



Relational Algebra

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Fundamental Operation in Relational Algebra are:

- Selection
- Projection
- Union
- Set Difference
- Cartesian Product
- Join



SELECTION (σ)



- The SELECT operator is σ (sigma) symbol
Used as an expression to choose tuples that meet the selection condition...

σ <selection condition>(R)

- > Select operation selects tuples that satisfy a given predicate.

Ex:- find all employees born after 1st Jan 1950:

σ '01/JAN/1950'(employee)

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PROJECTION(Π) Π_i




- Π (Π_i) symbol used to choose attributes from a relation.
- This operator shows the list of those attributes that we wish to appear in the result and rest attributes are eliminated from the table.

Π <attribute list>(relation)


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SELECTION & PROJECTION Example



Person

Id	Name	Address	Hobby
1123	John	123 Main	stamps
1123	John	123 Main	coins
5556	Mary	7 Lake Dr	hiking
9876	Bart	5 Pine St	stamps

σ Hobby='stamps'(Person)

Id	Name	Address	Hobby
1123	John	123 Main	stamps
9876	Bart	5 Pine St	stamps


Π Name, Hobby(Person)

Name	Hobby
John	stamps
John	coins
Mary	Hiking
Bart	stamps


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UNION (U)



- UNION is symbolized by \cup , and includes all tuples that are in R or in S, eliminating duplicate tuples, therefore set R UNION set S would be expressed as:
- **RESULT $\leftarrow R \cup S$**

UNION Example

A	1
B	2
D	3
F	4
E	5

A	1
C	2
D	3
E	4

A	1
B	2
C	2
D	3
E	5
F	4
E	4

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Set Difference Operator (R-S)



- the MINUS operation includes tuples from one Relation that are not in another Relation and symbolized by the - (minus) symbol. Therefore $R - S$ would be expressed as...
- $RESULT \leftarrow R - S$

R		R DIFFERENCE S	
A	1		
B	2	B	2
D	3		
F	4	F	4
E	5	E	5

S		S DIFFERENCE R	
A	1		
C	2	C	2
D	3		
E	4	E	4

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Intersection (\cap)



- The INTERSECTION operation on a relation A INTERSECTION relation B, is symbolized by $R \cap S$, includes tuples that are only in R and S.
- $RESULT \leftarrow R \cap S$

R		R INTERSECTION S	
A	1	A	1
B	2		
D	3	D	3
F	4		
E	5		

S			
A	1		
C	2		
D	3		
E	4		

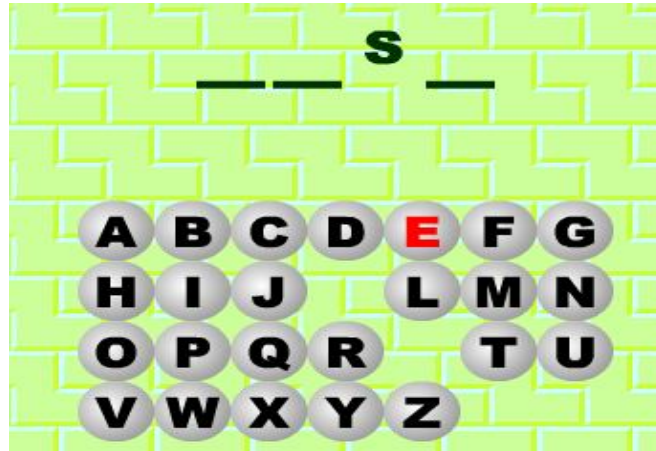
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Cartesian Product (RXS)



- Creates a relation that has all the attributes of R and S, allowing all the attainable combinations of tuples from R and S in the result. The notation used is X .
- $C = R \times S$

R		R CROSS S			
A	1	A	1	A	1
B	2	A	1	C	2
D	3	A	1	D	3
F	4	A	1	E	4
E	5	B	2	A	1
		B	2	C	2
		B	2	D	3
		B	2	E	4
		D	3	A	1
		D	3	C	2
		D	3	D	3
		D	3	E	4

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JOIN



- The JOIN operation is denoted by the $R \bowtie S$ symbol and is used to compound similar tuples from two Relations into single longer tuples.
- Join operation is generally the cross product of two relation.
- The notation used is $R \text{ JOIN}_{\text{join condition}} S$

Types of join

- Natural Join
- Outer Join

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JOIN Example



R	ColA	ColB	R JOIN R.ColA = S.SColA	S
A	1		A	1
B	2		D	3
D	3		E	4
F	4			
E	5			

S	SColA	SColB	R JOIN R.ColB = S.SColB	S
A	1		A	1
C	2		B	2
D	3		D	3
E	4		F	4

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Natural Join




- The JOIN involves an equality test, and thus is often described as an equi-join. Such joins result in two attributes in the resulting relation having exactly the same value. A 'natural join' will remove the duplicate attribute(s).
- In most systems a natural join will require that the attributes have the same name to identify the attribute(s) to be used in the join. This may require a renaming mechanism.
 - If you do use natural joins make sure that the relations do not have two attributes with the same name by accident.


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Outer Join




There are three forms of the outer join, depending on which data is to be kept.


- **LEFT OUTER JOIN** - keep data from the left-hand table
- **RIGHT OUTER JOIN** - keep data from the right-hand table
- **FULL OUTER JOIN** - keep data from both tables

R	CoIA	CoIB	R LEFT OUTER JOIN				R.CoIA = S.SCoIA	S
	A	1	A	1	A	1		
	B	2	D	3	D	3		
	D	3	E	5	E	4		
	F	4	B	2	-	-		
	E	5	F	4	-	-		
S	S.CoIA	S.CoIB	R RIGHT OUTER JOIN				R.CoIA = S.S.CoIA	S
	A	1	A	1	A	1		
	C	2	D	3	D	3		
	D	3	E	5	E	4		
	E	4	-	-	C	2		

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Assesment



Relational Algebra

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

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Answer



- Unary Relational Operations
- Relational Algebra Operations
- Binary Relational Operations
- Additional Relational Operations
- Queries in Relational Algebra
- Tuple Relational Calculus
- Domain Relational Calculus

- Relational Calculus



THANK YOU