

# Relation Algebra

## Notation







Common operations and their notations

OPERATION	NOTATION
Select	$\sigma$
Project	$\Pi$
Cartesian product	$\times$
Nature join	$\bowtie$
Union	$\cup$
Intersect	$\cap$
And	$\wedge$
Or	$\vee$
Not	$\neg$
Set difference	$-$
Rename	$\rho$

## Example

Here are two table

A

	 num 	 cha 	 hex 
1	1	a	61
2	2	b	62
3	3	c	63

B

	oct	cha	ascii
1	141	a	97
2	142	b	98
3	101	A	65
4	102	B	66

### Cartesian product ×

	num	a.cha	hex	oct	b.cha	ascii
1	1	a	61	141	a	97
2	1	a	61	142	b	98
3	1	a	61	101	A	65
4	1	a	61	102	B	66
5	2	b	62	141	a	97
6	2	b	62	142	b	98
7	2	b	62	101	A	65
8	2	b	62	102	B	66
9	3	c	63	141	a	97
10	3	c	63	142	b	98
11	3	c	63	101	A	65
12	3	c	63	102	B	66

### Experiment 1 Represent the following query in relational algebra: Query the information of letter a and b

$$\sigma_{(a.cha=a \vee a.cha=b) \wedge a.cha=b.cha}(a \times b)$$

### Nature join ⋈

	cha	num	hex	oct	ascii
1	a	1	61	141	97
2	b	2	62	142	98

### Experiment 2 Represent the following query in relational algebra: Query the information of letter a and b

$$\sigma_{cha=a \vee cha=b}(a \bowtie b)$$

## Select $\sigma$

	num	a.cha	hex	oct	b.cha	ascii
1	1	a	61	141	a	97
2	1	a	61	142	b	98
3	1	a	61	101	A	65
4	1	a	61	102	B	66
5	2	b	62	141	a	97
6	2	b	62	142	b	98
7	2	b	62	101	A	65
8	2	b	62	102	B	66
9	3	c	63	141	a	97
10	3	c	63	142	b	98
11	3	c	63	101	A	65
12	3	c	63	102	B	66

## Project $\Pi$

	num	a.cha	hex	oct	b.cha	ascii
1	1	a	61	141	a	97
2	1	a	61	142	b	98
3	1	a	61	101	A	65
4	1	a	61	102	B	66
5	2	b	62	141	a	97
6	2	b	62	142	b	98
7	2	b	62	101	A	65
8	2	b	62	102	B	66
9	3	c	63	141	a	97
10	3	c	63	142	b	98
11	3	c	63	101	A	65
12	3	c	63	102	B	66

## Experiment 3 Represent the following query in relational algebra: Query the information of letter a and b

$$\Pi_{num, a.cha, hex, oct, ascii}(\sigma_{(a.cha=a \vee a.cha=b) \wedge a.cha=b.cha}(a \times b))$$

**Tips:** here is a usage of project: extended projection. A relation  $R(A,B)$  with a record (1,2), after a relation algebra  $\Pi_{A+B \rightarrow C, B, B}(R)$ , the result is relation  $(C, B1, B2)$  with record(3,1,1).

## Experiment 4 Represent the following query in relational algebra, using "∪": Query the information of letter a and b

$$(\sigma_{cha=a}(a \bowtie b)) \cup (\sigma_{cha=b}(a \bowtie b))$$

### Exercise

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1. (软考2010) 若对关系R(A,B,C,D)和S(C,D,E)进行关系代数运算, 则表达式  $\pi_{3,4,7}(\sigma_{4<5}(R \times S))$  与 ( ) 等价。

- A.  $\pi_{C,D,E}(\sigma_{D<C}(R \times S))$
- B.  $\pi_{R,C,R,D,E}(\sigma_{R.D<R.C}(R \times S))$
- C.  $\pi_{C,D,E}(\sigma_{R.D<S.C}(R \times S))$
- D.  $\pi_{R,C,R,D,E}(\sigma_{D<C}(R \times S))$

2. (软考2011) 给定学生S (学号, 姓名, 年龄, 入学时间, 联系方式) 和选课SC (学号, 课程号, 成绩) 关系, 若要查询选修1号课程的学生学号、姓名和成绩, 则该查询与关系代数表达式 ( ) 等价。

- A.  $\pi_{1,2,8}(\sigma_{1=6 \wedge 7='1'}(S \bowtie SC))$
- B.  $\pi_{1,2,7}(\sigma_{6='1'}(S \bowtie SC))$
- C.  $\pi_{1,2,7}(\sigma_{1=6}(S \bowtie SC))$
- D.  $\pi_{1,2,8}(\sigma_{7='1'}(S \bowtie SC))$

3. (软考2014) 若关系模式R和S分别为: R (A,B,C,D)、S (B,C,E,F), 则关系R与S自然联结运算后的属性列有\_\_6个, 与表达式  $\pi_{1,3,5,6}(\sigma_{3<6}(R \bowtie S))$  等价的SQL语句为: SELECT ( ) FROM R, S WHERE ( )

**SELECT ( A,R.C,E,F ) FROM R, S WHERE ( R.B=S.B AND R.C=S.C AND R.C<S.F )**

4. (软考2015) 若关系R、S如下图所示, 则关系R与S进行自然连接运算后的元组个数和属性列数分别为3和4 ; 关系代数表达式  $\pi_{1,4}(\sigma_{3=6}(R \times S))$  与关系代数表达式 ( ) 等价。

- A.  $\pi_{A,D}(\sigma_{C=D}(R \times S))$
- B.  $\pi_{A,R,D}(\sigma_{S.C=R.D}(R \times S))$
- C.  $\pi_{A,R,D}(\sigma_{R.C=S.D}(R \times S))$

D.  $\pi_{A,R,D}(\sigma_{S,C=S,D}(R \times S))$

**R**

A	B	C	D
6	3	1	5
6	1	5	1
6	5	7	4
6	3	7	4

**S**

C	D
1	5
7	4