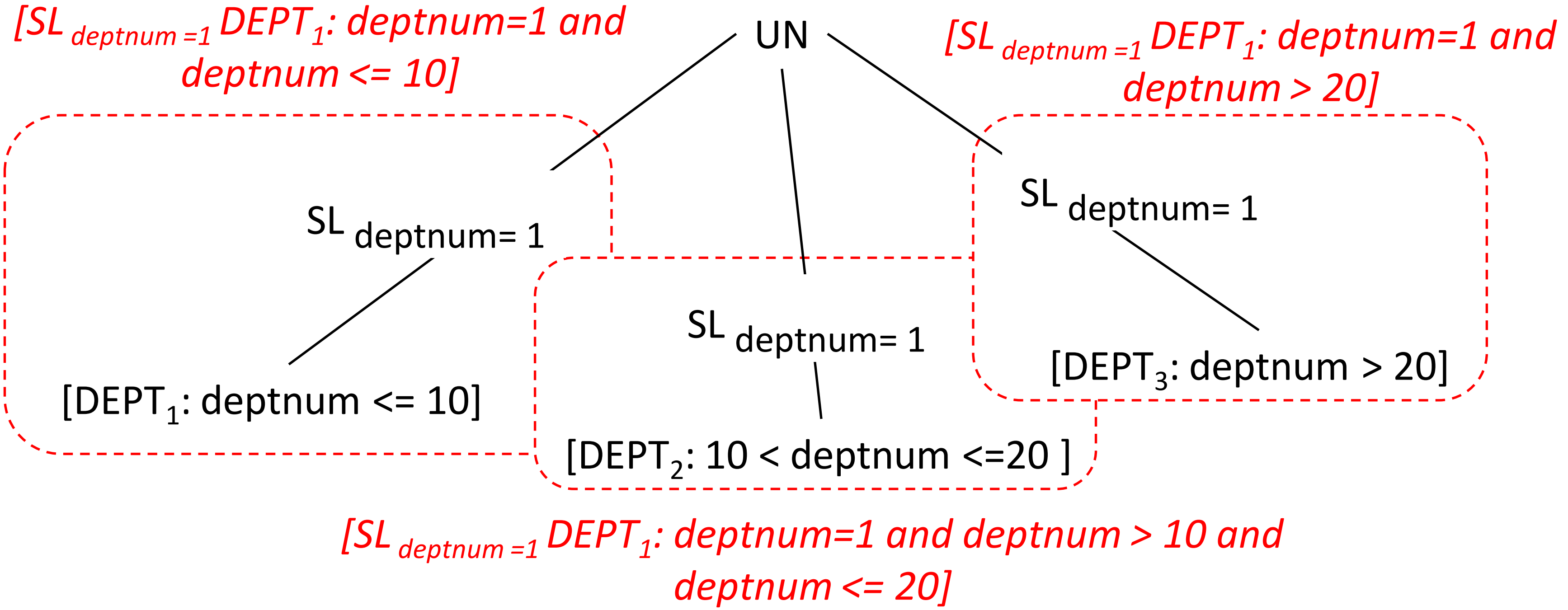
[DEPT$_1$: deptnum <= 10]

[DEPT$_2$: 10 < deptnum <=20]

[DEPT$_3$: deptnum > 20]

Example (contd.)

- Check if any contradiction.



[SL $_{deptnum=1}$ DEPT$_1$: deptnum=1 and deptnum <= 10]

UN

[SL $_{deptnum=1}$ DEPT$_1$: deptnum=1 and deptnum > 20]

SL $_{deptnum= 1}$

[DEPT$_1$: deptnum <= 10]

SL $_{deptnum= 1}$

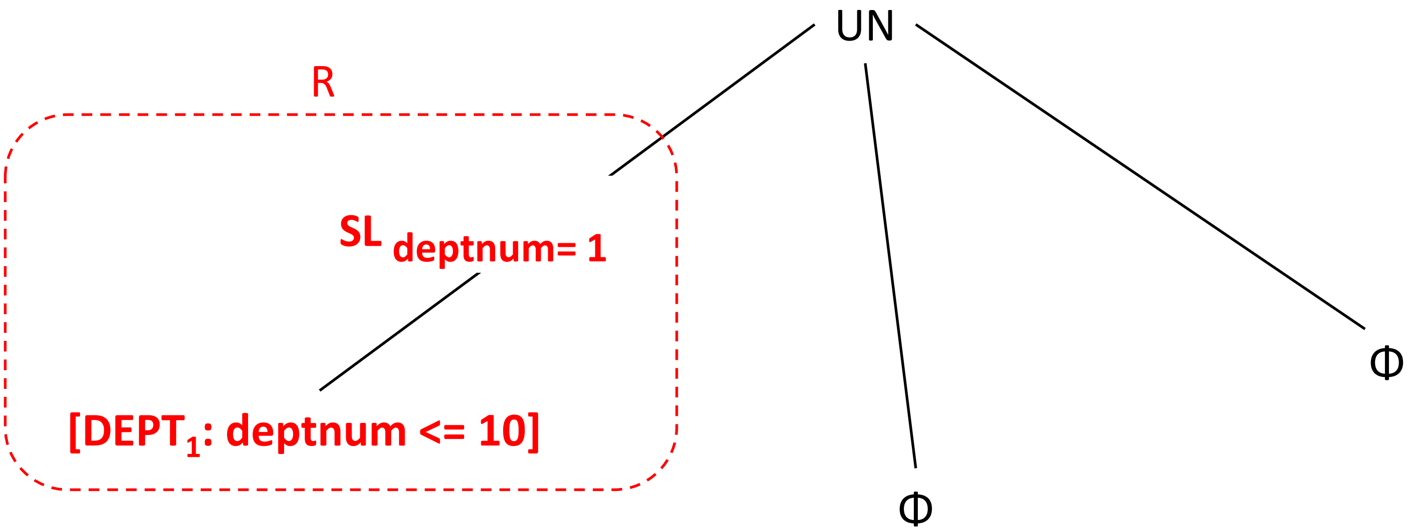
[DEPT$_2$: 10 < deptnum <=20]

SL $_{deptnum= 1}$

[DEPT$_3$: deptnum > 20]

[SL $_{deptnum=1}$ DEPT$_1$: deptnum=1 and deptnum > 10 and deptnum <= 20]

Example (contd.)



UN

R

$SL_{deptnum=1}$

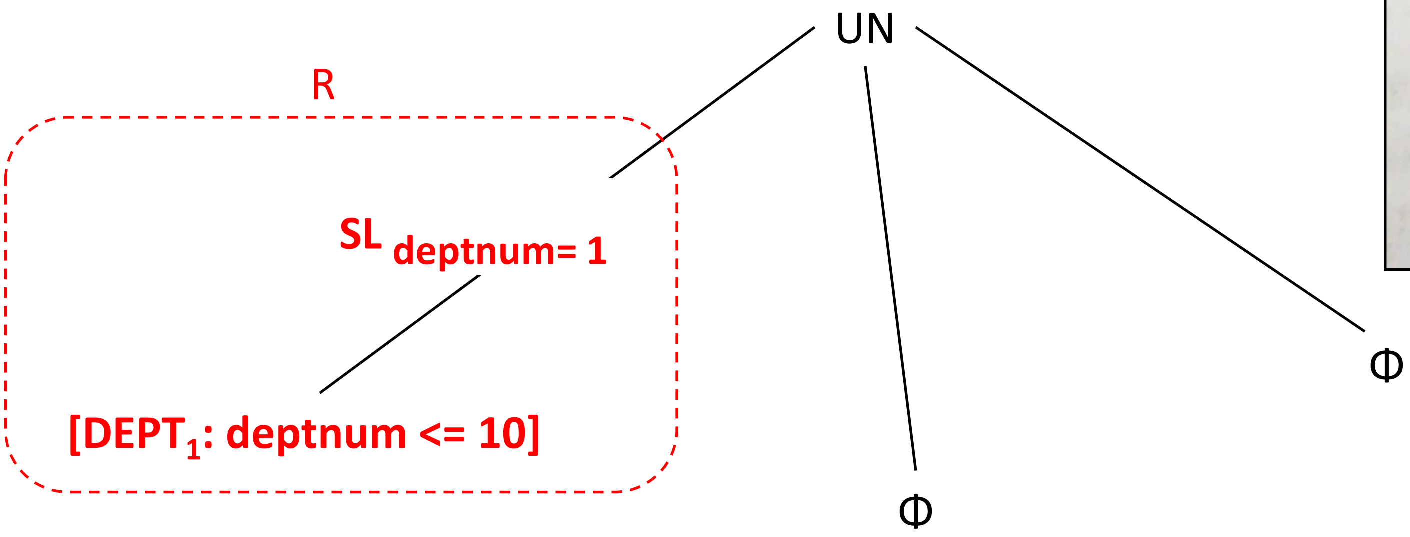
[$DEPT_1$: deptnum <= 10]

Φ

Φ

Example (contd.)

- Apply the predefined equivalence transformations.



UN

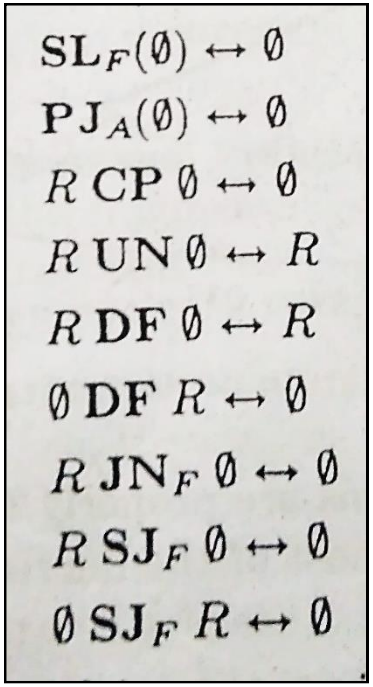
R

SL $_{\text{deptnum= 1}}$

[DEPT$_1$: deptnum <= 10]

Φ

Φ



$\mathbf{SL}_F(\emptyset) \leftrightarrow \emptyset$

$\mathbf{PJ}_A(\emptyset) \leftrightarrow \emptyset$

$R\ \mathbf{CP}\ \emptyset \leftrightarrow \emptyset$

$R\ \mathbf{UN}\ \emptyset \leftrightarrow R$

$R\ \mathbf{DF}\ \emptyset \leftrightarrow R$

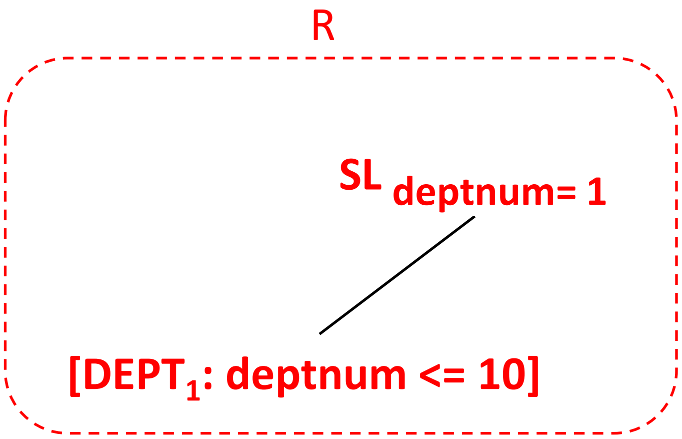
$\emptyset\ \mathbf{DF}\ R \leftrightarrow \emptyset$

$R\ \mathbf{JN}_F\ \emptyset \leftrightarrow \emptyset$

$R\ \mathbf{SJ}_F\ \emptyset \leftrightarrow \emptyset$

$\emptyset\ \mathbf{SJ}_F\ R \leftrightarrow \emptyset$

Example (contd.)



R

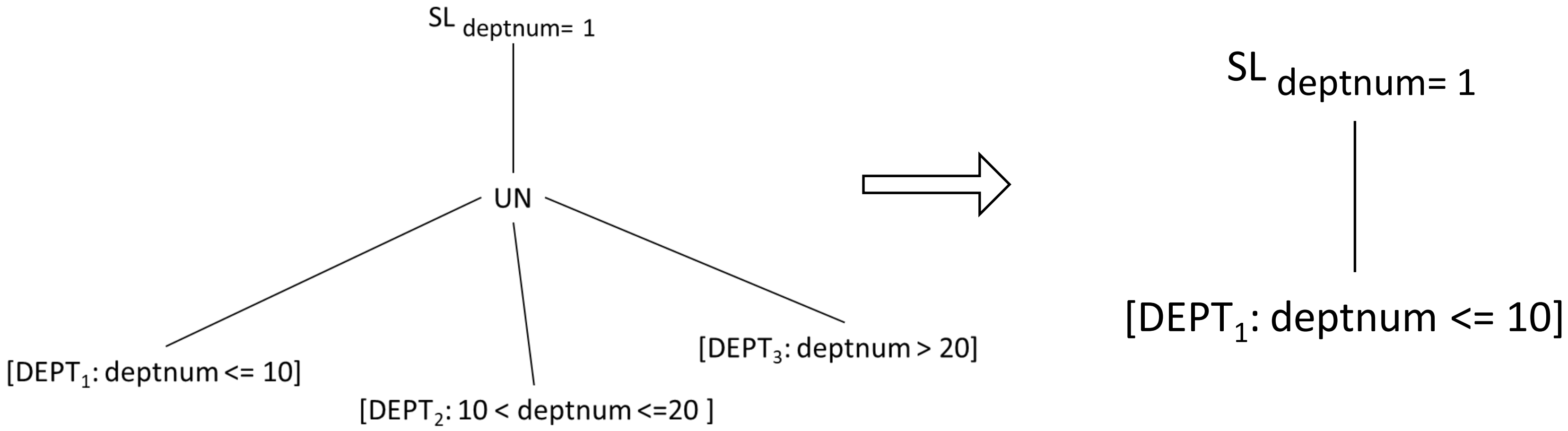
$SL_{\text{deptnum}= 1}$

$[DEPT_1\text{: deptnum} <= 10]$

Criterion - 3

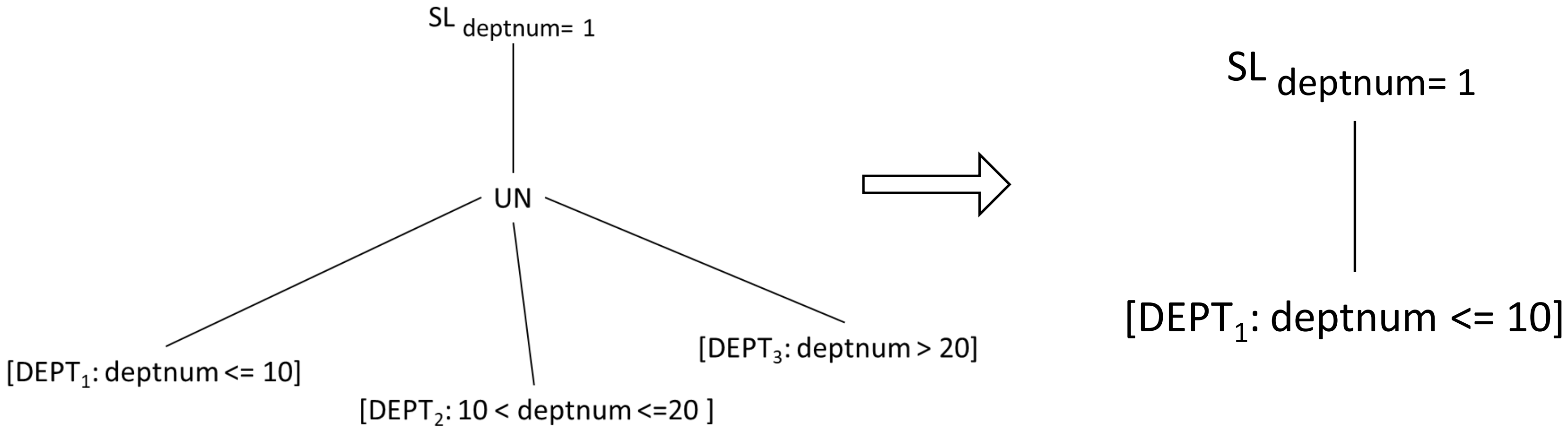
Criterion - 3:

- Push *SL* down, then apply *algebra of qualified relations*.
- Substitute the selection with *empty* if the qualifications *contradicts*.


$SL_{deptnum= 1}$
UN
[$DEPT_1$: deptnum <= 10]
[$DEPT_2$: 10 < deptnum <=20]
[$DEPT_3$: deptnum > 20]
$SL_{deptnum= 1}$
[$DEPT_1$: deptnum <= 10]

Criterion - 3

So, from now, you also have to apply **criterion – 3** after applying **criterion – 1** and **criterion – 2**.



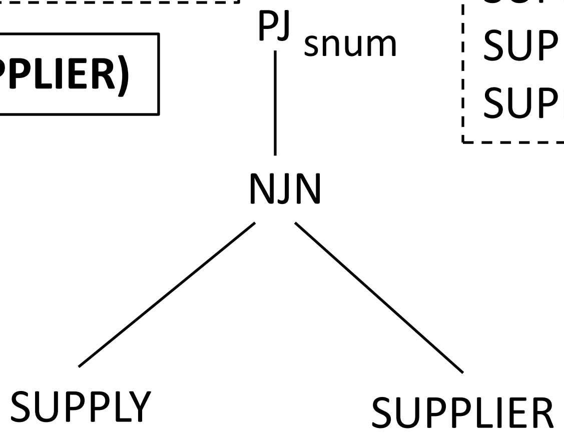
SL deptnum= 1
UN
[DEPT$_1$: deptnum <= 10]
[DEPT$_2$: 10 < deptnum <=20]
[DEPT$_3$: deptnum > 20]
SL deptnum= 1
[DEPT$_1$: deptnum <= 10]

Simplification of Join between Horizontally Fragmented Relations

Example

SUPPLIER ($\underline{snum}$*, name, city)*
SUPPLY ($\underline{snum}$*, pnum, deptnum, quan)*

Q: PJ $_{snum}$ **(SUPPLY** NJN **SUPPLIER)**



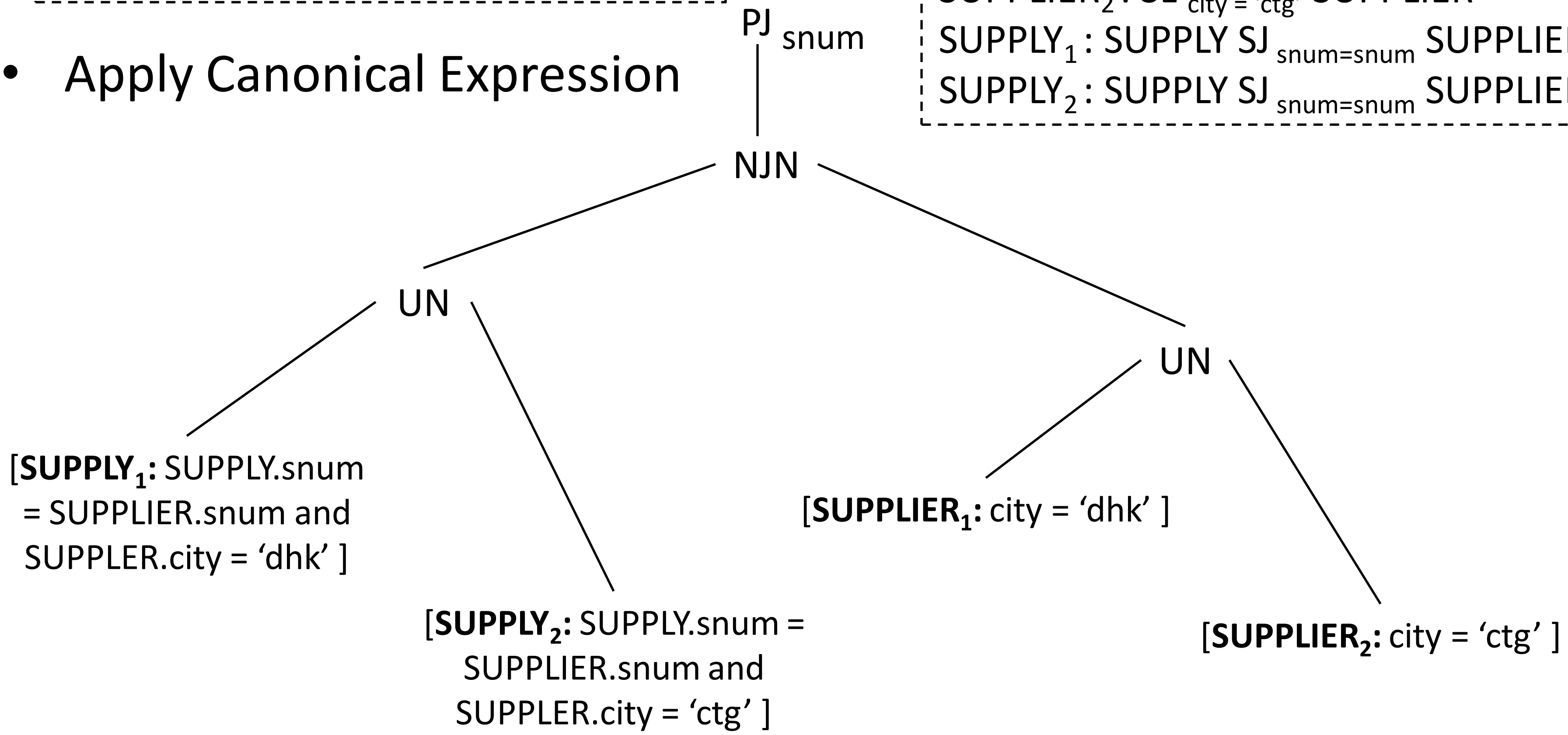
SUPPLIER$_1$: SL $_{city\ =\ 'dhk'}$ SUPPLIER
SUPPLIER$_2$: SL $_{city\ =\ 'ctg'}$ SUPPLIER
SUPPLY$_1$: SUPPLY SJ $_{snum=snum}$ SUPPLIER$_1$
SUPPLY$_2$: SUPPLY SJ $_{snum=snum}$ SUPPLIER$_2$

Example (contd.)

SUPPLIER (snum, name, city)
SUPPLY (snum, pnum, deptnum, quan)

SUPPLIER$_1$: SL $_{\text{city = 'dhk'}}$ SUPPLIER
SUPPLIER$_2$: SL $_{\text{city = 'ctg'}}$ SUPPLIER
SUPPLY$_1$: SUPPLY SJ $_{\text{snum=snum}}$ SUPPLIER$_1$
SUPPLY$_2$: SUPPLY SJ $_{\text{snum=snum}}$ SUPPLIER$_2$

- Apply Canonical Expression



PJ snum

NJN

UN

UN

[**SUPPLY$_1$:** SUPPLY.snum = SUPPLIER.snum and SUPPLER.city = 'dhk']

[**SUPPLY$_2$:** SUPPLY.snum = SUPPLIER.snum and SUPPLER.city = 'ctg']

[**SUPPLIER$_1$:** city = 'dhk']

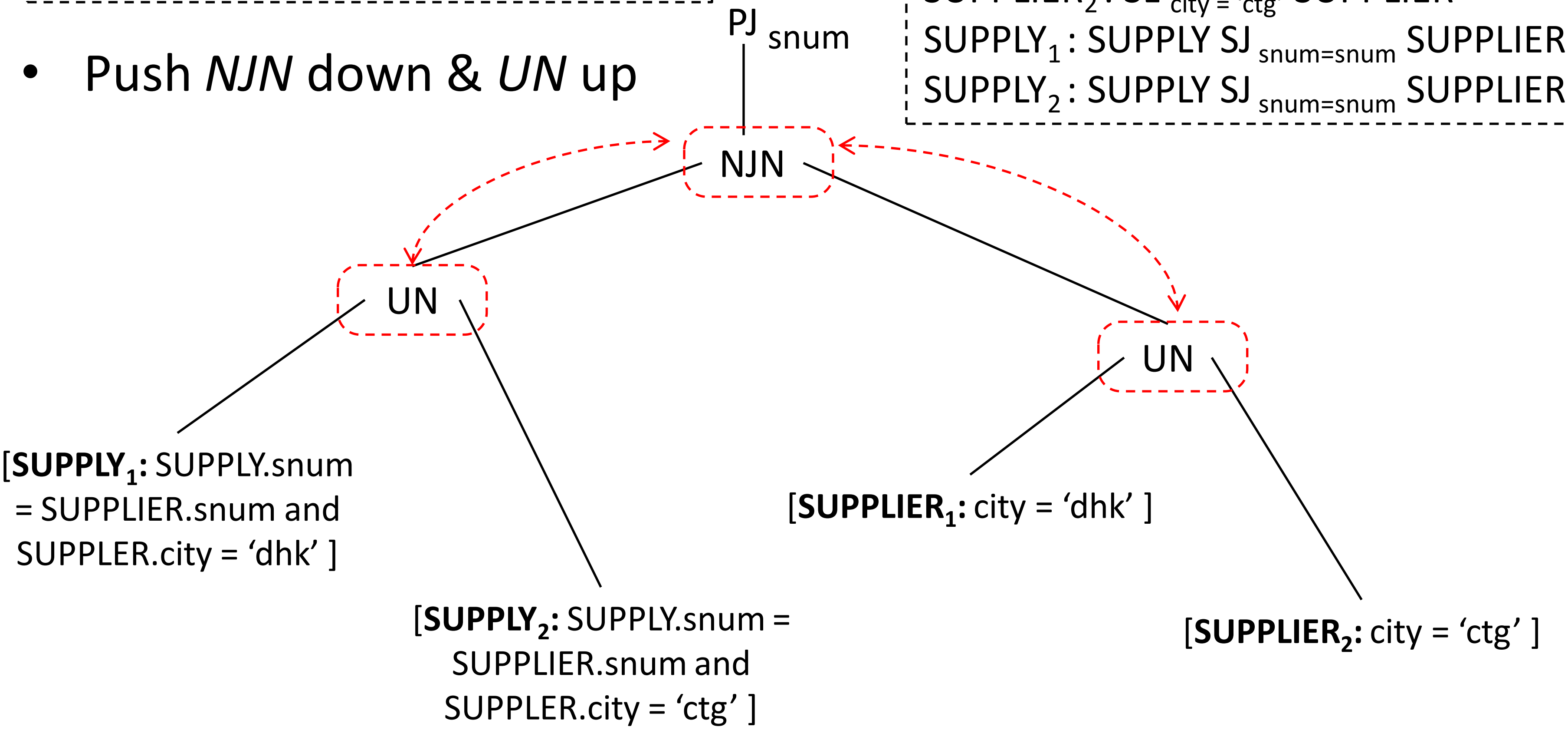
[**SUPPLIER$_2$:** city = 'ctg']

Example (contd.)

SUPPLIER (snum, name, city)
SUPPLY (snum, pnum, deptnum, quan)

SUPPLIER$_1$: SL $_{\text{city = 'dhk'}}$ SUPPLIER
SUPPLIER$_2$: SL $_{\text{city = 'ctg'}}$ SUPPLIER
SUPPLY$_1$: SUPPLY SJ $_{\text{snum=snum}}$ SUPPLIER$_1$
SUPPLY$_2$: SUPPLY SJ $_{\text{snum=snum}}$ SUPPLIER$_2$

- Push *NJN* down & *UN* up

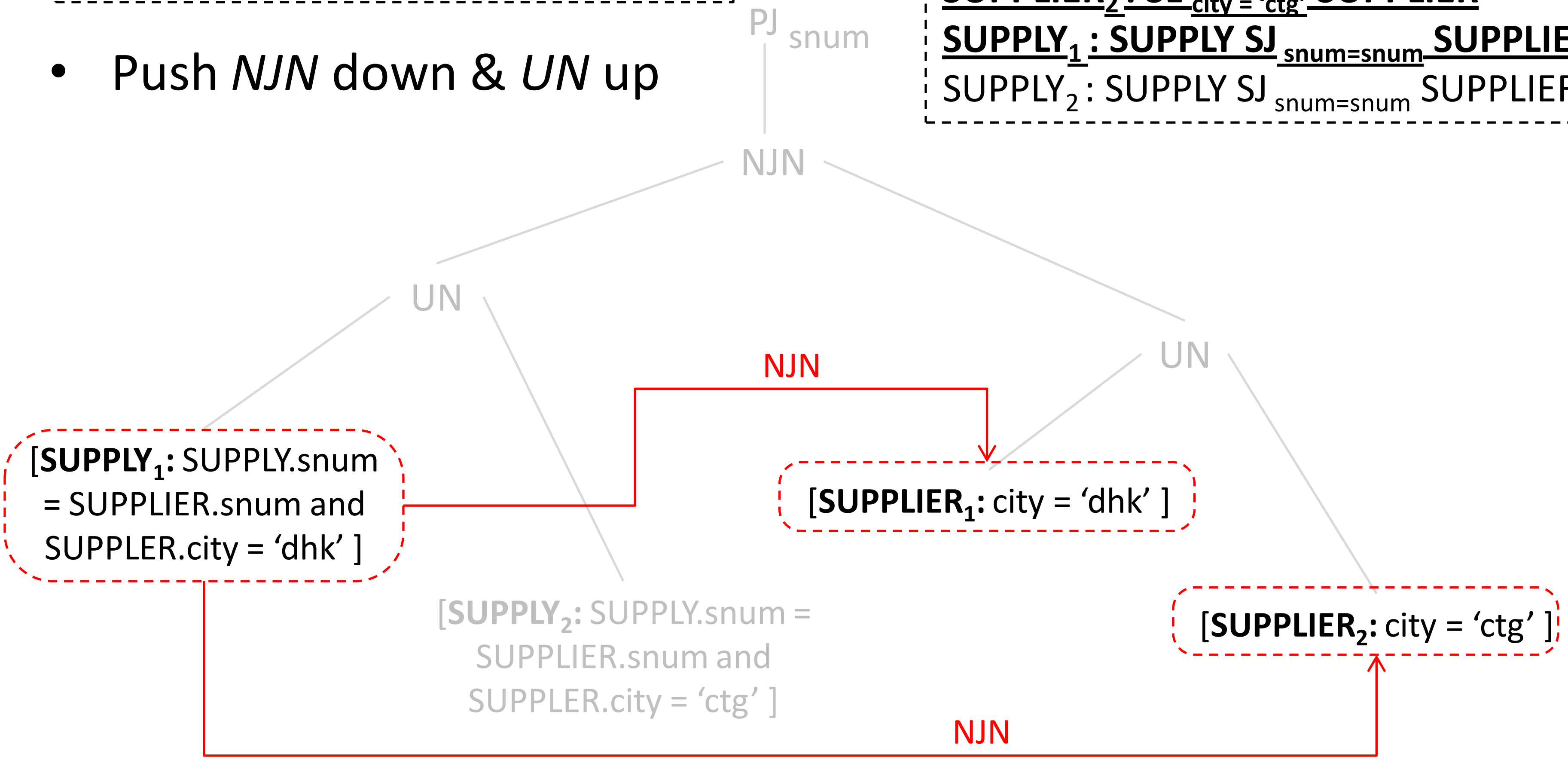

PJ snum
NJN
UN
UN
[**SUPPLY$_1$:** SUPPLY.snum = SUPPLIER.snum and SUPPLER.city = 'dhk']
[**SUPPLY$_2$:** SUPPLY.snum = SUPPLIER.snum and SUPPLER.city = 'ctg']
[**SUPPLIER$_1$:** city = 'dhk']
[**SUPPLIER$_2$:** city = 'ctg']

Example (contd.)

SUPPLIER (<u>snum</u>, name, city)
SUPPLY (<u>snum</u>, pnum, deptnum, quan)

- Push *NJN* down & *UN* up

<u>SUPPLIER$_1$: SL $_{city = 'dhk'}$ SUPPLIER</u>
<u>SUPPLIER$_2$: SL $_{city = 'ctg'}$ SUPPLIER</u>
<u>SUPPLY$_1$: SUPPLY SJ $_{snum=snum}$ SUPPLIER$_1$</u>
SUPPLY$_2$: SUPPLY SJ $_{snum=snum}$ SUPPLIER$_2$



[**SUPPLY$_1$:** SUPPLY.snum = SUPPLIER.snum and SUPPLER.city = 'dhk']

[**SUPPLY$_2$:** SUPPLY.snum = SUPPLIER.snum and SUPPLER.city = 'ctg']

[**SUPPLIER$_1$:** city = 'dhk']

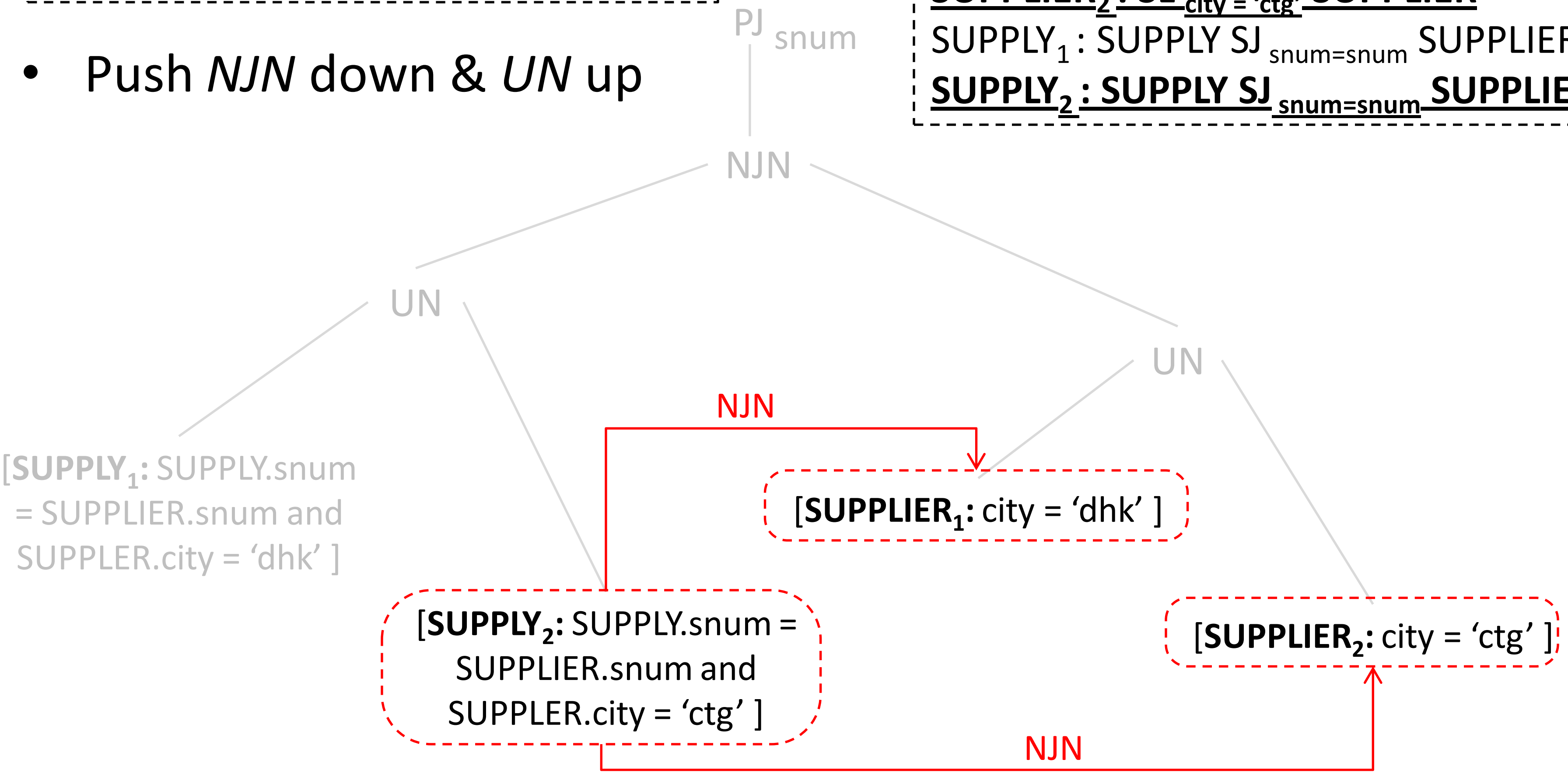
[**SUPPLIER$_2$:** city = 'ctg']

Example (contd.)

SUPPLIER (<u>snum</u>, name, city)
SUPPLY (<u>snum</u>, pnum, deptnum, quan)

- Push *NJN* down & *UN* up

<u>$SUPPLIER_1$: SL $_{city = \text{'dhk'}}$ SUPPLIER</u>
<u>$SUPPLIER_2$: SL $_{city = \text{'ctg'}}$ SUPPLIER</u>
$SUPPLY_1$: SUPPLY SJ $_{snum=snum}$ $SUPPLIER_1$
<u>$SUPPLY_2$: SUPPLY SJ $_{snum=snum}$ $SUPPLIER_2$</u>



[**$SUPPLY_1$:** SUPPLY.snum = SUPPLIER.snum and SUPPLER.city = ‘dhk’]

[**$SUPPLIER_1$:** city = ‘dhk’]

[**$SUPPLY_2$:** SUPPLY.snum = SUPPLIER.snum and SUPPLER.city = ‘ctg’]

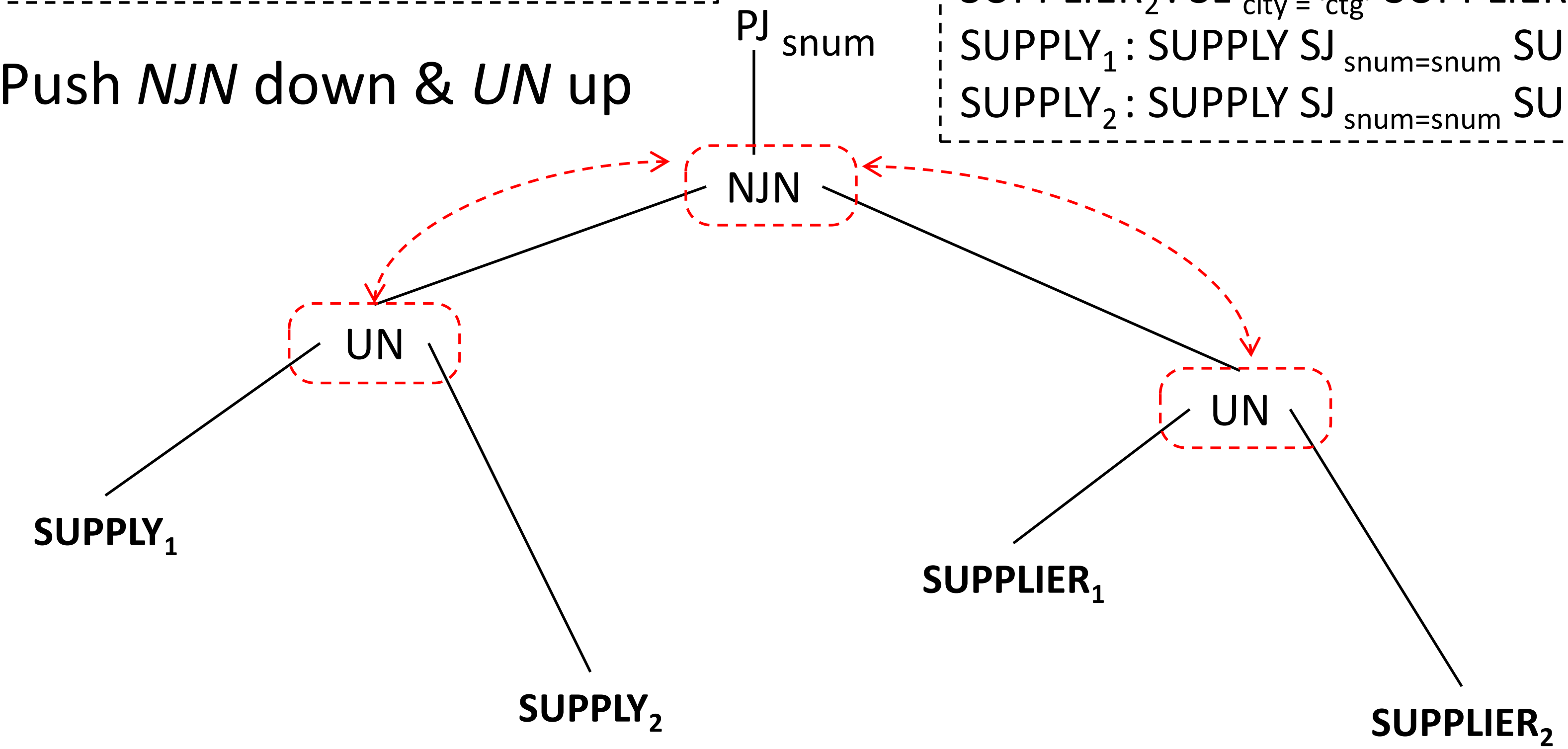
[**$SUPPLIER_2$:** city = ‘ctg’]

Example (contd.)

SUPPLIER (snum, name, city)
SUPPLY (snum, pnum, deptnum, quan)

- Push *NJN* down & *UN* up

SUPPLIER$_1$: SL $_{\text{city = 'dhk'}}$ SUPPLIER
SUPPLIER$_2$: SL $_{\text{city = 'ctg'}}$ SUPPLIER
SUPPLY$_1$: SUPPLY SJ $_{\text{snum=snum}}$ SUPPLIER$_1$
SUPPLY$_2$: SUPPLY SJ $_{\text{snum=snum}}$ SUPPLIER$_2$

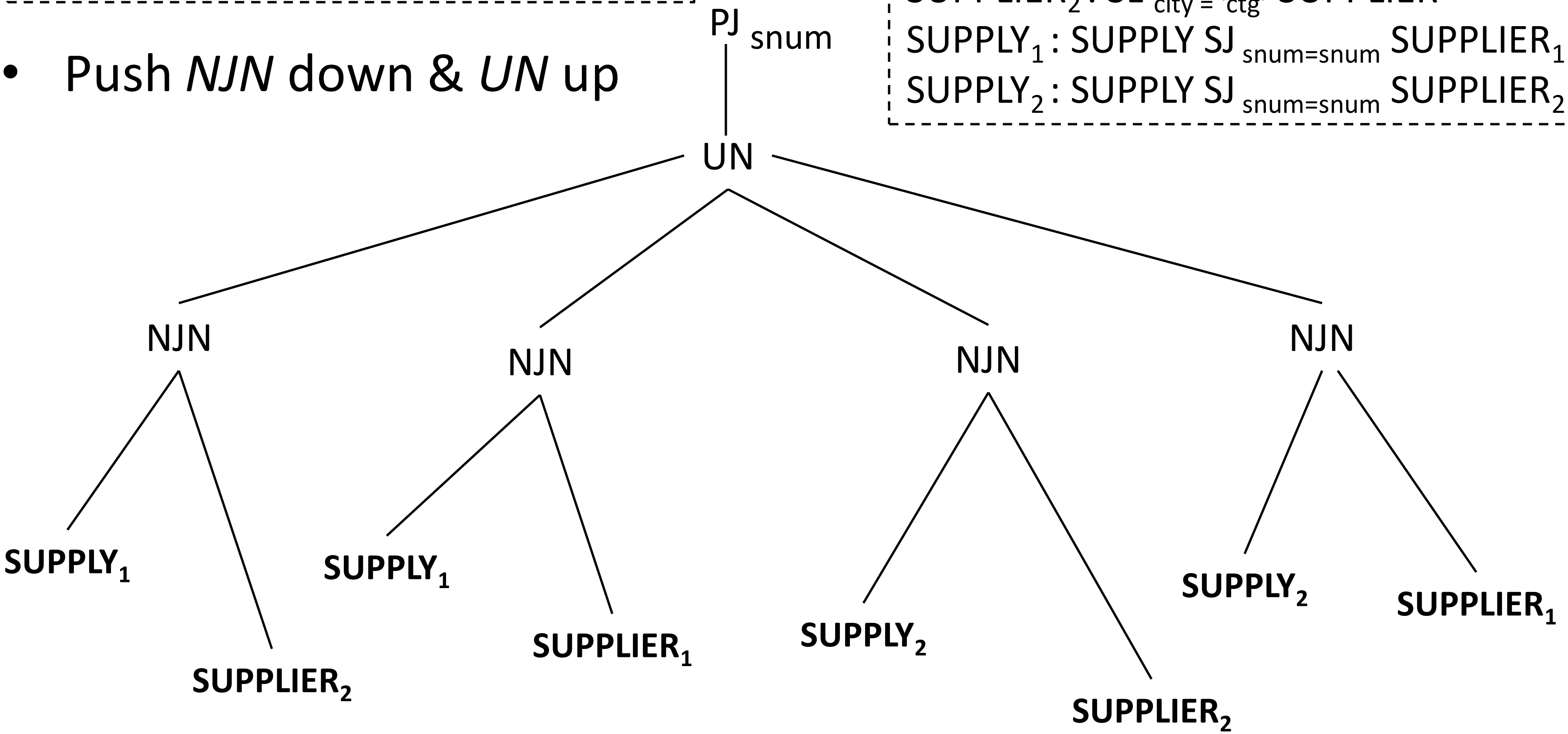


Example (contd.)

SUPPLIER (snum, name, city)
SUPPLY (snum, pnum, deptnum, quan)

- Push *NJN* down & *UN* up

$SUPPLIER_1$: SL $_{city = ‘dhk’}$ SUPPLIER
$SUPPLIER_2$: SL $_{city = ‘ctg’}$ SUPPLIER
$SUPPLY_1$: SUPPLY SJ $_{snum=snum}$ $SUPPLIER_1$
$SUPPLY_2$: SUPPLY SJ $_{snum=snum}$ $SUPPLIER_2$

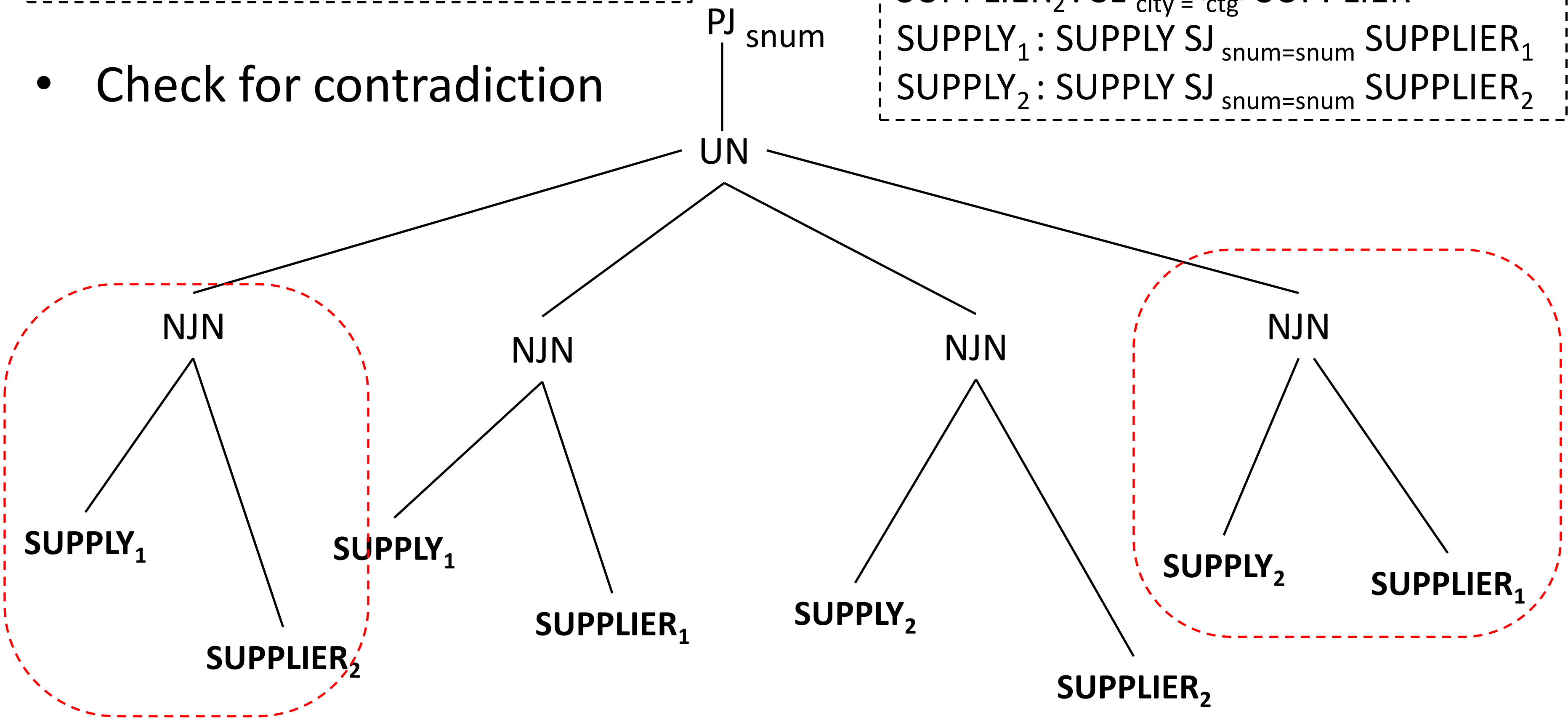


Example (contd.)

SUPPLIER (snum, name, city)
SUPPLY (snum, pnum, deptnum, quan)

SUPPLIER$_1$: SL $_{city\ =\ 'dhk'}$ SUPPLIER
SUPPLIER$_2$: SL $_{city\ =\ 'ctg'}$ SUPPLIER
SUPPLY$_1$: SUPPLY SJ $_{snum=snum}$ SUPPLIER$_1$
SUPPLY$_2$: SUPPLY SJ $_{snum=snum}$ SUPPLIER$_2$

- Check for contradiction

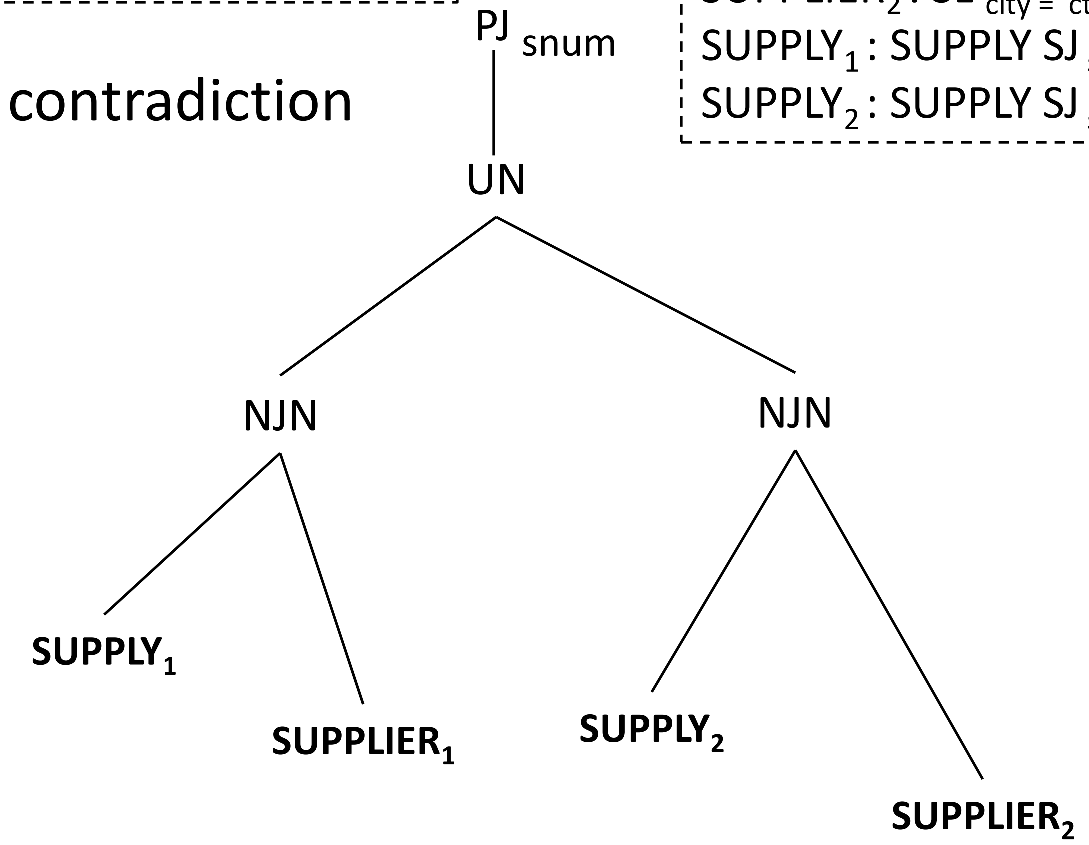


Example (contd.)

SUPPLIER (snum, name, city)
SUPPLY (snum, pnum, deptnum, quan)

- Check for contradiction

$SUPPLIER_1$: SL $_{city\ =\ 'dhk'}$ SUPPLIER
$SUPPLIER_2$: SL $_{city\ =\ 'ctg'}$ SUPPLIER
$SUPPLY_1$: SUPPLY SJ $_{snum=snum}$ $SUPPLIER_1$
$SUPPLY_2$: SUPPLY SJ $_{snum=snum}$ $SUPPLIER_2$

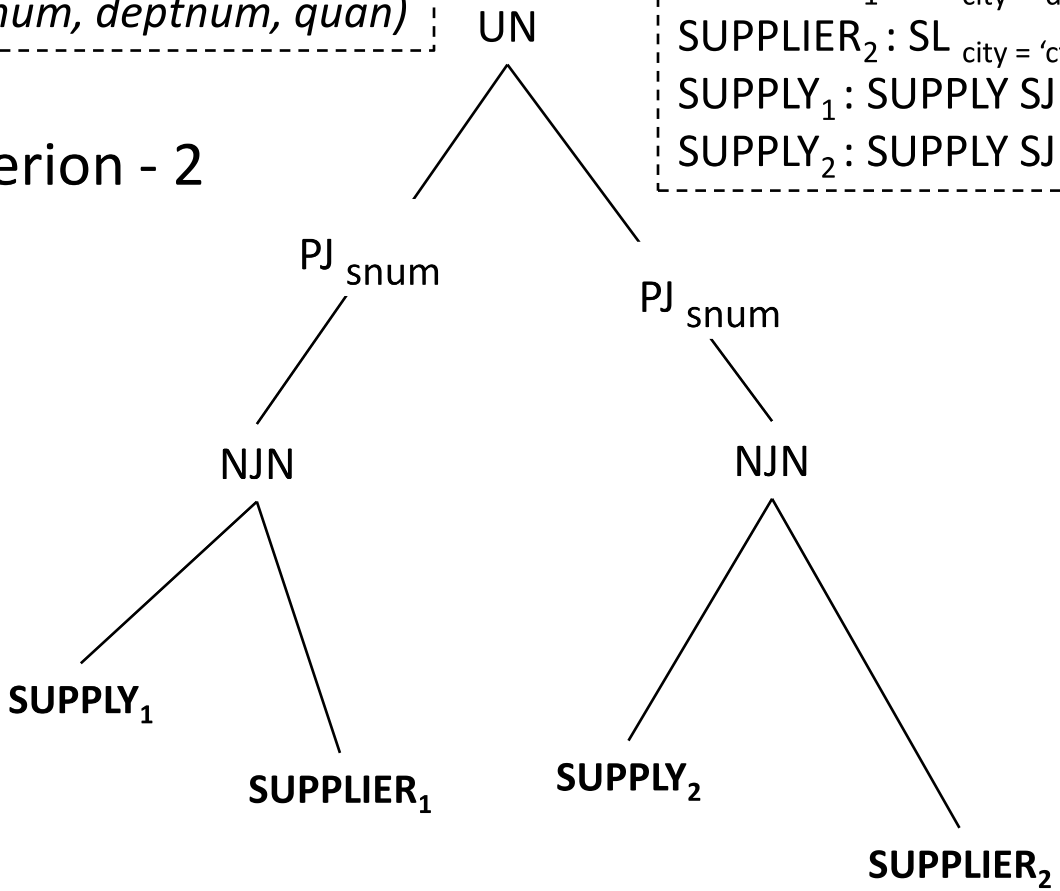


Example (contd.)

SUPPLIER (snum, name, city)
SUPPLY (snum, pnum, deptnum, quan)

SUPPLIER$_1$: SL $_{city = 'dhk'}$ SUPPLIER
SUPPLIER$_2$: SL $_{city = 'ctg'}$ SUPPLIER
SUPPLY$_1$: SUPPLY SJ $_{snum=snum}$ SUPPLIER$_1$
SUPPLY$_2$: SUPPLY SJ $_{snum=snum}$ SUPPLIER$_2$

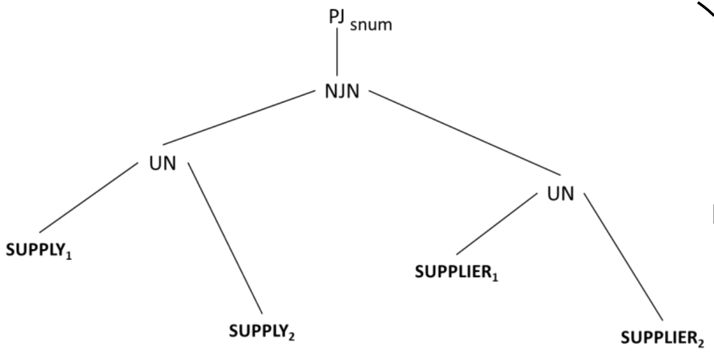
- Apply criterion - 2



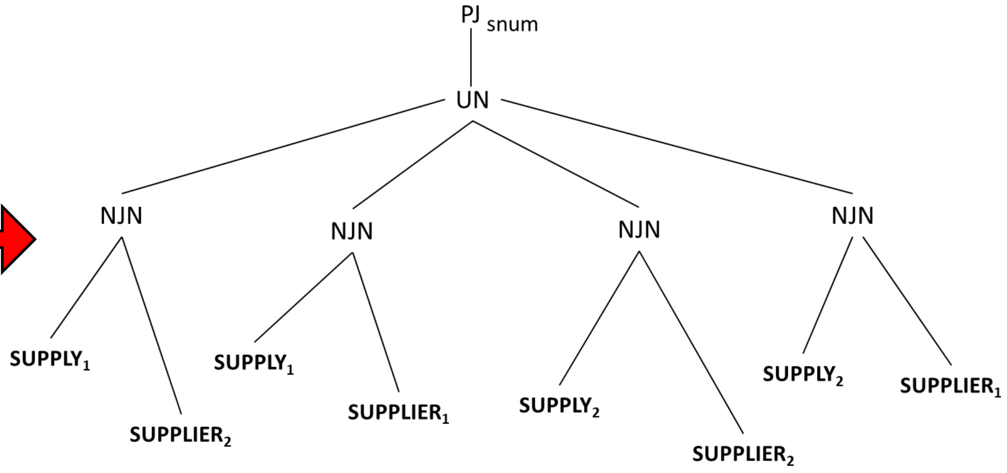
Criterion – 5 and 4

Criterion - 5:

Push *JN* down and UN up.



i. First, collect data (UN)
ii. Then Join (NJN)



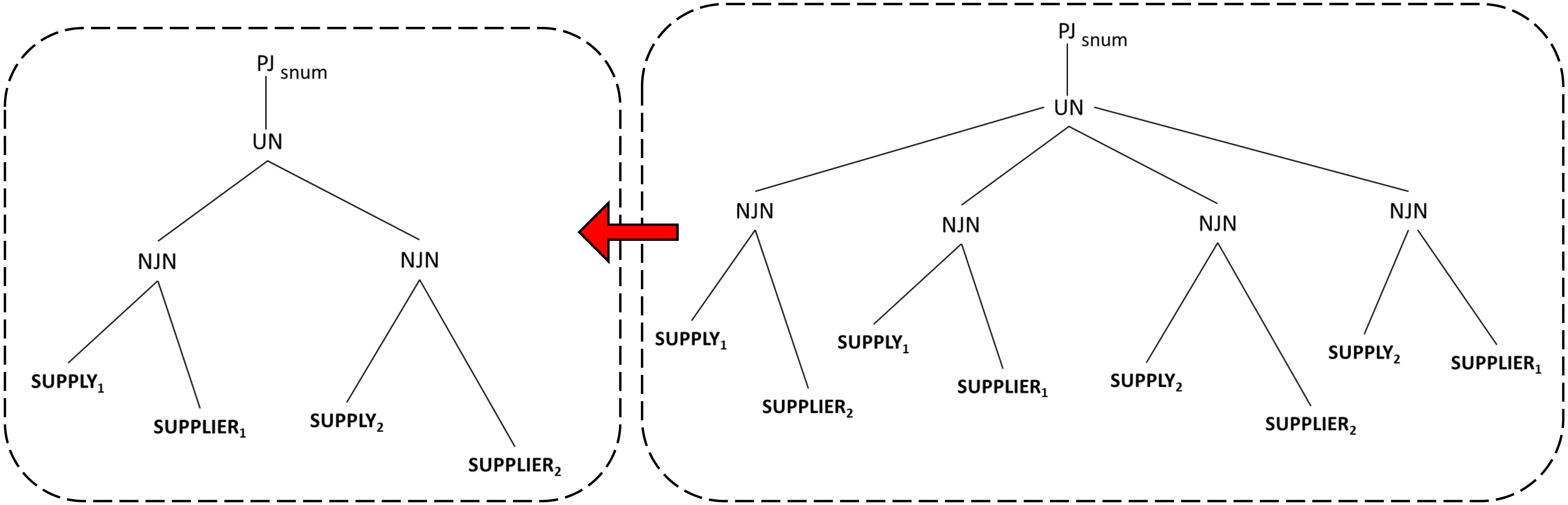
i. First, do join (NJN)
ii. Then collect data (UN)

(this is called *distributed join*)

Criterion – 5 and 4

Criterion - 4:

Eliminate *JN* between fragments that do not contribute to results.



Simplification of Vertically Fragmented Relations

Simplification of Vertically Fragmented Relations

- To determine a proper subset of the fragments which is sufficient for generating result for a query.

Example

Global schema:

EMP (empno, name, sal, tax, mgrnum, deptnum)

Fragmentation schema:

$EMP_1 = SL_{\text{deptnum <=10}}\ PJ_{\text{empnum, name, magnum, deptname}}\ (EMP)$

$EMP_2 = SL_{\text{10 < deptnum <= 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}(EMP)$

$EMP_3 = SL_{\text{deptnum > 20}}\ PJ_{\text{empnum, name, mgrnum, deptname}}\ (EMP)$

$EMP_4 = PJ_{\text{empnum, name, sal, tax}}\ (EMP)$

Example (contd.)

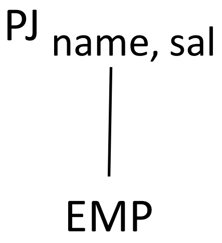
$EMP_1 = SL_{\text{deptnum <=10}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_2 = SL_{\text{10 < deptnum <= 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_3 = SL_{\text{deptnum > 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_4 = PJ_{\text{empnum, name, sal, tax}}\ (EMP)$

Q: $PJ_{\text{name, sal}}$ **EMP**



$PJ_{\text{name, sal}}$

EMP

Example (contd.)

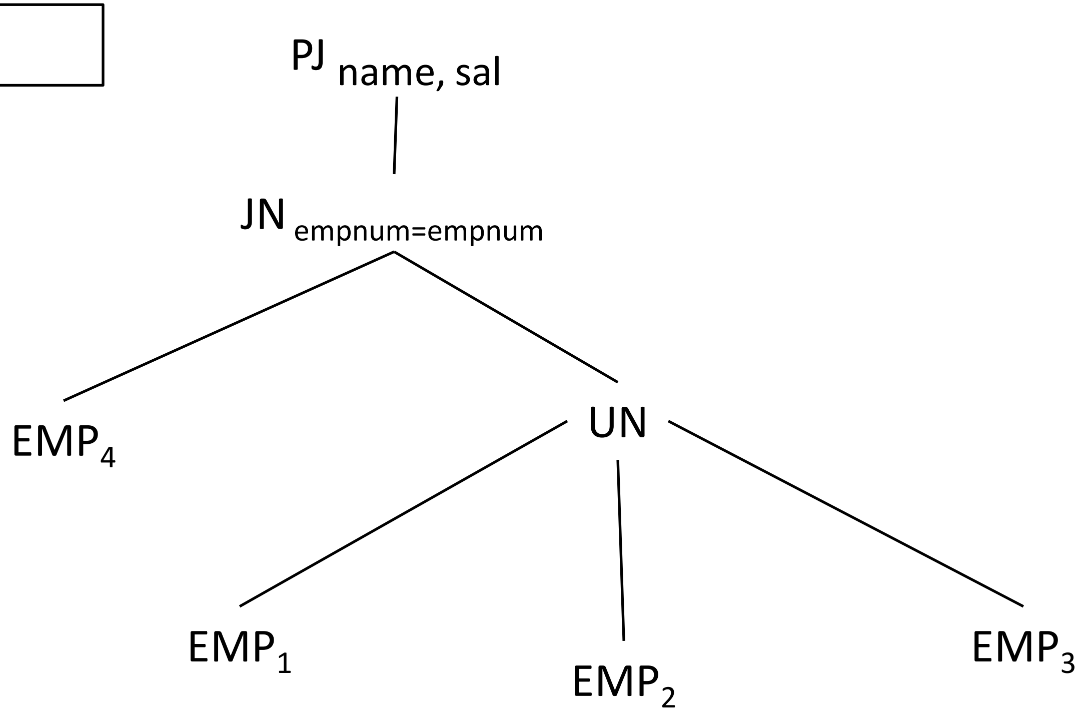
$EMP_1 = SL_{\text{deptnum} <= 10}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_2 = SL_{10 < \text{deptnum} <= 20}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_3 = SL_{\text{deptnum} > 20}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_4 = PJ_{\text{empnum, name, sal, tax}}\ (EMP)$

Q: PJ $_{\text{name, sal}}$ **EMP**



$PJ_{\text{name, sal}}$

$JN_{\text{empnum=empnum}}$

EMP_4

UN

EMP_1

EMP_2

EMP_3

Example (contd.)

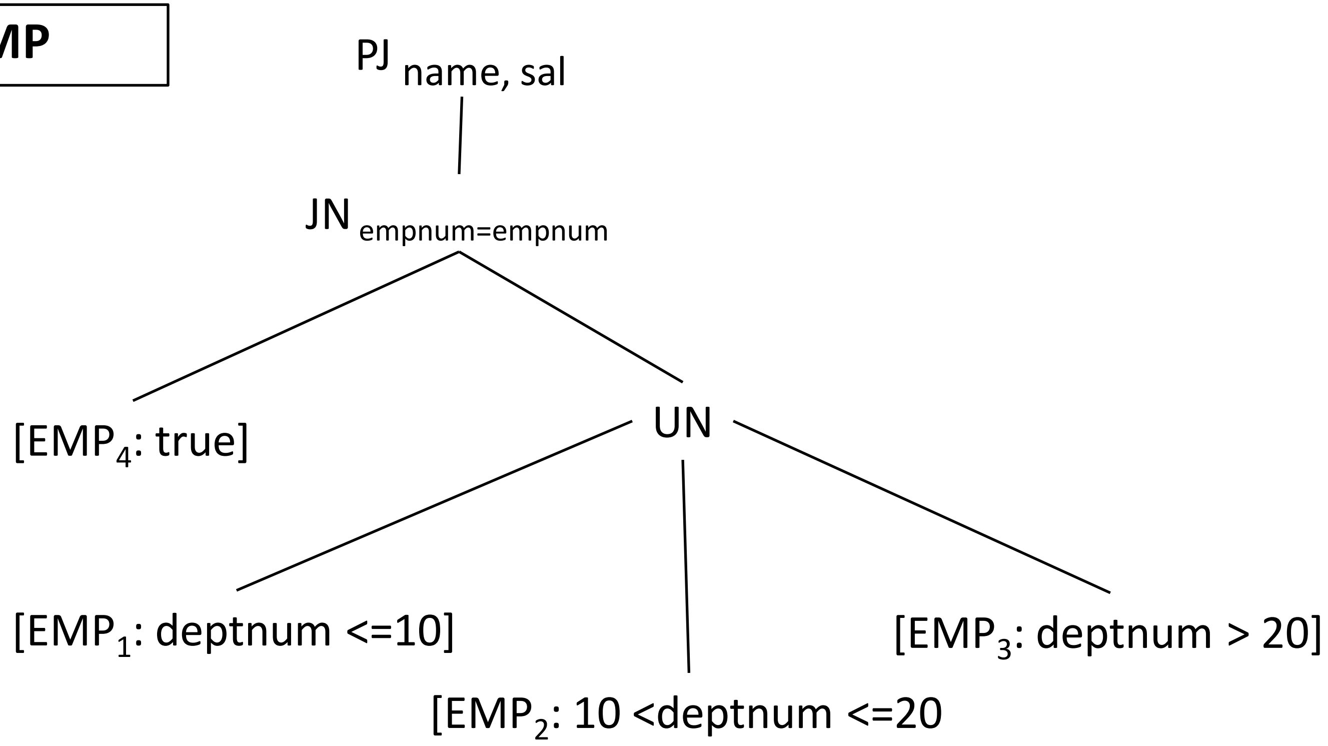
$EMP_1 = SL_{\text{deptnum <=10}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_2 = SL_{\text{10 < deptnum <= 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_3 =SL_{\text{deptnum > 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_4=PJ_{\text{empnum, name, sal, tax}}\ (EMP)$

Q: $PJ_{\text{name, sal}}$ **EMP**



$PJ_{\text{name, sal}}$

$JN_{\text{empnum=empnum}}$

$[EMP_4\text{: true}]$

UN

$[EMP_1\text{: deptnum <=10}]$

$[EMP_2\text{: 10 <deptnum <=20}$

$[EMP_3\text{: deptnum > 20}]$

Example (contd.)

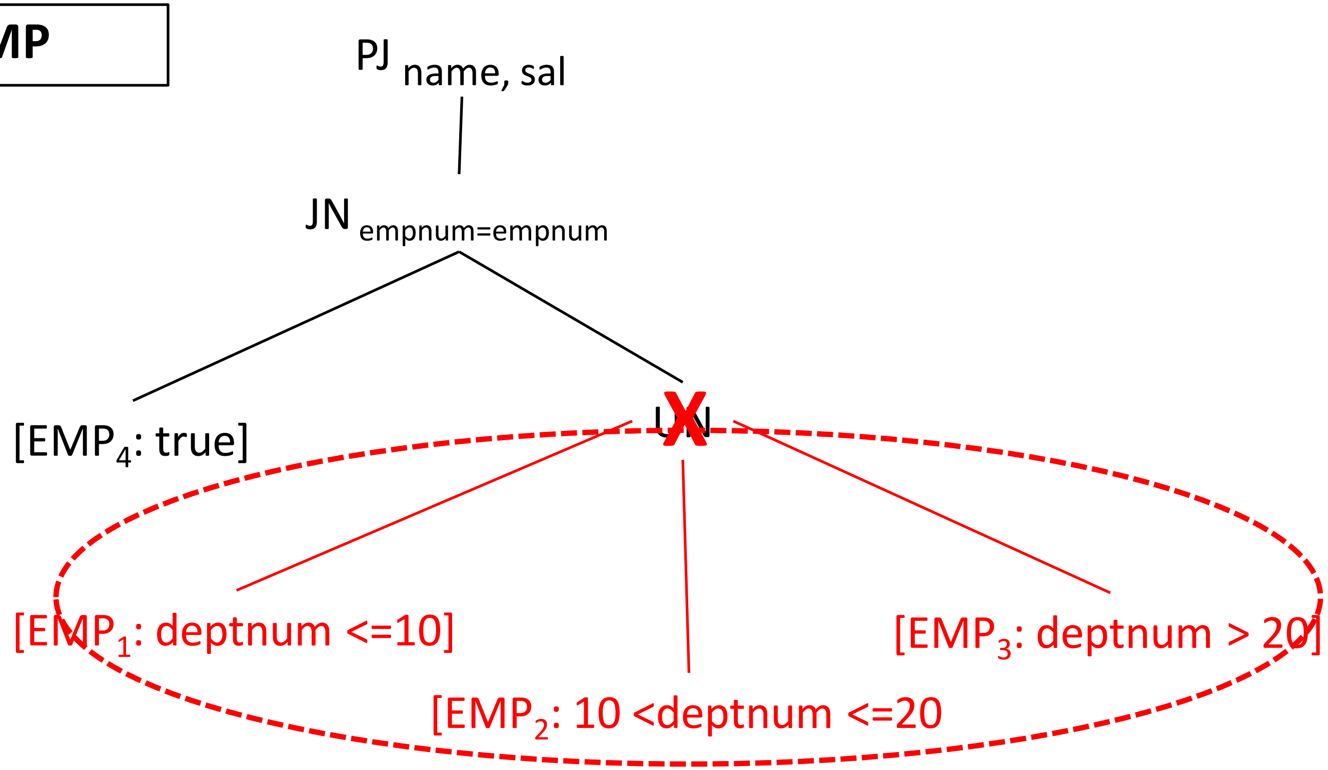
$EMP_1 = SL_{\text{deptnum <=10}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_2 = SL_{\text{10 < deptnum <= 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_3 =SL_{\text{deptnum > 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_4=PJ_{\text{empnum, name, sal, tax}}\ (EMP)$

Q: $PJ_{\text{name, sal}}$ **EMP**



$PJ_{\text{name, sal}}$

$JN_{\text{empnum=empnum}}$

$[EMP_4\text{: true}]$

UN

$[EMP_1\text{: deptnum <=10}]$

$[EMP_2\text{: 10 <deptnum <=20}]$

$[EMP_3\text{: deptnum > 20}]$

Example (contd.)

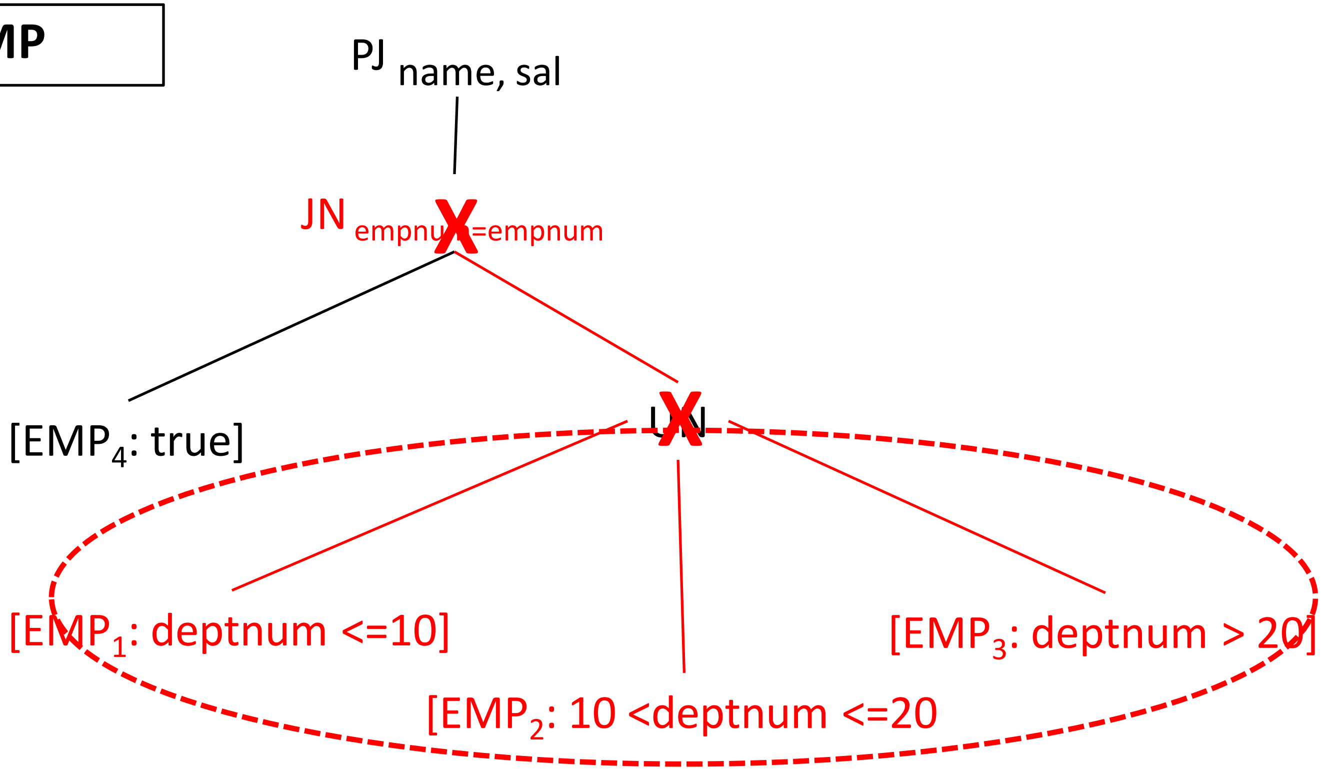
$EMP_1 = SL_{\text{deptnum <=10}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_2 = SL_{\text{10 < deptnum <= 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_3 = SL_{\text{deptnum > 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_4 = PJ_{\text{empnum, name, sal, tax}}\ (EMP)$

Q: $PJ_{\text{name, sal}}$ **EMP**



$PJ_{\text{name, sal}}$

$JN_{\text{empnum=empnum}}$

[EMP_4: true]

UN

[EMP_1: deptnum <=10]

[EMP_2: 10 <deptnum <=20]

[EMP_3: deptnum > 20]

Example (contd.)

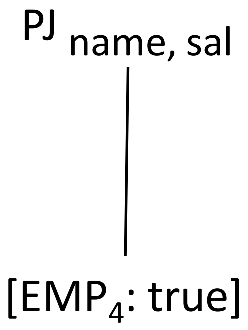
$EMP_1 = SL_{\text{deptnum <=10}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_2 = SL_{\text{10 < deptnum <= 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_3 = SL_{\text{deptnum > 20}}\ PJ_{\text{empnum, name, mgrnum, deptnum}}\ (EMP)$

$EMP_4 = PJ_{\text{empnum, name, sal, tax}}\ (EMP)$

Q: $PJ_{\text{name, sal}}$ **EMP**



$PJ_{\text{name, sal}}$

$[EMP_4\text{: true}]$

Parametric Queries

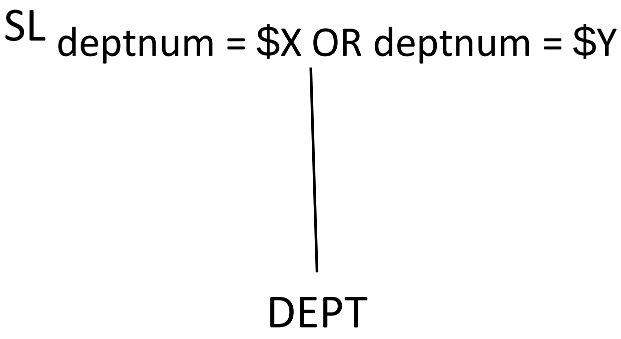
Parametric Queries

- *SL* include parameters values that are not known in *compile time*.
- When parametric queries executed, the user provides values in *runtime*, which are bound to (substituted for) parameters.
- Example: $SL_{deptnum = \mathbf{\$X}}\ DEPT$

Simplification of Parametric Queries

Example

Q: $SL_{deptnum = \$X \text{ OR } deptnum = \$Y}$ **DEPT**

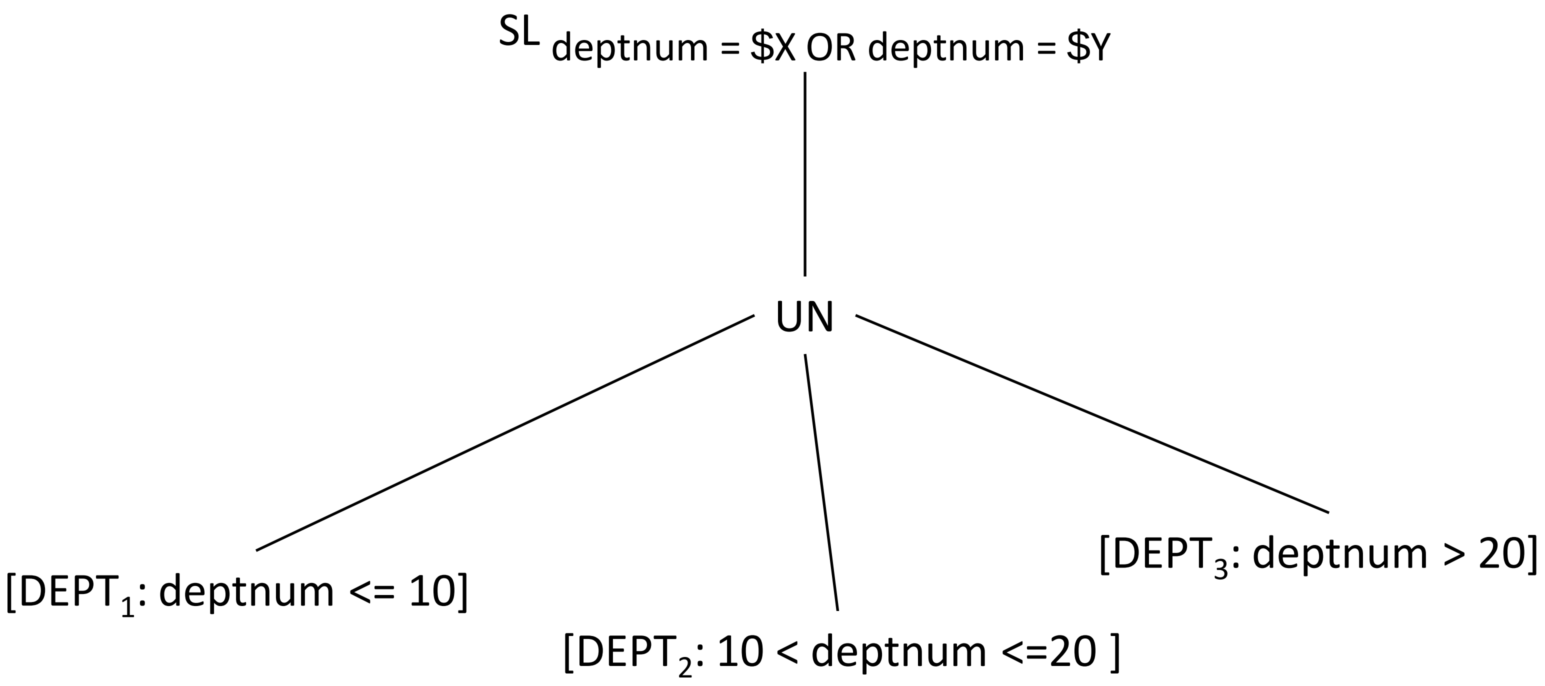


$SL_{deptnum = \$X \text{ OR } deptnum = \$Y}$

DEPT

Example (contd.)

Q: SL$_{\text{deptnum = \$X OR deptnum = \$Y}}$ **DEPT**



SL$_{\text{deptnum = \$X OR deptnum = \$Y}}$

UN

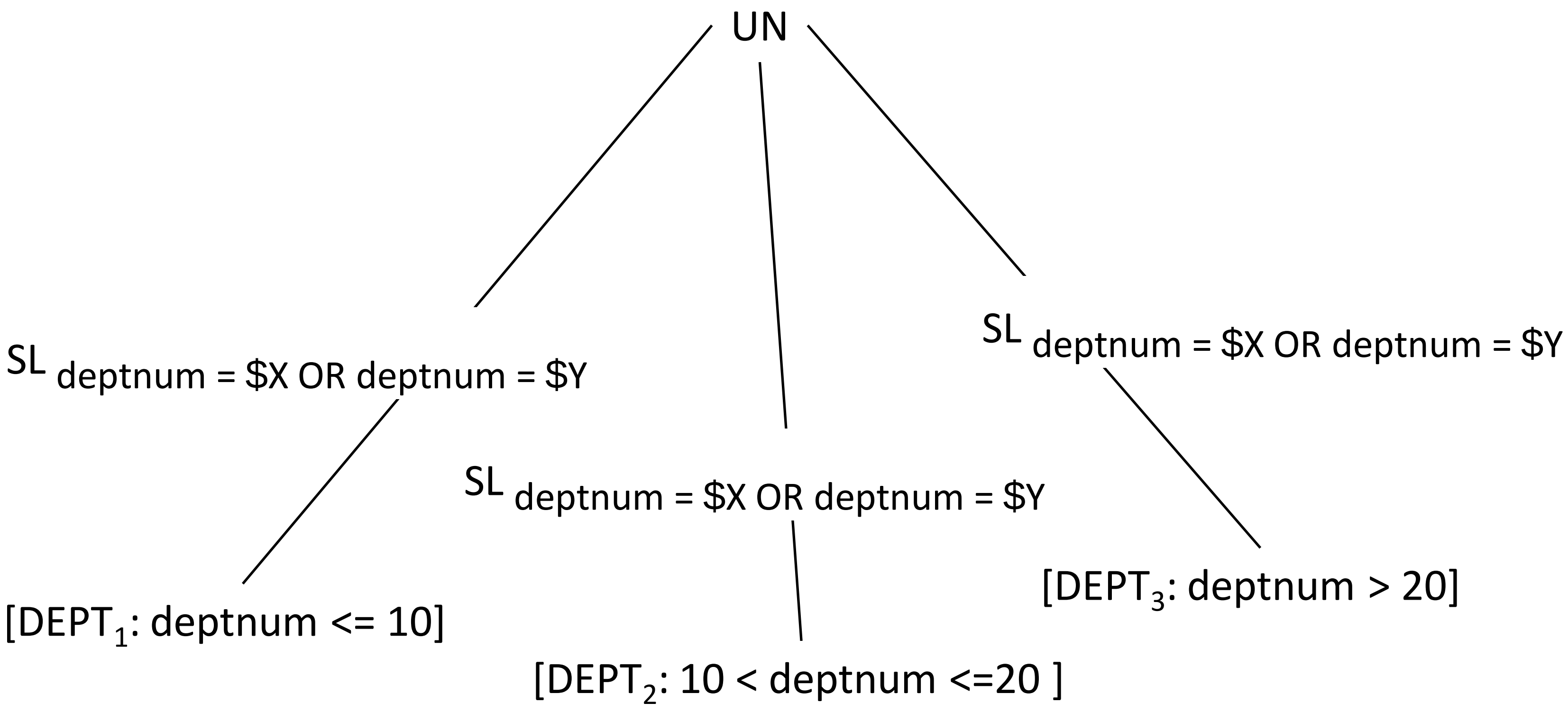
[DEPT$_1$: deptnum <= 10]

[DEPT$_2$: 10 < deptnum <=20]

[DEPT$_3$: deptnum > 20]

Example (contd.)

Q: $SL_{\text{deptnum = \$X OR deptnum = \$Y}}$ **DEPT**



UN

$SL_{\text{deptnum = \$X OR deptnum = \$Y}}$

$SL_{\text{deptnum = \$X OR deptnum = \$Y}}$

$SL_{\text{deptnum = \$X OR deptnum = \$Y}}$

[$DEPT_1$: deptnum <= 10]

[$DEPT_2$: 10 < deptnum <=20]

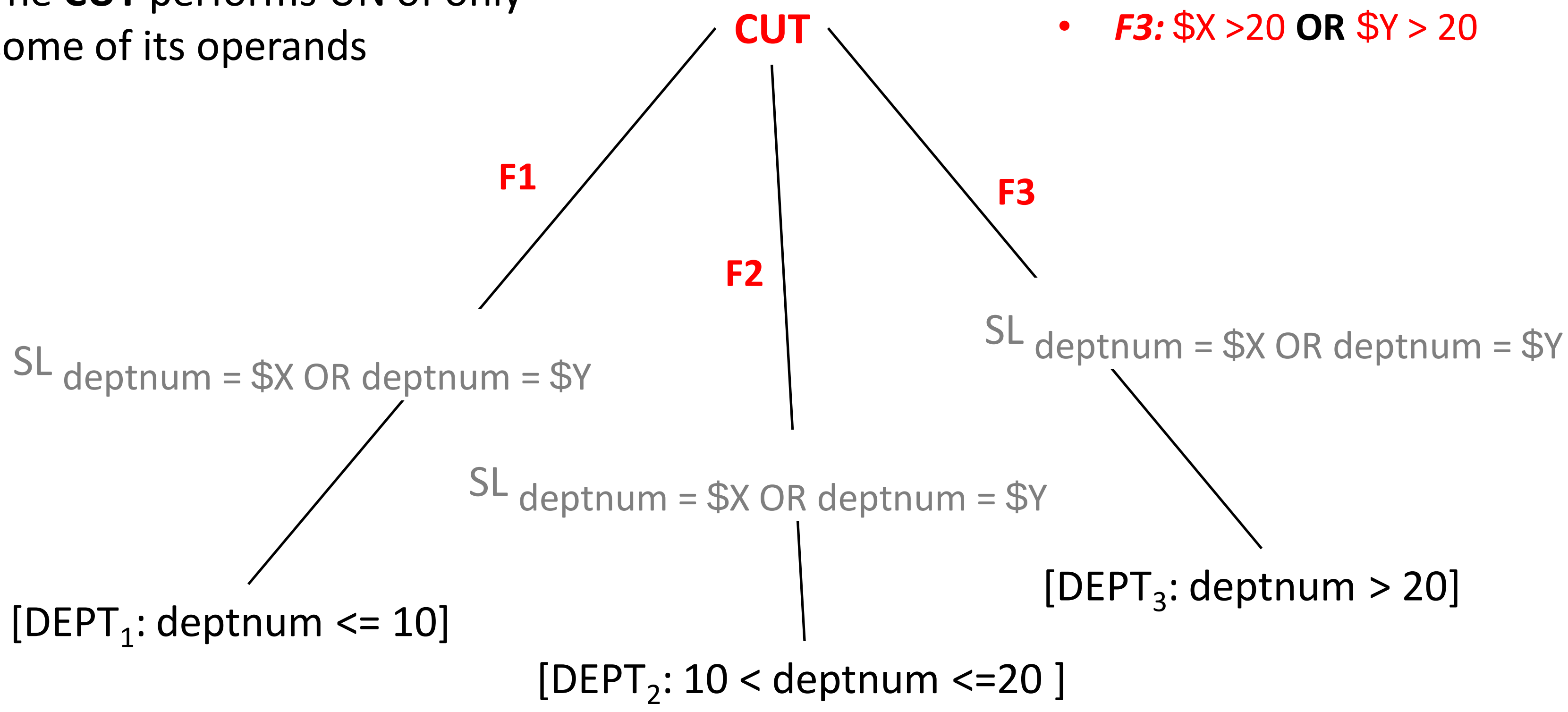
[$DEPT_3$: deptnum > 20]

Example (contd.)

Q: SL$_{\text{deptnum = \$X OR deptnum = \$Y}}$ **DEPT**

- ***F1:*** \$X <= 10 **OR** \$Y <= 10
- ***F2:*** (\$X > 10 AND \$X <= 20) **OR** (\$Y > 10 AND \$Y <=20)
- ***F3:*** \$X >20 **OR** \$Y > 20

The **CUT** performs UN of only some of its operands



CUT

F1

F2

F3

SL$_{\text{deptnum = \$X OR deptnum = \$Y}}$

SL$_{\text{deptnum = \$X OR deptnum = \$Y}}$

SL$_{\text{deptnum = \$X OR deptnum = \$Y}}$

[DEPT_1: deptnum <= 10]

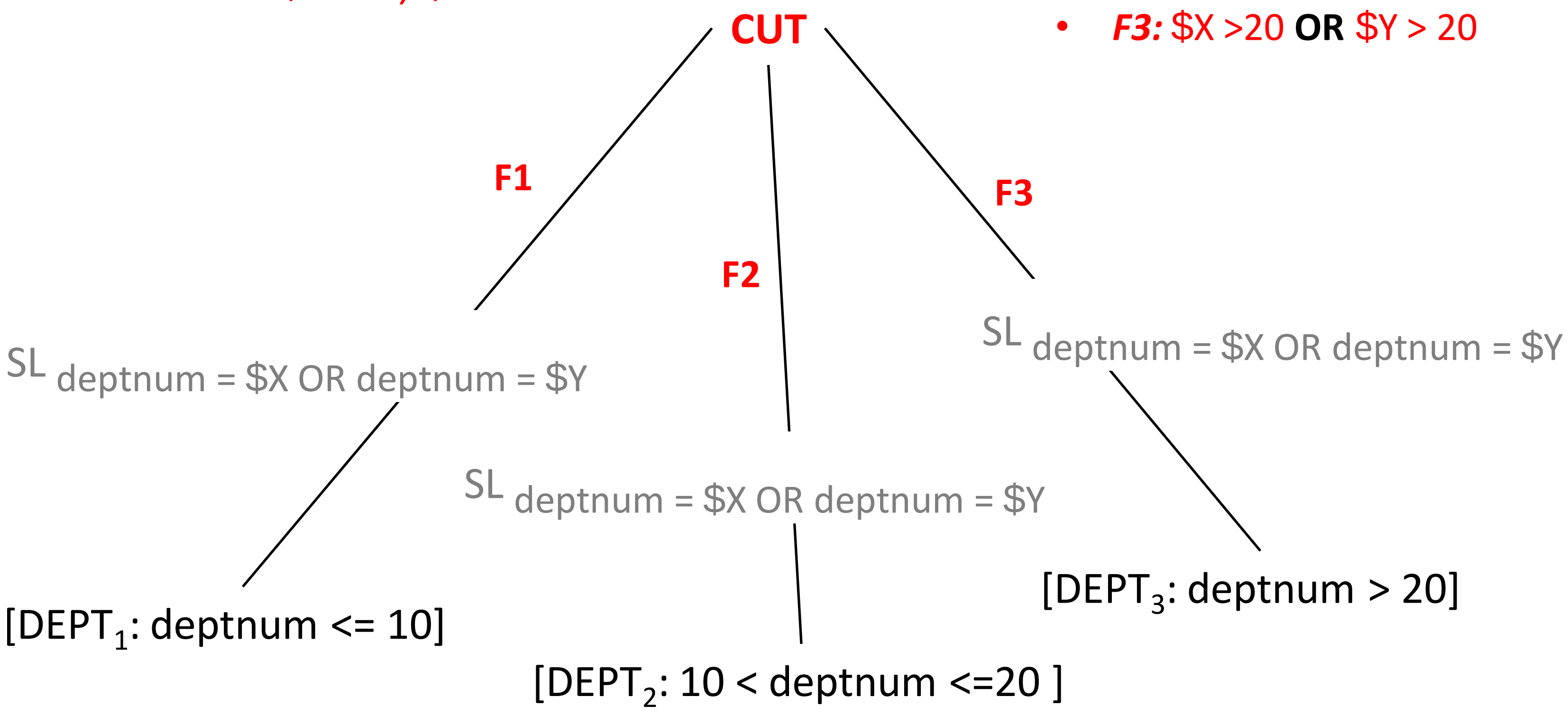
[DEPT_2: 10 < deptnum <=20]

[DEPT_3: deptnum > 20]

Example (contd.)

- ***F1:*** $X <= 10 **OR** $Y <= 10
- ***F2:*** ($X > 10 AND $X <= 20) **OR** ($Y > 10 AND $Y <=20)
- ***F3:*** $X >20 **OR** $Y > 20

QUESTION: What will happen to the tree for $X = 1, $Y = 35?



CUT

F1

F2

F3

SL deptnum = $X OR deptnum = $Y

SL deptnum = $X OR deptnum = $Y

SL deptnum = $X OR deptnum = $Y

[$DEPT_1$: deptnum <= 10]

[$DEPT_2$: 10 < deptnum <=20]

[$DEPT_3$: deptnum > 20]

Additional Reading

- Get the intuition behind all the rules of algebra of qualified relation.
- Proof of rule – 6 and 7 of algebra of qualified relations.
  - Understand what is happening in each line of the proofs.

Practice Problems/ Questions

- Text book: exercise 5.2 (a) and (b)
  - N.B: use criteria – 1 to 5
- Text book: exercise 5.3, 5.4 and 5.7