

# Relational Operators

# Relational Operators

- Project
- Select
- Join
- Aggregate
- Group-by
- Having
- Order by

# Project

- $\Pi_{(\text{Att\_List})}(R)$
- SELECT (Att\_List) FROM R
- SELECT Distinct (Att\_List) FROM R

Complexity

$O(n_R)$

$R(K, A_1, \dots, A_n)$

① Scan all blocks  
Store the rows

②  $\Pi_A(R)$   
 $\rightarrow (C_1)$

③ Scan all blocks  
Store the rows

$O(K=Val)$  (R).  
 $E_{no} = 10101$

$Emp(E_{no}, Name, Dno, Sal)$

a)  $\frac{n_R}{2}$  file unsorted

b)  $\lg_2(n_R)$  if file sorted on Key

c)  $\lg_2(n_{PI}) + 1$  PI.

d)  $\lg_2(N) + 1$  SIK

$\lg_2(n_{pi}) + 1$

PI  $\leftarrow$   $\frac{n_R}{2}$   $\lg_2(n_R)$   
FOK

$\lg_p(n)$  B+tree  
 $+ \dots$

e)  $\lg_p(N/n_R) + 1$   
B-tree

f)  $\lg_p(N/n_R) + 2$   
B+tree

g)  $len = \frac{1}{1.15}$

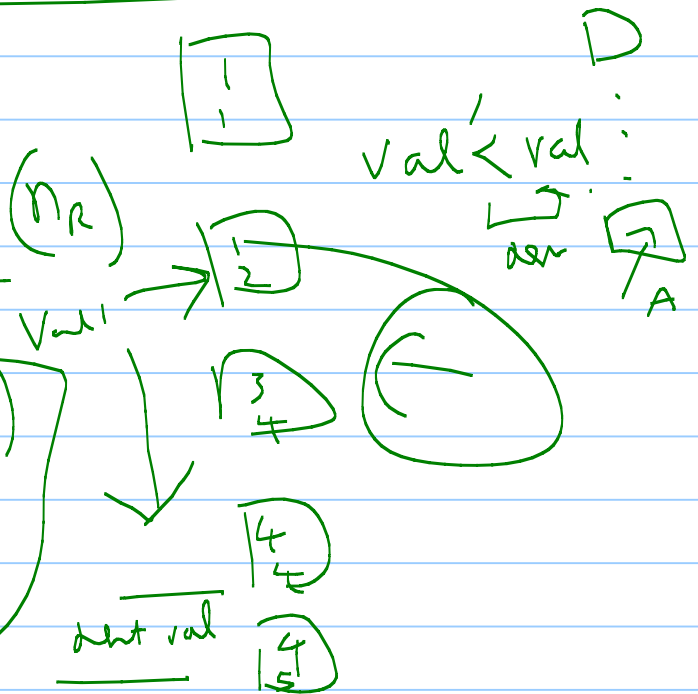
$$\sigma_{(k=val_1) \vee (k=val_2) \vee \dots \vee (k=val_r)}(R) \quad H/W$$

$$\sigma_{A=val(R)} \quad | \quad \sigma_{Dno=4(E)} \quad \downarrow \quad \text{? rows there: } N/N_R$$

a)  $n_R$

b)  $\lg_2(n_R) + \left\lceil \frac{(A)i}{bf_i} \right\rceil + \lg_2(n_R)$

$\lg_2(n_R) + (\text{loc frst record is there}) \rightarrow \underline{\text{last block}}$



$$\sigma(A = \text{val}) (R).$$

(c) CI on ~~A~~ | R.

$$\lg_L(fA) + \left\lceil \frac{C(A)_i}{bfr} \right\rceil$$

(d) SINK A | R

$$\lg_2(fA) + \left\lceil \frac{C(A)_i}{\text{reph.}} \right\rceil + (C(A)_i)$$

(e) B trees on A

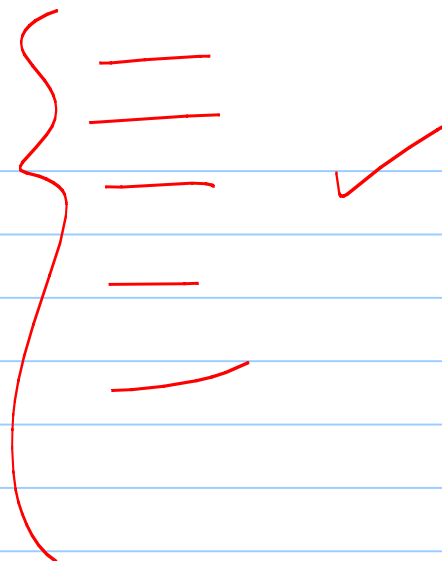
$$\lg_p(fA) + \left\lceil \frac{C(A)_i}{bfr} \right\rceil$$

(f) B tree on A

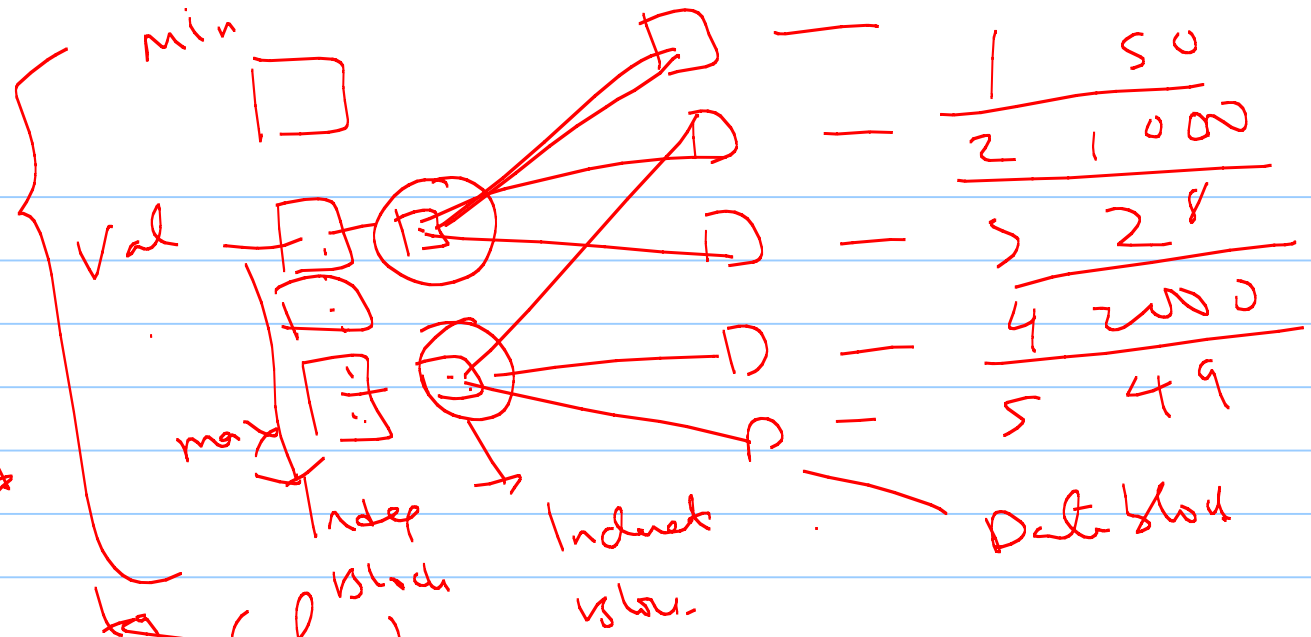
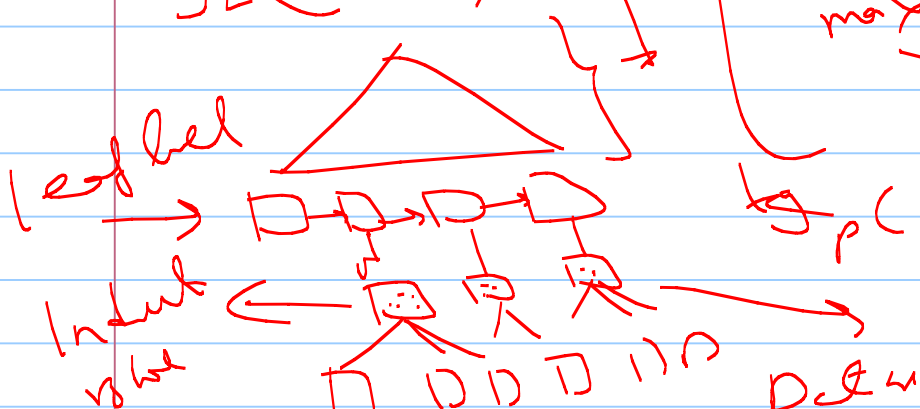
$$\lg_p(fA) + 1 + (x|y) \leftarrow \text{node}$$

←  
nmr.

✓  $A = \text{val}(R)$



$\sigma(R)$   
A7val

$$\lg(n_{\text{Sink}})$$


$A > \text{val}_1$  AND  $A < \text{val}_2$



$\sigma_{(K=val) \text{ AND } (A=val')} (R)$

$\approx \sigma_{(K=val)}(R)$   
Check  $(A=val')$   
for that row.

$\sigma_{(A=val) \text{ AND } (B=val)} (R)$

Sal = 10000  
AND Bsm = 5000

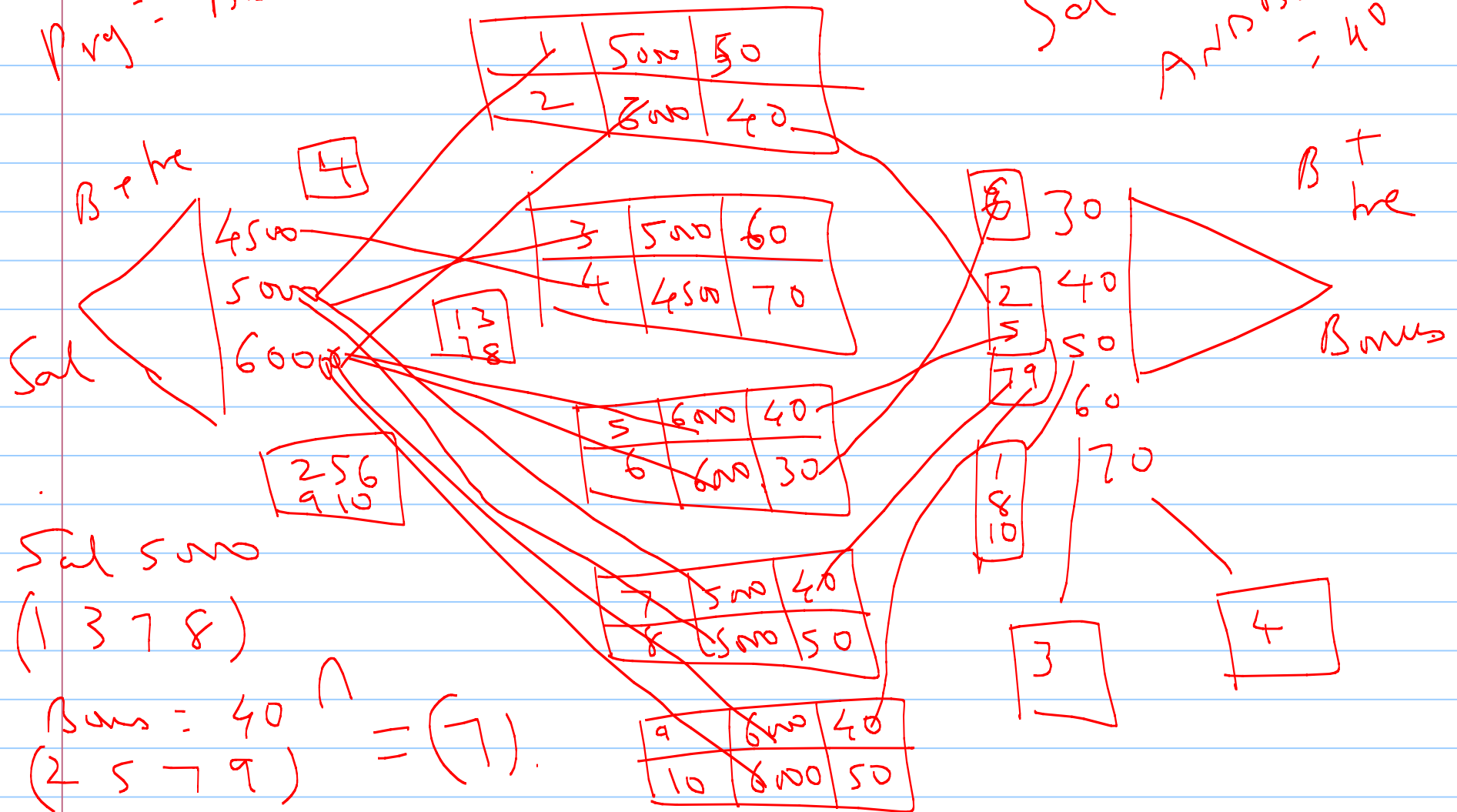
- (a) Linear scan
- (b) Use A or B | SI or ordered file & search for B & A values to filter
- (c) | A=val | B=val | pick smaller & scan the rows.

(d) Compute  
Index on A & B

Loc = 'Hd'  
 Prg = 'AB'

Emp Sal Bonus Loc Prg

Sal = 5000  
 AND Bonus = 40



(R)  
 $A > \text{val}$  AND  $B < \text{val}$

(E)  
 $(S_d \ll S_{row})$  AND  
 $(B_{ms} \geq 70)$

End Sel Rows.

1	500	50
2	600	40

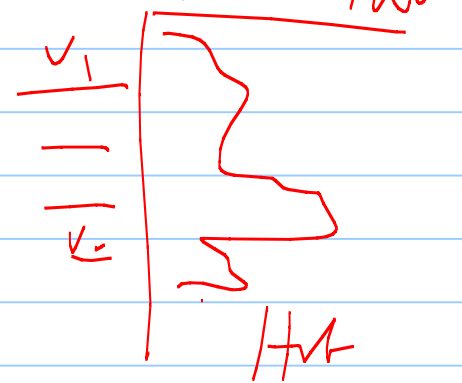
3	500	60
4	450	70

5	600	40
6	600	30

7	500	40
8	500	50

9	600	40
10	600	50

(E)  
 $S_d \geq S_{row}$   
 AND  $D_{ms} \geq 60$



4500 70

5000 40

5000 50

5000 60

6000 30

6000 40

6000 50

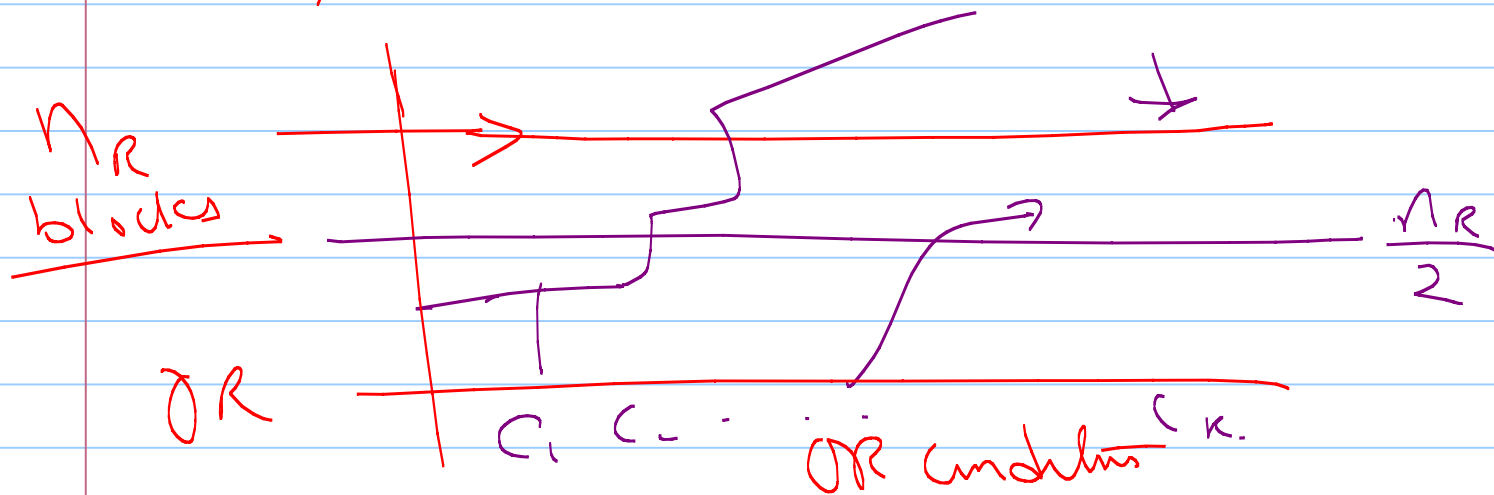
Computer Index

$K = \text{val}$  OR  $A = \text{val}$  (R).

$i = m = s$  OR  $Sch = s no$  (E).

$A = \text{val}$  OR  $B = \text{val}$  (R).

$Sch = s no$  OR  $B no = 60$  (E).



In some wa.

$$C_i \quad S_i \subseteq V \quad 1, 2, \dots$$

$$C_p \cdot \sum_p \leq U$$

CV

$$\bigcirc \quad (R)$$

$$C_i \vee C_j \vee C_k$$

$$\Rightarrow (S_i \cup S_j \cup S_k)$$

$$n_R \cup C_R, C_i \text{ AND } C_j \text{ AND } C_k$$

$$(S_i \wedge S_j \wedge S_k)$$

Sal  $\neq$  Sw  $(\bar{E})$ .



THE

A hand-drawn diagram of a cell membrane cross-section. It features a phospholipid bilayer with purple heads and yellow tails. Several proteins are embedded within the bilayer, represented by blue and green shapes. A large, light blue oval is drawn on the left side, partially overlapping the membrane. The entire diagram is set against a background of horizontal blue lines.



# Select

- $\sigma_{(cond)}(R)$ , where condition is a predicate
- Cond can be
  - $(A <op> Value)$  – A can be key or non-key attribute
  - $(A <op> Value) \text{ AND } (B <op> Value)$  – A, B non-key attributes
  - $(A <op> Value) \text{ OR } (B <op> Value)$  – A, B non-key attributes
  - Combination of above attributes
- How to process these conditions?

# Join Operator

$R \bowtie_{(\text{join condition})} S$

- Nested loop
- Index based
- Hash
- Sort Merge

# Aggregate operators

- Count
- Max/min/sum
- Average/standard deviation
- Rank

# Group By

- Sorting
- Hashing

# Having

- Sort and count
- Hash and count
- Other techniques

# Order by

- Single Attribute
- Nested Attributes