

## Outer Join

1. Left outer join
2. Right outer join ↗
3. Both outer ↗



SAL	
Eid	Sal
E01	1000
E02	1100
E03	1200

LOC

Eid	Location
E01	Kol
E02	Dgp
E04	Sil

L.O.J (~~笛卡尔积~~)

'SAL ~~笛卡尔积~~ LOC'

Eid	Sal	Location
E01	1000	Kol
E02	1100	Dgp
E03	1200	-

R O J (~~笛卡尔积~~)

SAL ~~笛卡尔积~~ LOC

Eid	Sal	Location
E01	1000	Kol
E02	1100	Dgp
E04	(NULL)	Sil

SAL ~~笛卡尔积~~ LOC

Eid	Sal	Location
E01	1000	Kol
E02	1100	Dgp
E03	1200	-
E04	-	Sil

Eid	Sal	Location
E01	1000	Kol
E02	1100	Dgp

Locn

loan-no	Amount
101	800
102	3000
103	5000

Self joining

$\rho$  (Locn)

$\varphi$  :- Find ~~max~~ <sup>min</sup> loan amount!

~~$\exists G \min(\text{amount}) (\text{Loan})$~~

$n^{(2)}=3$

loan-no	Amount
101	800
102	3000

Locn  $\times$  Locn

$\downarrow P \text{ (Loan)}$

$\downarrow L$

$\text{Loan} \times f_L \text{ (Loan)}$

Loan. loan-no	Loan. amount	L. loan-no	L. amount
101	800	101	800
101	800	102	3000
101	800	103	5000
102	3000	101	800
	"	:	3000

$\pi_{L. amount} (G \text{ (loan amount < L. amount)} \rightarrow \text{Temp1})$

$\pi_{\text{amount}} (\text{loan}) - \text{Temp1}$

$$\begin{array}{r} 800 \\ 3000 \\ \hline 3800 \end{array} - \begin{array}{r} 3000 \\ 5000 \\ \hline 800 \end{array}$$

Q: find max sel of employee name from Emp table.

Emp	E_id	E_name	sel
E1	A		10
E2	B		12
E3	C		8

$\pi_{\text{Emp}, \text{sel}} (G_{\text{Emp}, \text{sel}} \rightarrow \text{E.sel} \rightarrow \text{Emp.sel})$

$$\begin{array}{r} 10 \\ 12 \\ 8 \\ 8 \end{array} \xrightarrow{\text{Emp.sel}} \begin{array}{r} 10 \\ 12 \\ 8 \end{array}$$

Emp. E_id	Emp. Eno	Emp. sel	E. E_id	E. Ename	F. sel
E1	A	10	E1	A	10
E1	A	10	E2	B	12
E1	A	10	E2	C	8
E2	B	12	E1	A	10
E2	B	12	E2	B	12
E2	B	12	E3	C	8

$\pi_{\text{sel}} (\text{Emp}) - \pi_{\text{Emp.sel}} (G_{\text{Emp.sel}} < \text{E.sel} \rightarrow \text{Emp} \times f_E (\text{Emp})) = r$

$\pi_{\text{name}} (G_{\text{sel} = 1} = \pi_{\text{Emp}})$

Account (acc-no, Name, bal) ←  
 find the largest account bal & account holder  
 from Account table

Division

$\Pi_{\text{bal}}(\text{Account}) - \Pi_{\text{account}, \text{bal}}(\text{Account.bal} < \text{?}. \text{bal})$

$\text{Account} \times \sum_a P(\text{Account}))$

Division operator ( $\div$ )

Account (Acc-no, Branch-name)

Branch (Branch-name, Branch-city)

Depositor (Customer-name, Acc-no)

Q: Give the name of all customers who have account  
 in all the branches located at "Kol".

Ans:-  $\Pi_{\text{Branch-name}}(\text{Branch-city} = 'Kol' (\text{Branch}))$

All customer who have  
 account in all Branch  
at Kol

$\Pi_{\text{Customer-name, Branch-name}} (\text{Account} \Delta \text{Depositor})$

(All customer & branchname for  
all customer)

$\Pi_{\text{Customer-name, Branch-name}} (\text{Account} \Delta \text{Depositor})$

$\Pi_{\text{Branch-name}}(\text{Branch-city} = 'Kol' (\text{Branch}))$

Q2: Find the name of all customer who have a loan at

— all branches located at 'Dhp'

$\Pi_{\text{branch-id}} (\text{6 city} = \text{'Dhp'} \text{ branch}) \leftarrow T_1$

$\Pi_{\text{customer-name, branch-id}} (\text{Loan } \bowtie \text{ Borrower}) \leftarrow T_2$

Ans:  $T_2 \div T_1$

Q1: find the name of all customer who live in 'kol'.

$\Pi_{\text{customer-name}} (\text{6 city} = \text{'kol'} \text{ customer})$

Q2: find the customer-id who have loan or account or both.

$\Pi_{\text{customer-id}} (\text{Borrower}) \cup \Pi_{\text{customer-id}} (\text{Depositor})$

Q3: find the all customer who have an account but no loan.

$\Pi_{\text{customer-id}} (\text{deposit}) - \Pi_{\text{customer-id}} (\text{Borrower})$

Q4: find all customers who have loan at 'Newton's' branch.

$\Pi_{\text{customer-name}} (\text{6 branch-id} = \text{'Newton's'})$  Borrower  $\bowtie$  Loan

Q5: find the name of all customers who have a loan at "manikdals" branch but do not have an account at any branch of the bank.

Find all customer who have loan at manikdals.

$\Pi_{\text{customer-name}} (\text{6 branch-id} = \text{'manikdals'})$  (Borrower  $\bowtie$  Loan)

—  $\Pi_{\dots} (\text{Depositor})$

$\pi_{\text{cust\_name}} (\text{Depositor})$

Q7: Find the name of all customers with an account having  $< \text{balance} > 12000$ .

Q8: Find the cust\_id who lives in the same city at their bank located.

Q9:

(Customer  $\bowtie$  Depositor  $\bowtie$  Account  $\bowtie$  Branch)

$\pi_{\text{cust\_name}} \{ \text{Customer}. \text{city} = \text{Branch}. \text{city} \}$

or

$\pi_{\text{cust\_name}} \left( \begin{array}{l} \{ \text{Customer}. \text{cust\_id} = \text{Depositor}. \text{cust\_id} \wedge \\ \text{Depositor}. \text{acc\_no} = \text{Account}. \text{acc\_no} \wedge \\ \text{Account}. \text{branch\_id} = \text{Branch}. \text{branch\_id} \wedge \\ \text{Customer}. \text{city} = \text{Branch}. \text{city} \end{array} \right) \quad (\text{Customer} \times \\ \text{Depositor} \times \\ \text{Account} \times \\ \text{Branch})$