Relation Algebra

Notation

Common operations and their notations

OPERATION	NOTATION
Select	σ
Project	Π
Cartesian product	×
Nature join	⋈
Union	∪
Intersect	∩
And	∧
Or	∨
Not	¬
Set difference	–
Rename	ρ

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 ⋈

	num	cha	hex	oct	ascii
1	1	a	61	141	97
2	2	b	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 σ

	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 Π

	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 $\Pi_{A+B->C,B,B}(R)$, the result is relation (C, B1,B2) with record(3,2,2).

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

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

$$\Pi_{R.c,R.d,e}(\sigma_{R.d<S.c}(R \times S))$$

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