

## Exercise 4: formalization in SQL

### Formalize in SQL

List all project numbers for projects that involve an employee whose last name is Smith as a manager of the department that controls the project.

#### EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
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#### DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
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#### DEPT\_LOCATIONS

<u>Dnumber</u>	<u>Dlocation</u>
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#### PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
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#### WORKS\_ON

<u>Essn</u>	<u>Pno</u>	Hours
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#### DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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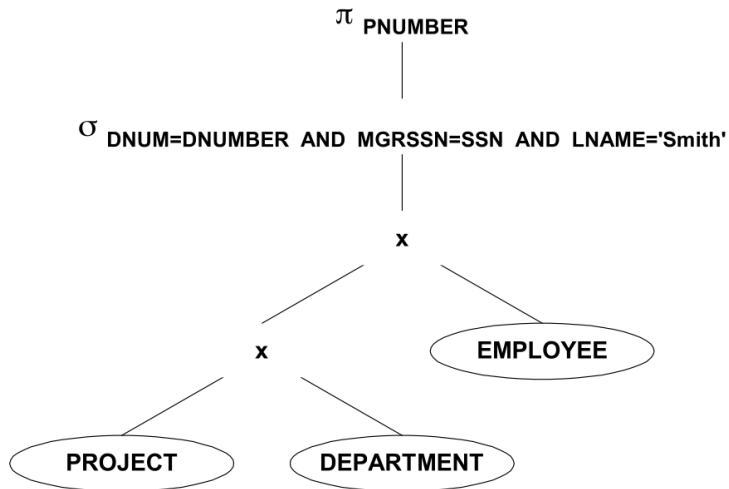
## Exercise 4: formalization in SQL

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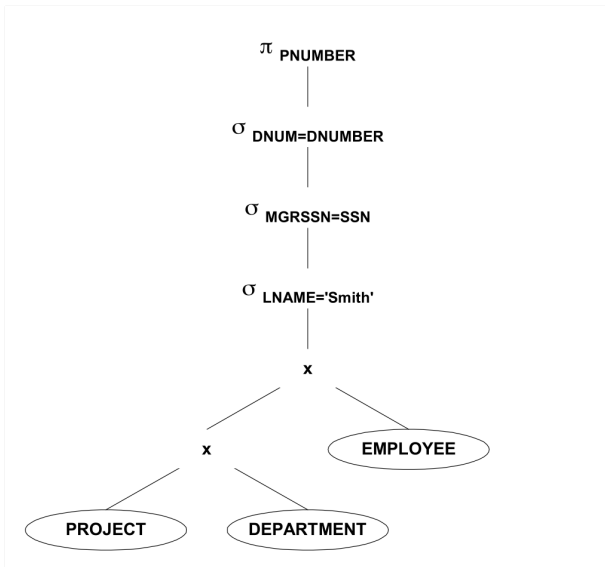
Transform SQL formalization into relational algebra  
and create a parsing tree

```
SELECT PNUMBER  
FROM PROJECT, DEPARTMENT, EMPLOYEE  
WHERE DNUM = DNUMBER  
AND MGRSSN = SSN  
AND LNAME = 'Smith'
```

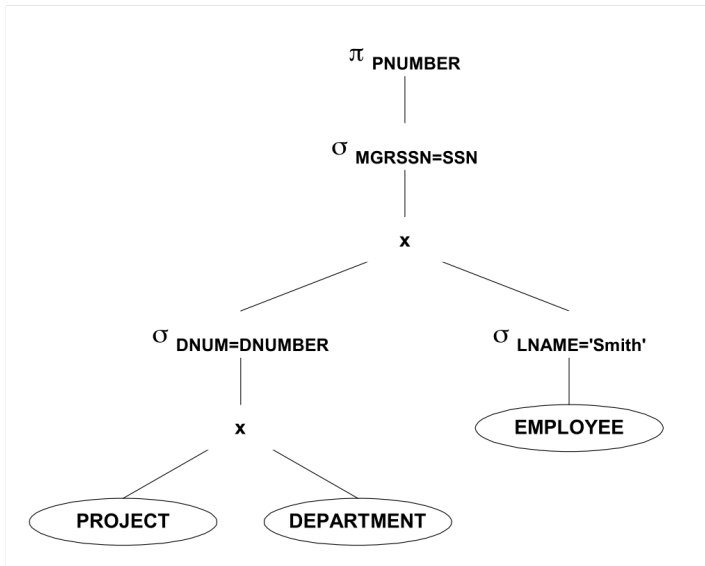
## Exercise 4: initial tree



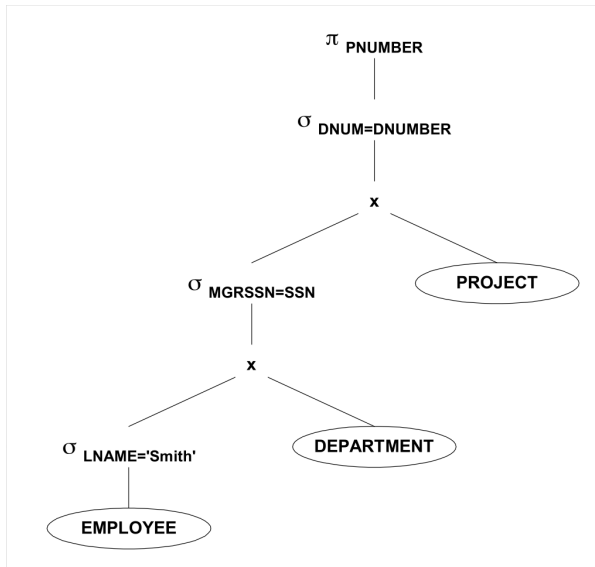
## Exercise 4: tree transformation – step 1



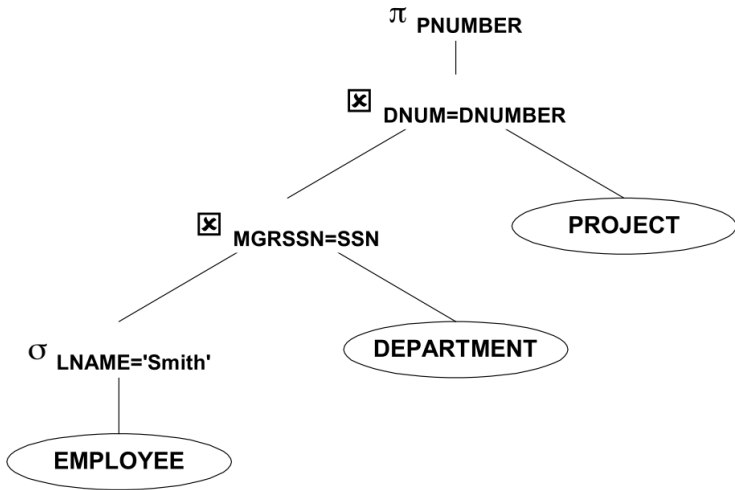
## Exercise 4: tree transformation – step 2



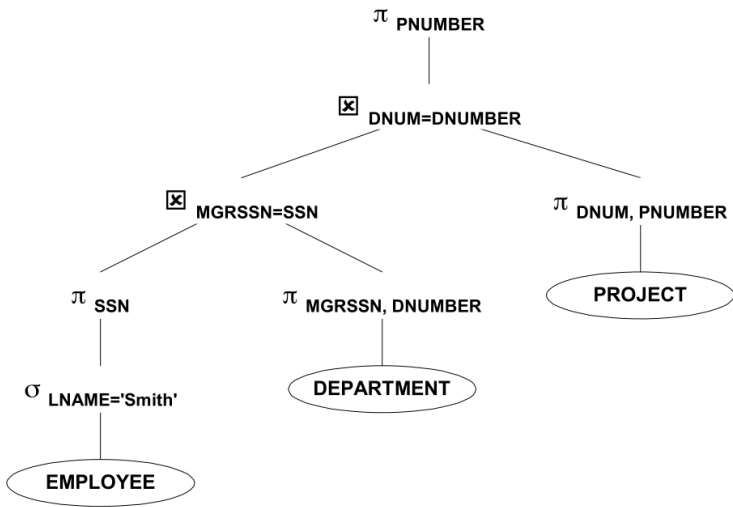
## Exercise 4: tree transformation – step 3



## Exercise 4: tree transformation – step 4



## Exercise 4: tree transformation – step 5

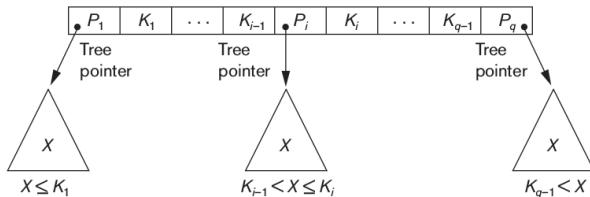




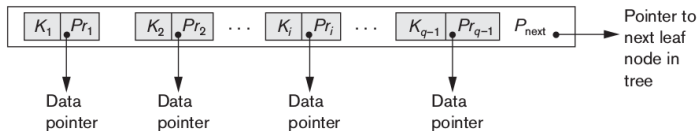
# Exercise 1 – $B^+$ -trees

The nodes of a  $B^+$ -tree. (a) Internal node of a  $B^+$ -tree with  $q - 1$  search values.  
(b) Leaf node of a  $B^+$ -tree with  $q - 1$  search values and  $q - 1$  data pointers.

(a)

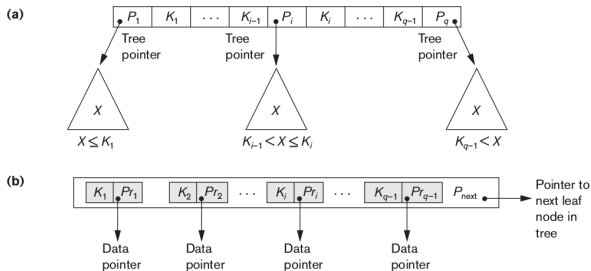


(b)



# Exercise 1 – $B^+$ -trees

The nodes of a  $B^+$ -tree. (a) Internal node of a  $B^+$ -tree with  $q - 1$  search values.  
 (b) Leaf node of a  $B^+$ -tree with  $q - 1$  search values and  $q - 1$  data pointers.



(i) for an internal node

$$p * P + (p - 1) * I_{SSN} \leq B$$

for a leaf node

$$p_{leaf} * (P_R + I_{SSN}) + P \leq B$$