

CS 525: Advanced Database Organisation

**07: Query Processing Overview**

Boris Glavic

Slides: adapted from a [course](#) taught by [Hector Garcia-Molina](#), Stanford InfoLab

CS 525
Notes 7 - Query Processing
1 IIT College of Science and Letters  
ILLINOIS INSTITUTE OF TECHNOLOGY

Query Processing

Q → Query Plan

CS 525
Notes 7 - Query Processing
2 IIT College of Science and Letters  
ILLINOIS INSTITUTE OF TECHNOLOGY

Query Processing

Q → Query Plan

Focus: Relational System

- Others?

CS 525
Notes 7 - Query Processing
3 IIT College of Science and Letters  
ILLINOIS INSTITUTE OF TECHNOLOGY

Example

Select B,D  
From R,S  
Where R.A = "c" ∧ S.E = 2 ∧  
R.C=S.C

CS 525
Notes 7 - Query Processing
4 IIT College of Science and Letters  
ILLINOIS INSTITUTE OF TECHNOLOGY

R	A	B	C	S	C	D	E
a	1	10	10	x	2		
b	1	20	20	y	2		
c	2	10	30	z	2		
d	2	35	40	x	1		
e	3	45	50	y	3		

CS 525
Notes 7 - Query Processing
5 IIT College of Science and Letters  
ILLINOIS INSTITUTE OF TECHNOLOGY

R	A	B	C	S	C	D	E
a	1	10	10	x	2		
b	1	20	20	y	2		
c	2	10	30	z	2		
d	2	35	40	x	1		
e	3	45	50	y	3		

Answer 

B	D
2	x

CS 525
Notes 7 - Query Processing
6 IIT College of Science and Letters  
ILLINOIS INSTITUTE OF TECHNOLOGY

• How do we execute query?

One idea

- Do Cartesian product
- Select tuples
- Do projection

CS 525



Notes 7 - Query Processing

7



RXS

R.A	R.B	R.C	S.C	S.D	S.E
a	1	10	10	x	2
a	1	10	20	y	2
⋮					
C	2	10	10	x	2
⋮					

CS 525



Notes 7 - Query Processing

8



RXS

R.A	R.B	R.C	S.C	S.D	S.E
a	1	10	10	x	2
a	1	10	20	y	2
⋮					
C	2	10	10	x	2
⋮					

Bingo!  
Got one...

CS 525



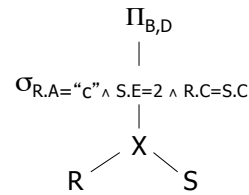
Notes 7 - Query Processing

9



Relational Algebra - can be used to describe plans...

Ex: Plan I



CS 525



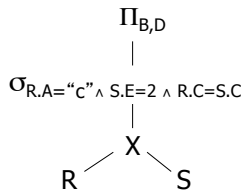
Notes 7 - Query Processing

10



Relational Algebra - can be used to describe plans...

Ex: Plan I



OR:  $\Pi_{B,D} [ \sigma_{R.A='c' \wedge S.E=2 \wedge R.C=S.C} (RXS) ]$

CS 525



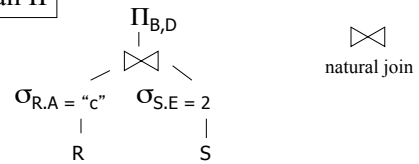
Notes 7 - Query Processing

11



Another idea:

Plan II



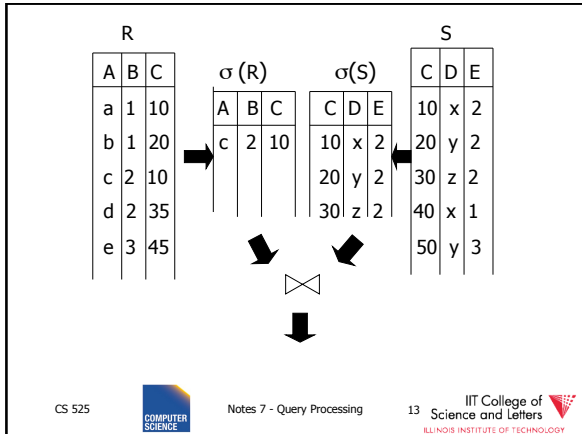
CS 525



Notes 7 - Query Processing

12





### Plan III

Use R.A and S.C Indexes

- (1) Use R.A index to select R tuples with R.A = "c"
- (2) For each R.C value found, use S.C index to find matching tuples

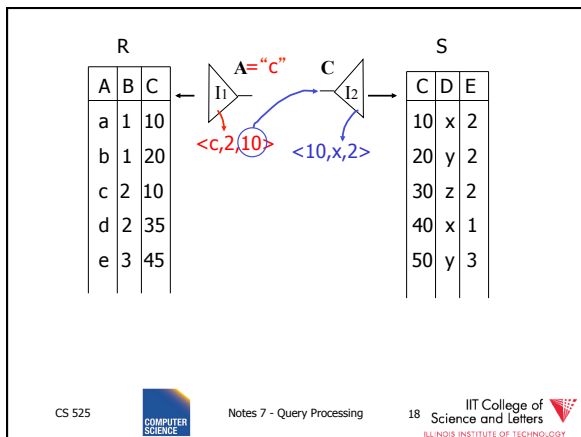
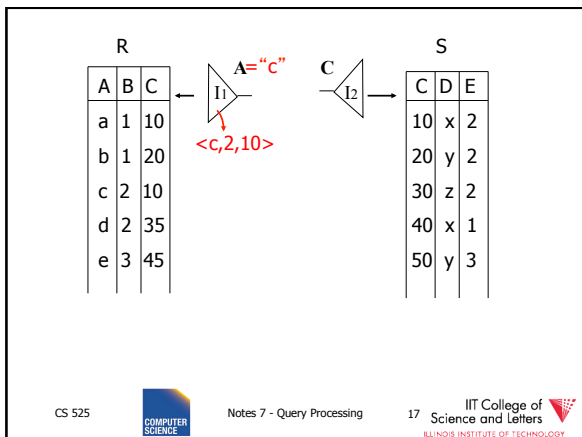
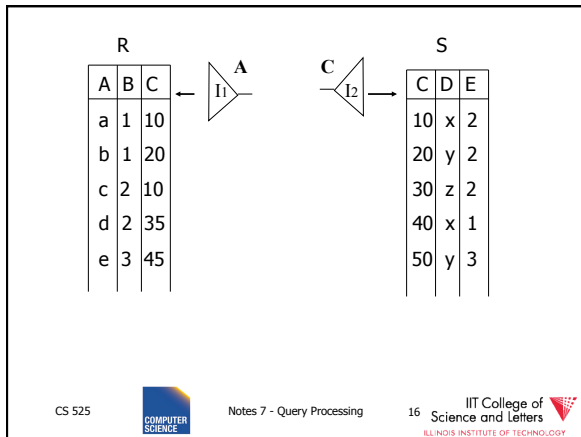
CS 525 IIT College of Science and Letters

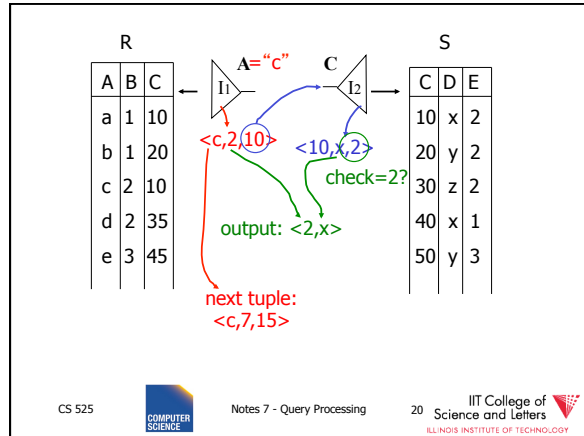
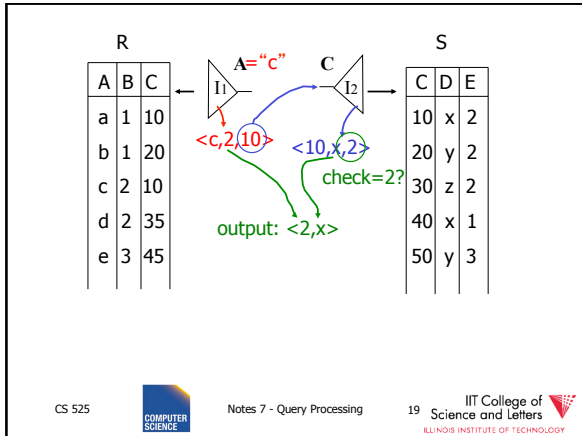
### Plan III

Use R.A and S.C Indexes

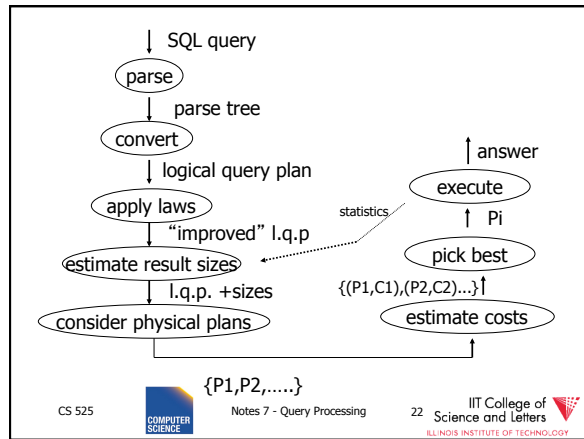
- (1) Use R.A index to select R tuples with R.A = "c"
- (2) For each R.C value found, use S.C index to find matching tuples
- (3) Eliminate S tuples S.E  $\neq$  2
- (4) Join matching R,S tuples, project B,D attributes and place in result

CS 525 IIT College of Science and Letters





## Overview of Query Optimization



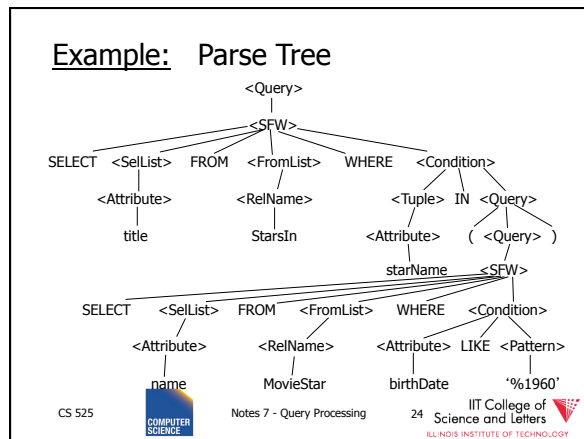
**Example: SQL query**

```

SELECT title
FROM StarsIn
WHERE starName IN (
  SELECT name
  FROM MovieStar
  WHERE birthdate LIKE '%1960'
);

```

(Find the movies with stars born in 1960)



Example: Generating Relational Algebra

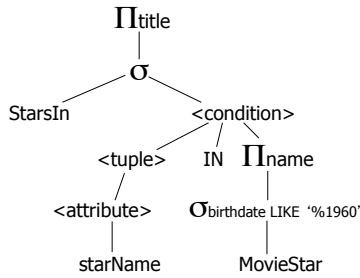


Fig. 7.15: An expression using a two-argument  $\sigma$ , midway between a parse tree and relational algebra

Example: Logical Query Plan

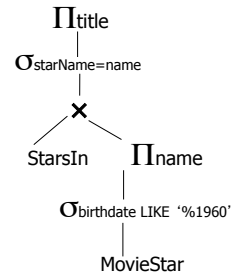
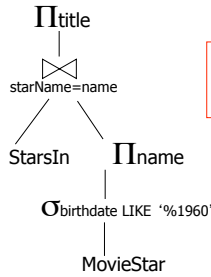


Fig. 7.18: Applying the rule for IN conditions

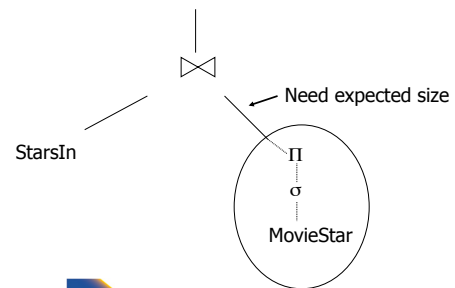
Example: Improved Logical Query Plan



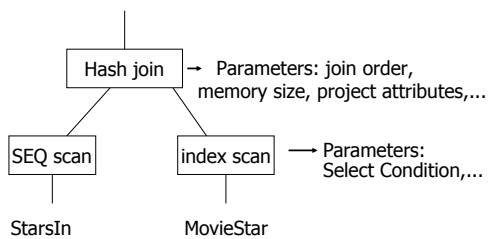
Question: Push project to StarsIn?

Fig. 7.20: An improvement on fig. 7.18.

Example: Estimate Result Sizes



Example: One Physical Plan



Example: Estimate costs

