

CS 525: Advanced Database Organisation



07: Query Processing Overview

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



Query Processing

Q \rightarrow Query Plan



Query Processing

Q \rightarrow Query Plan

Focus: Relational Systems

- Others?

Example

Select B,D

From R,S

Where R.A = "c" \wedge S.E = 2 \wedge

R.C=S.C

R	A	B	C
a	1	10	
b	1	20	
c	2	10	
d	2	35	
e	3	45	

S	C	D	E
	10	x	2
	20	y	2
	30	z	2
	40	x	1
	50	y	3

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

- How do we execute query?

One idea

- Do Cartesian product
- Select tuples
- Do projection

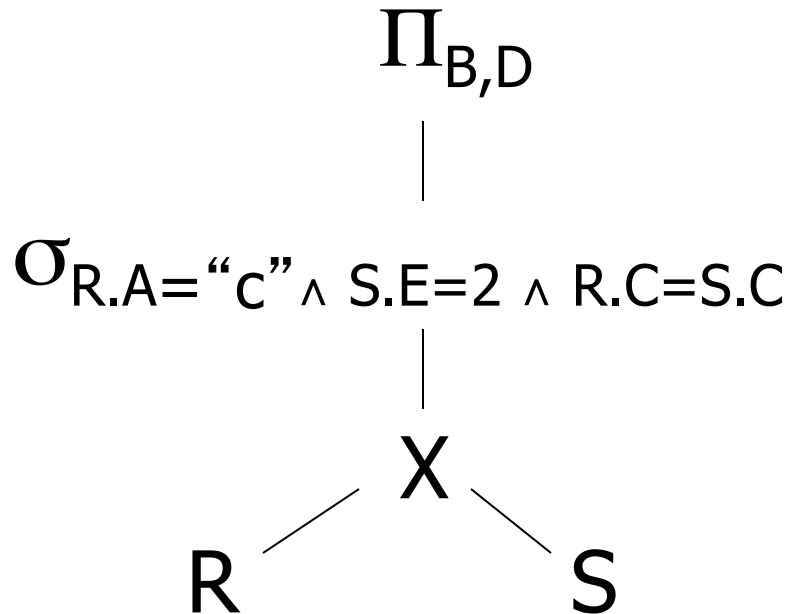
RXS

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
.					
.					

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	
.						
.						
Bingo! →	C	2	10	10	x	2
Got one...	.					
.						

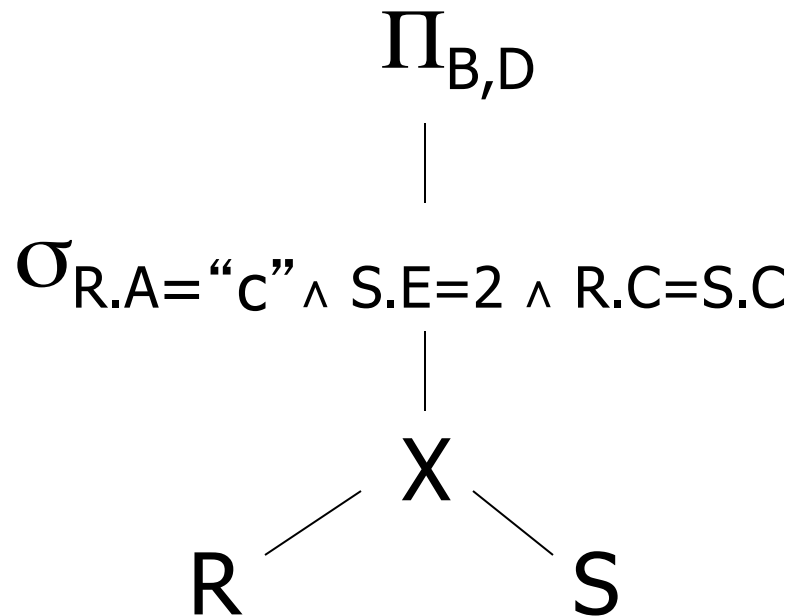
Relational Algebra - can be used to describe plans...

Ex: Plan I



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

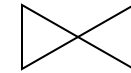
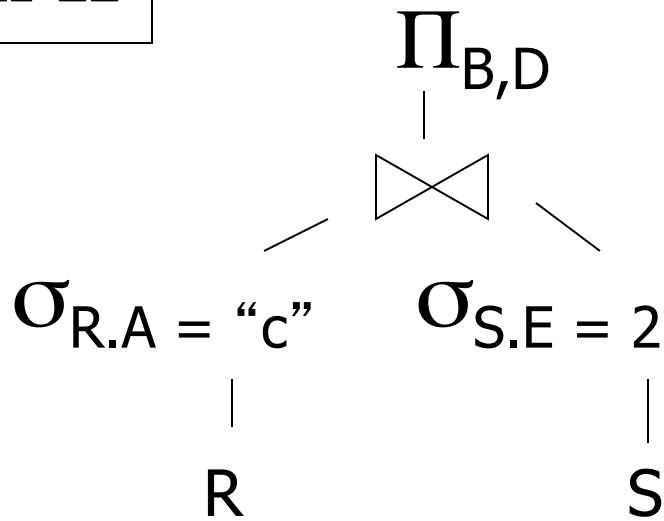
Ex: Plan I



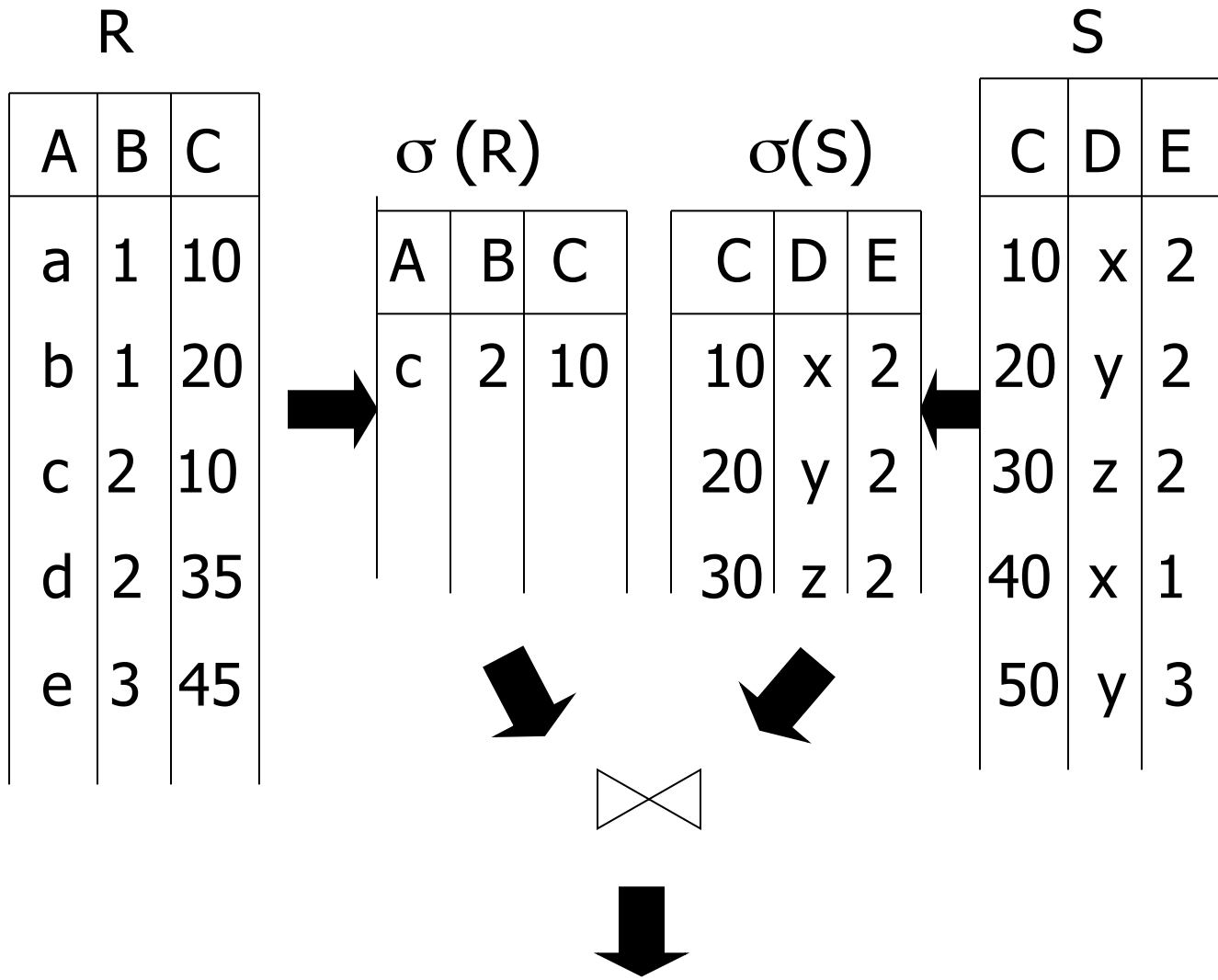
OR: $\Pi_{B,D} [\sigma_{R.A="C" \wedge S.E=2 \wedge R.C=S.C} (RXS)]$

Another idea:

Plan II



natural join



Plan III

Use R.A and S.C Indexes

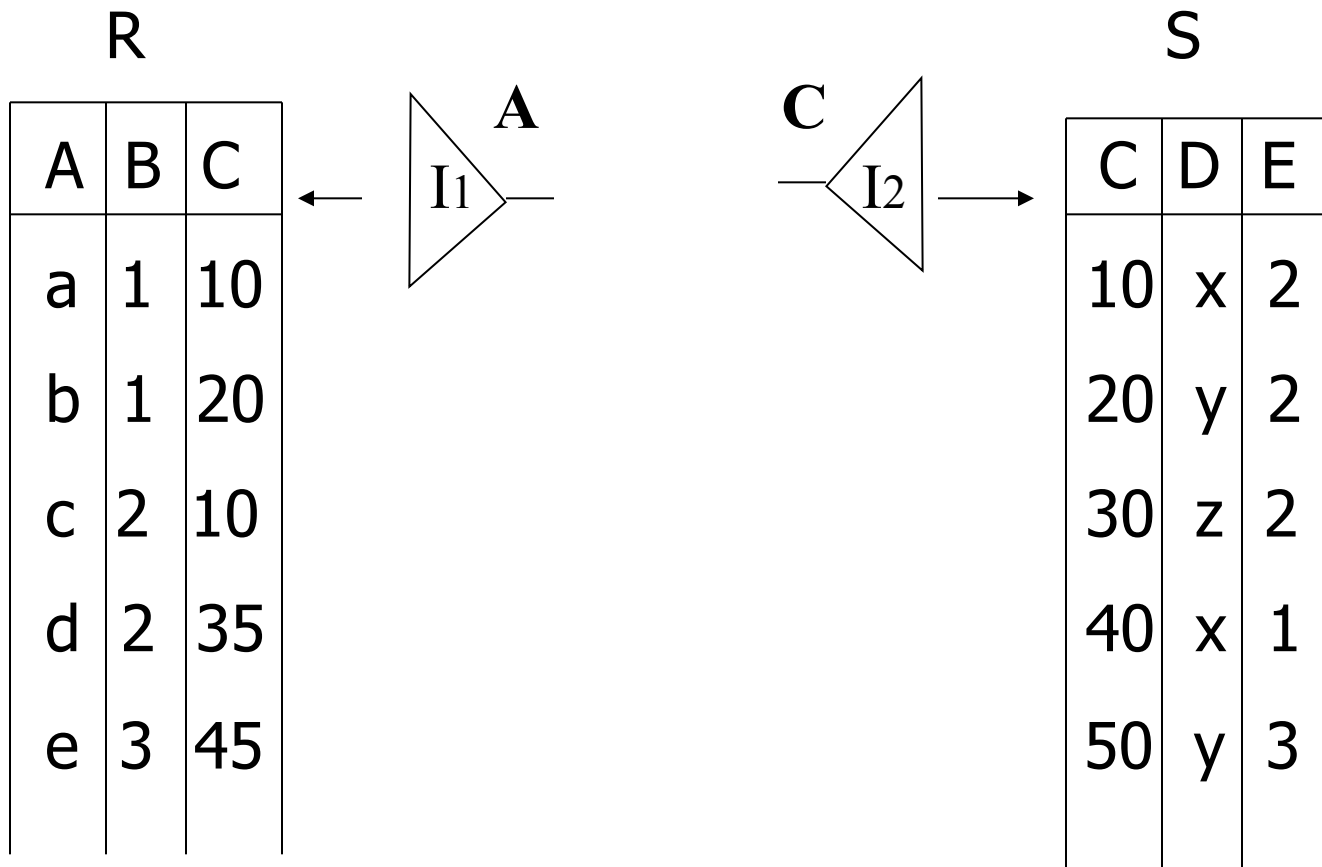
- (1) Use R.A index to select R tuples with R.A = “c”
- (2) For each R.C value found, use S.C index to find matching tuples

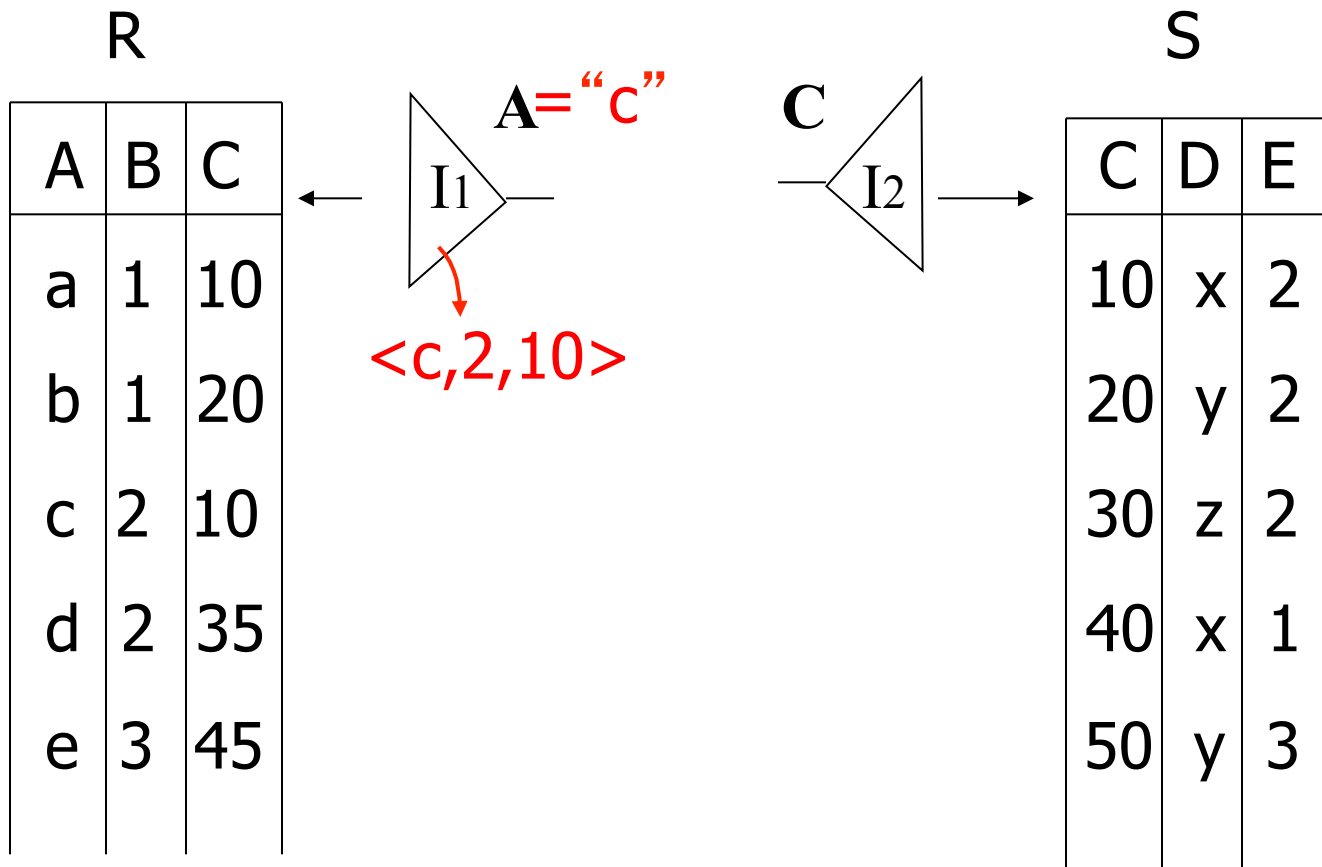


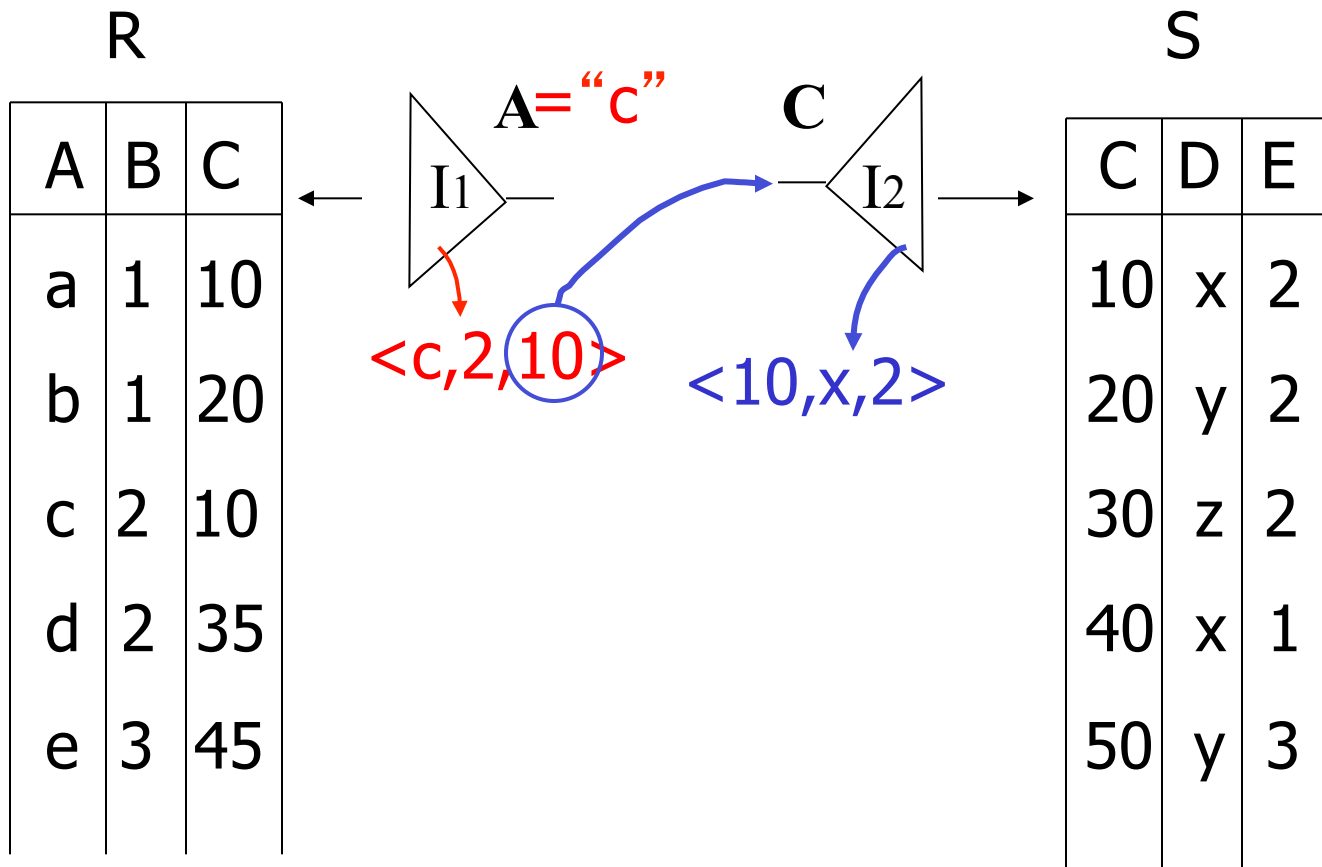
Plan III

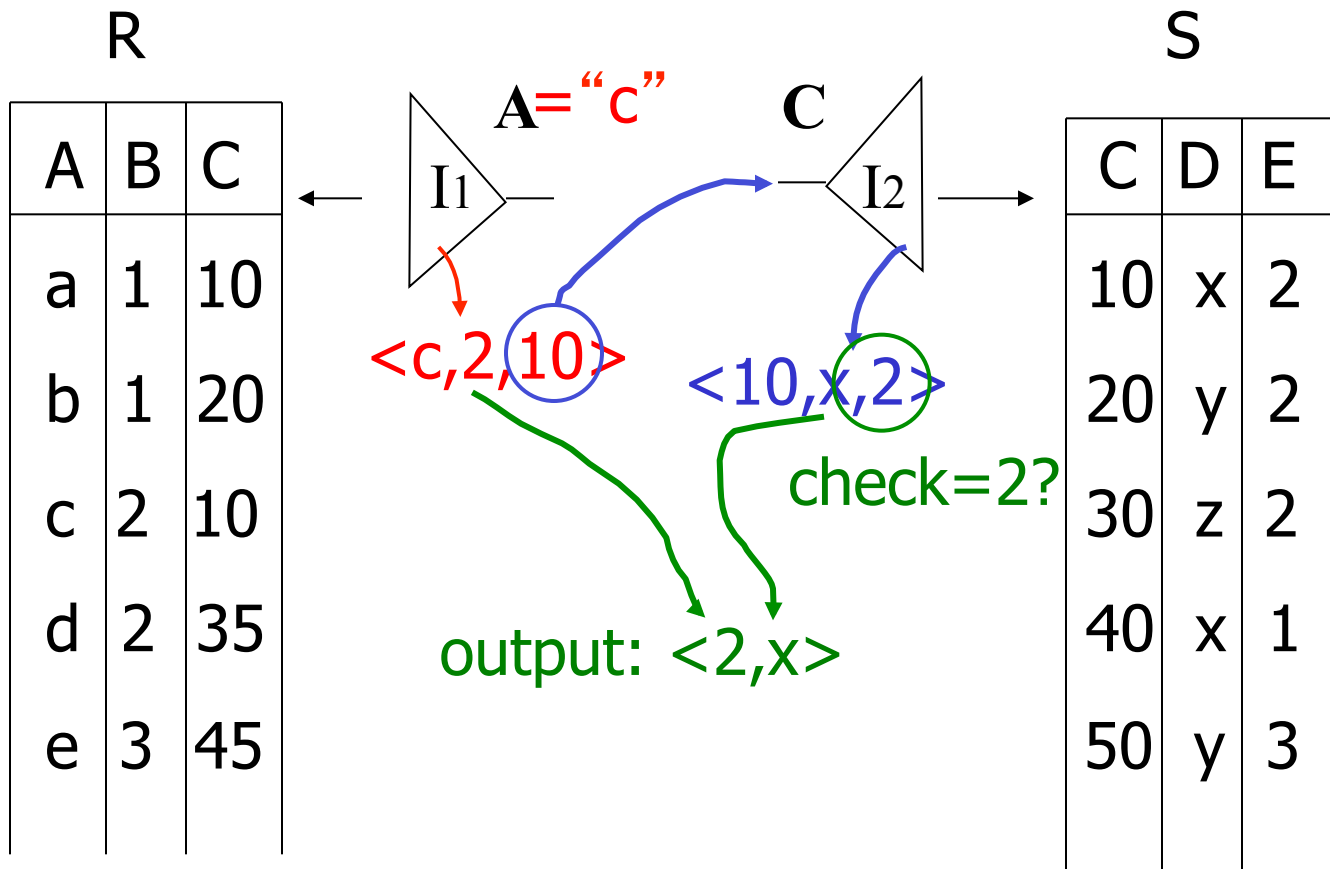
Use R.A and S.C Indexes

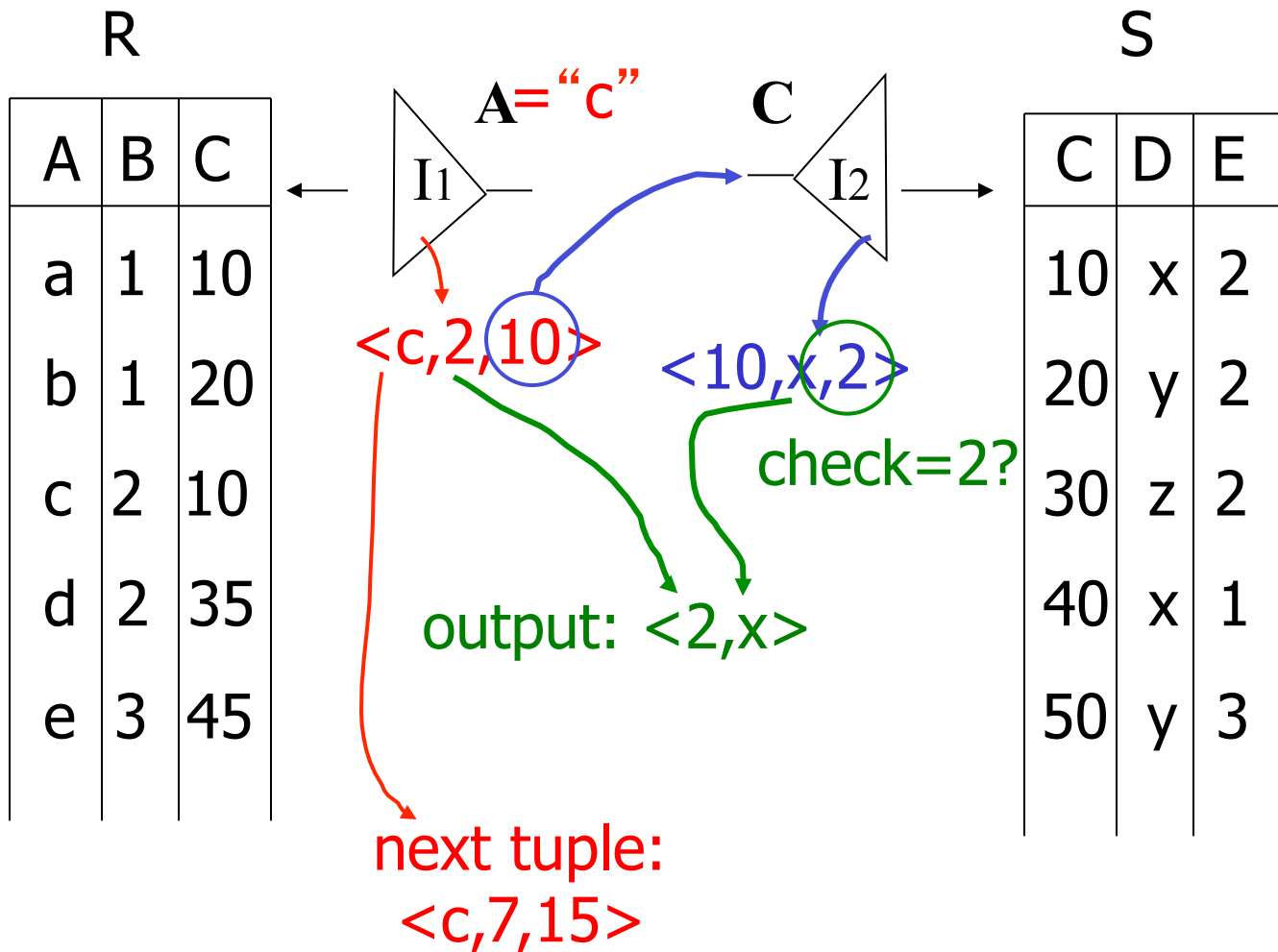
- (1) Use R.A index to select R tuples with R.A = “c”
- (2) For each R.C value found, use S.C index to find matching tuples
- (3) Eliminate S tuples S.E \neq 2
- (4) Join matching R,S tuples, project B,D attributes and place in result



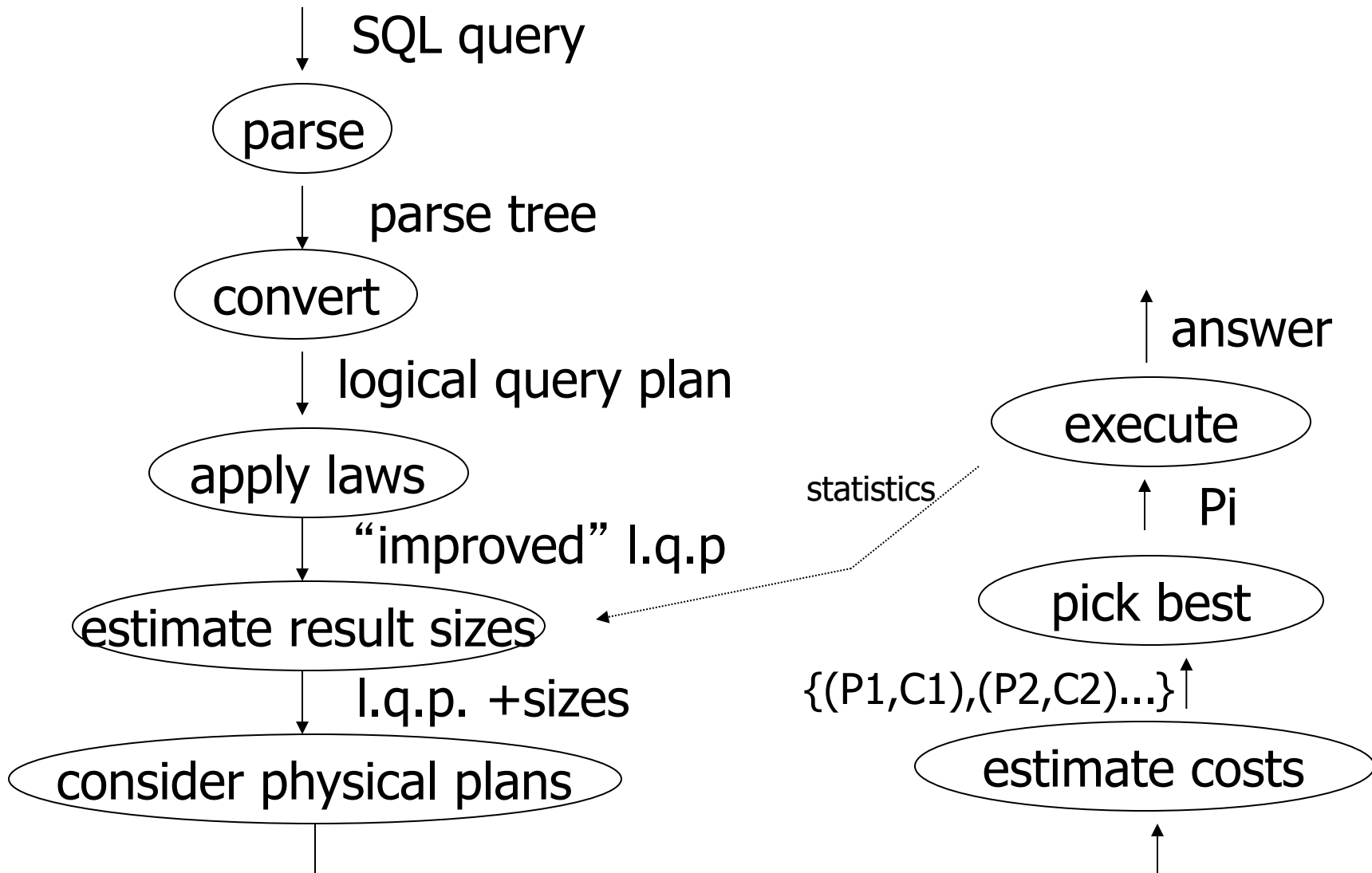








Overview of Query Optimization



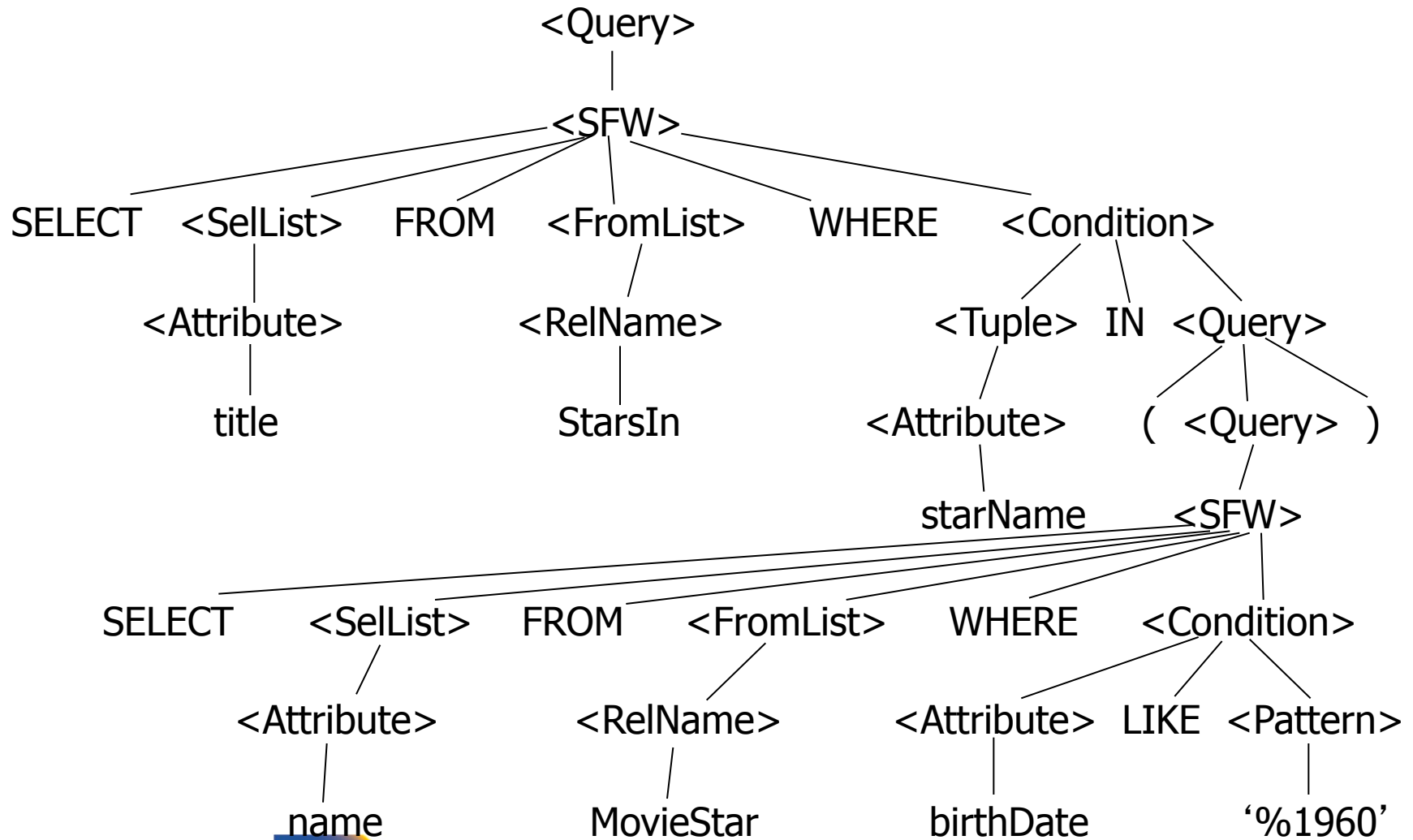
Example: SQL query

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

(Find the movies with stars born in 1960)



Example: Parse Tree



Example: Generating Relational Algebra

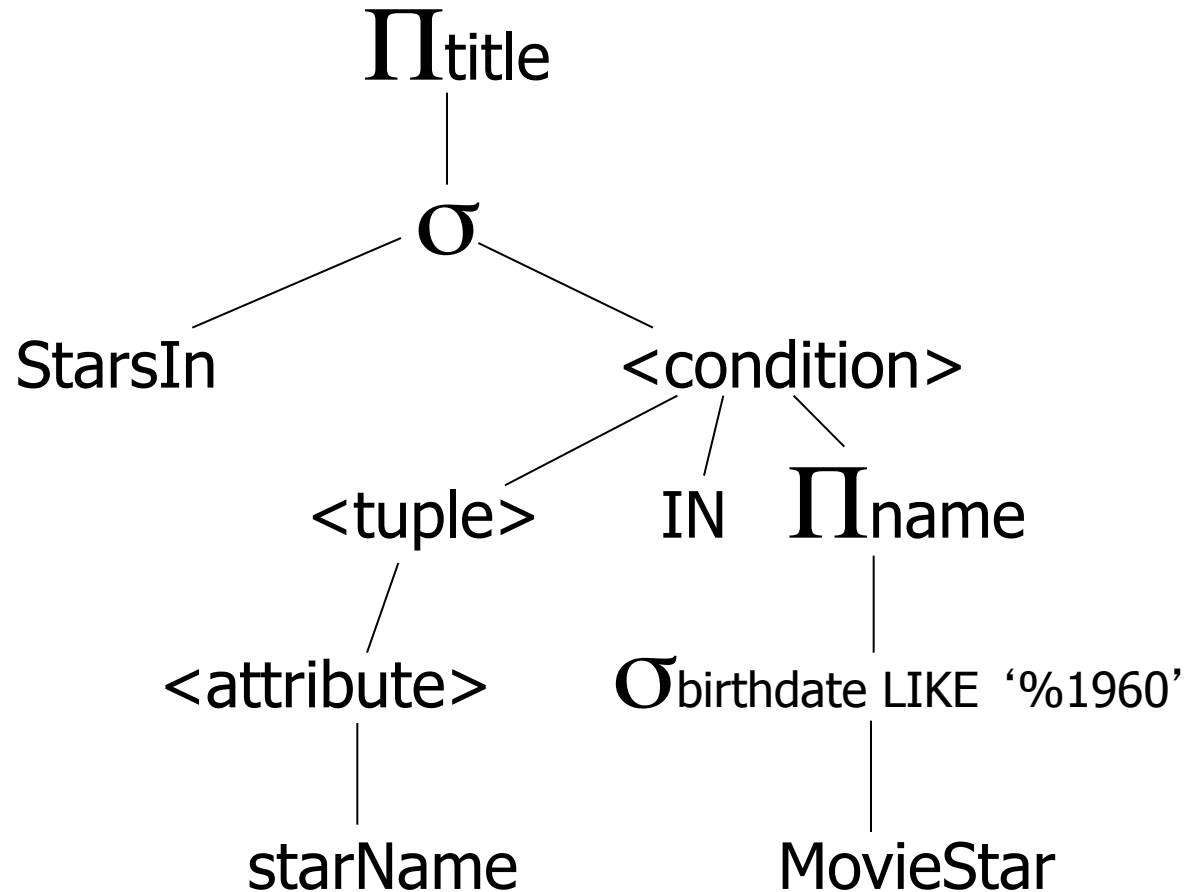


Fig. 7.15: An expression using a two-argument σ , midway between a parse tree and relational algebra

Example: Logical Query Plan

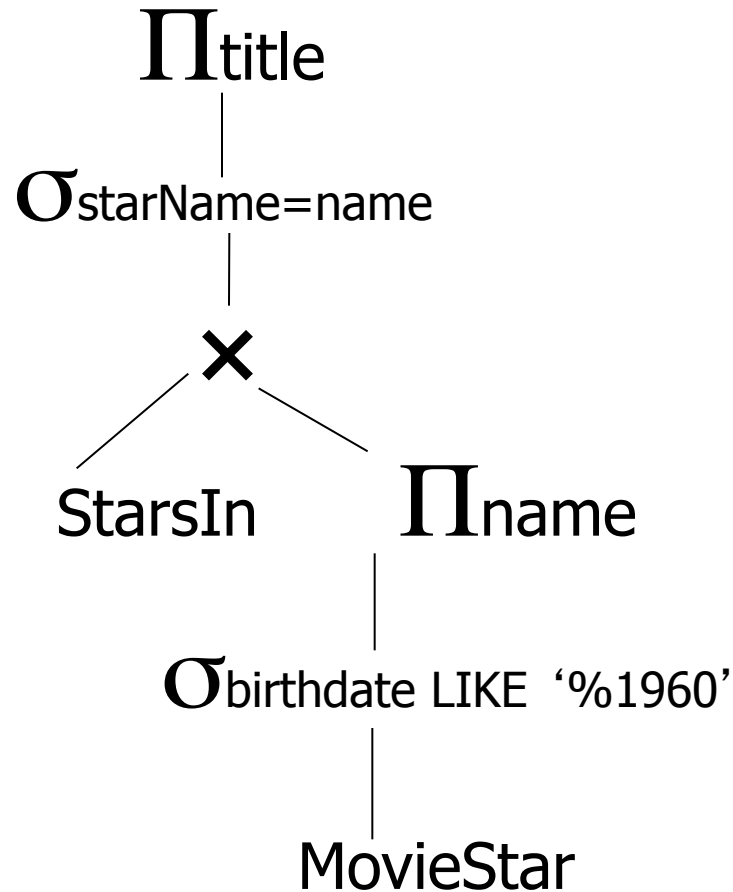
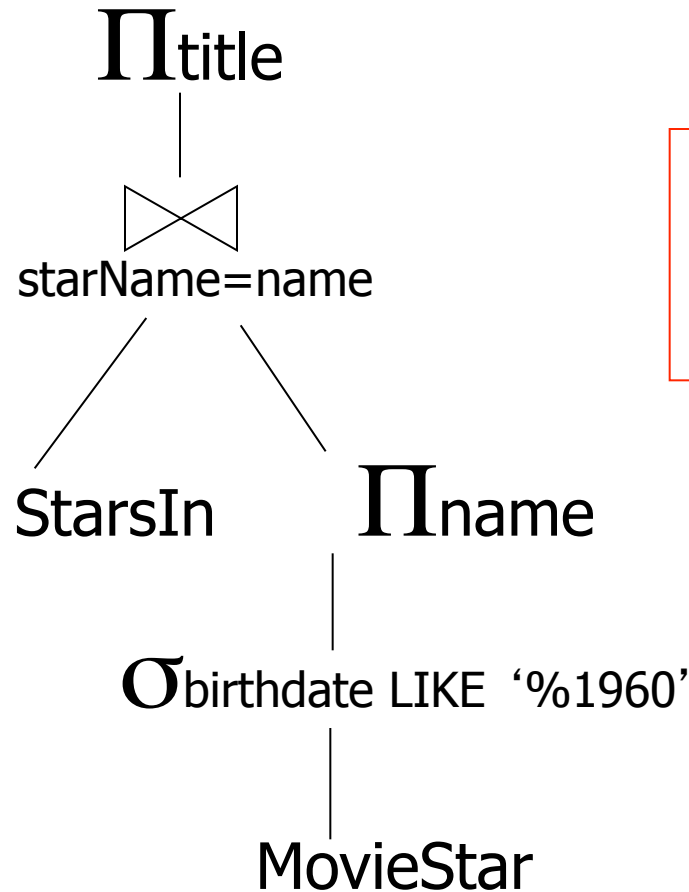


Fig. 7.18: Applying the rule for IN conditions

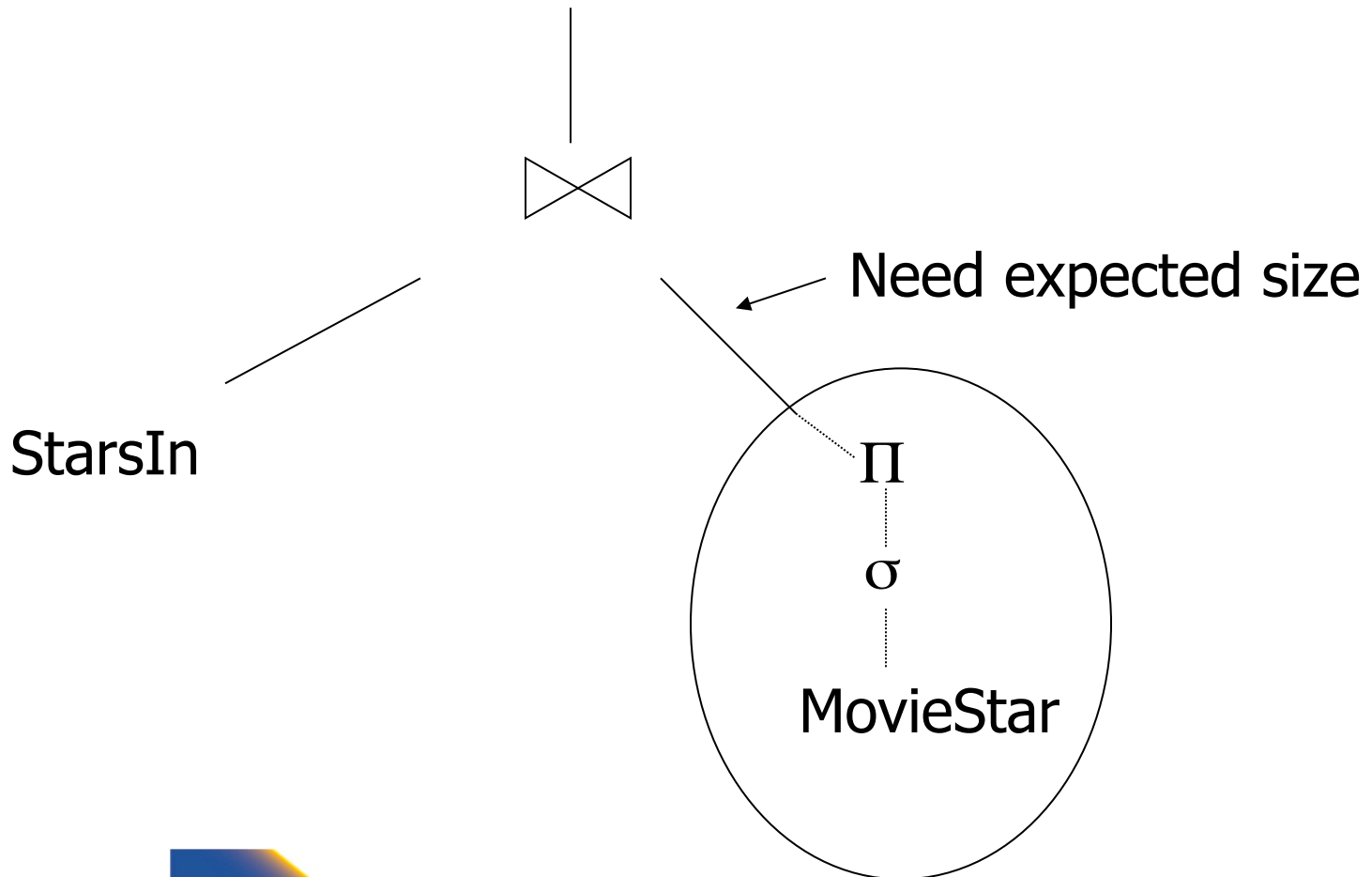
Example: Improved Logical Query Plan



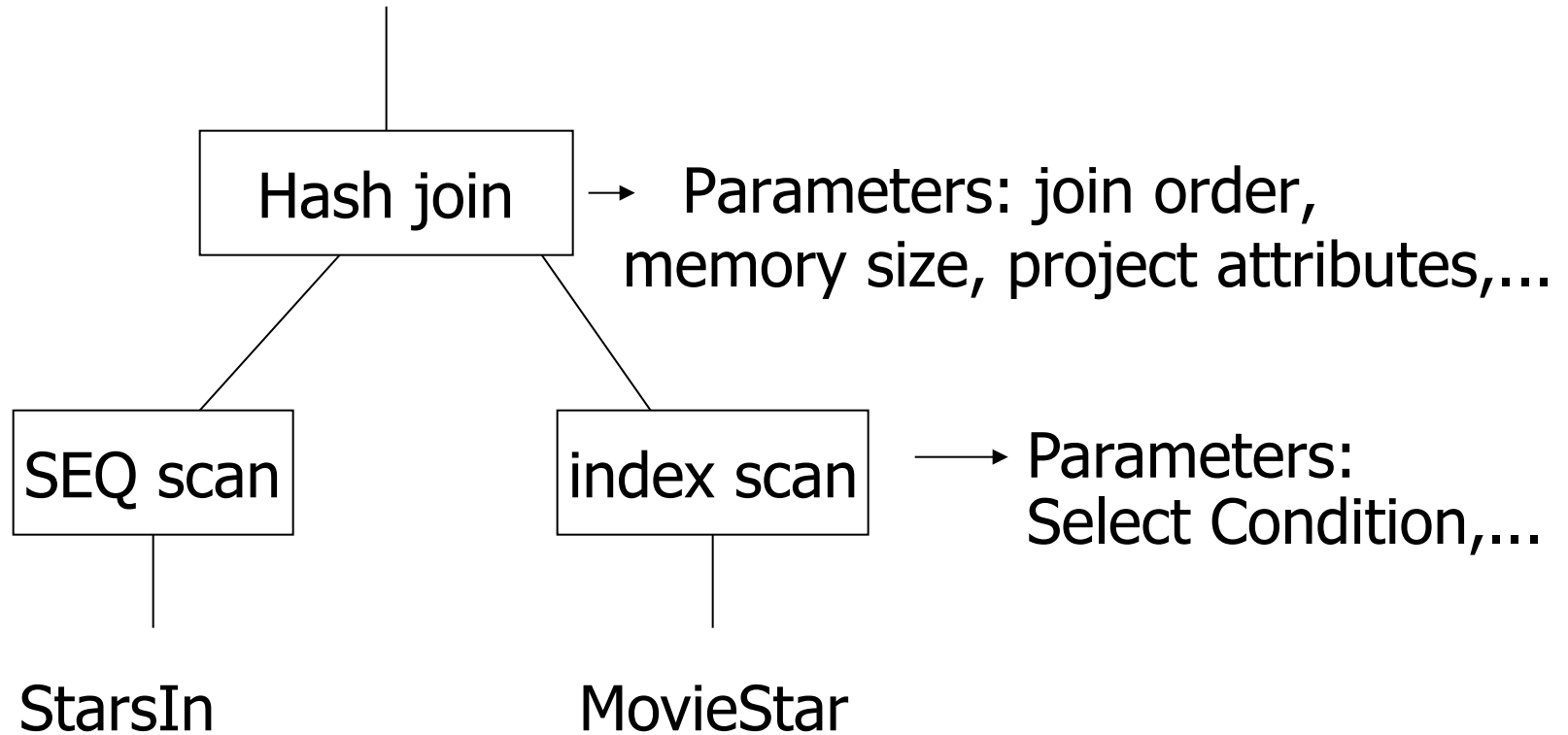
Question:
Push project to
StarsIn?

Fig. 7.20: An improvement on fig. 7.18.

Example: Estimate Result Sizes



Example: One Physical Plan



Example: Estimate costs

