

Review of Last Lecture

- More advanced RA operations:
 - Rename (ρ)
 - Cross Product (X)
 - Join (\bowtie)
 - EquiJoin
 - Natural Join (*)
- Exercises



Today's Plan

- More advanced RA operations:
 - Division
- Exercises



In-class Exercise #6 – Thoughts

- Retrieve the names of employees who are neither a supervisor nor a manager

EMPLOYEE	FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
John	B		Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	3000	333445555	5
Franklin	T		Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	4000	888665555	5
Alicia	J		Zelaya	999887777	1968-07-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S		Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	4300	888665555	4
Ramesh	K		Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A		English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V		Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E		Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	null	1

DEPARTMENT	DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
Research		5	333445555	1988-05-22
Administration		4	987654321	1995-01-01
Headquarters		1	888665555	1981-06-19

DEPT_LOCATIONS	DNUMBER	DLOCATION
	1	Houston
	4	Stafford
	5	Bellaire
	5	Sugarland
	5	Houston

WORKS_ON	ESSN	PNO	HOURS
	123456789	1	32.5
	123456789	2	7.5
	666884444	3	40.0
	453453453	1	20.0
	453453453	2	20.0
	333445555	2	10.0
	333445555	3	10.0
	333445555	10	10.0
	333445555	20	10.0
	999887777	30	30.0
	999887777	10	10.0
	987987987	10	35.0
	987987987	30	5.0
	987654321	30	20.0
	987654321	20	15.0
	888665555	20	null

PROJECT	PNAME	PNUMBER	PLOCATION	DNUM
	ProductX	1	Bellaire	5
	ProductY	2	Sugarland	5
	ProductZ	3	Houston	5
	Computerization	10	Stafford	4
	Reorganization	20	Houston	1
	Newbenefits	30	Stafford	4

DEPENDENT	ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP
	333445555	Alice	F	1986-04-05	DAUGHTER
	333445555	Theodore	M	1983-10-25	SON
	333445555	Joy	F	1958-05-03	SPOUSE
	987654321	Abner	M	1942-02-28	SPOUSE
	123456789	Michael	M	1988-01-04	SON
	123456789	Alice	F	1988-12-30	DAUGHTER
	123456789	Elizabeth	F	1967-05-05	SPOUSE



In-class Exercise #6 – Common Mistake

- Retrieve the names of employees who are not a supervisor nor a manager
 - Who are NOT managers?

R1 ← Employee  **Department**
 $MGR_SSN \neq SSN$

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19



In-class Exercise #6 – Step 1

- Retrieve the names of employees who are not a supervisor nor a manager
 - Who are NOT managers?

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	937654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	656884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	937987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19



In-class Exercise #6 – Step 2

- Retrieve the names of employees who are not a supervisor nor a manager
 - Who are NOT supervisors?

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19



In-class Exercise #6 – Step 3

- Retrieve the names of employees who are not a supervisor nor a manager

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19



In-class Exercise #6 – Your Turn

1. Retrieve the names of employees who are neither a supervisor nor a manager.

$$M \leftarrow \pi_{\text{MGR_SSN}}(\text{Department})$$
$$E \leftarrow \pi_{\text{SSN}}(\text{Employee})$$
$$NM \leftarrow E - M$$
$$S \leftarrow \pi_{\text{Super_SSN}}(\text{Employee})$$
$$NS \leftarrow E - S$$
$$NSM \leftarrow NS \cap NM$$
$$EN \leftarrow NSM * \text{Employee}$$
$$\text{Result} \leftarrow \pi_{\text{Fname, Lname}}(EN)$$

2. Find the names of employees who does not work on any project.



Division: Motivation

- Find employees who work on all the projects

WORKS_ON

<u>Essn</u>	<u>Pno</u>	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	NULL

PROJECT

<u>Pname</u>	<u>Pnumber</u>	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse



Division Operator

For $R \div S$ where $R (r1, r2, r3, r4)$ and $S(s1, s2)$

Since S has two attributes, there must be two attributes in R (say $r3$ and $r4$) that are defined on the same domains, respectively, as $s1$ and $s2$. We could say that $(r3, r4)$ is union-compatible with $(s1, s2)$.

The query answer has the remaining attributes $(r1, r2)$.
And the answer has a tuple, $(r1, r2)$, in the answer if the $(r1, r2)$ value appears with *every* S tuple in R .



Division: Example

Account	Number	Owner	Balance	Type
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Find customers who have all the accounts that the bank offers

checking
savings

Find account owners
who have ALL types of
accounts.



Division: Examples

sno	pno
s1	p1
s1	p2
s1	p3
s1	p4
s2	p1
s2	p2
s3	p2
s4	p2
s4	p4

A

pno
p2

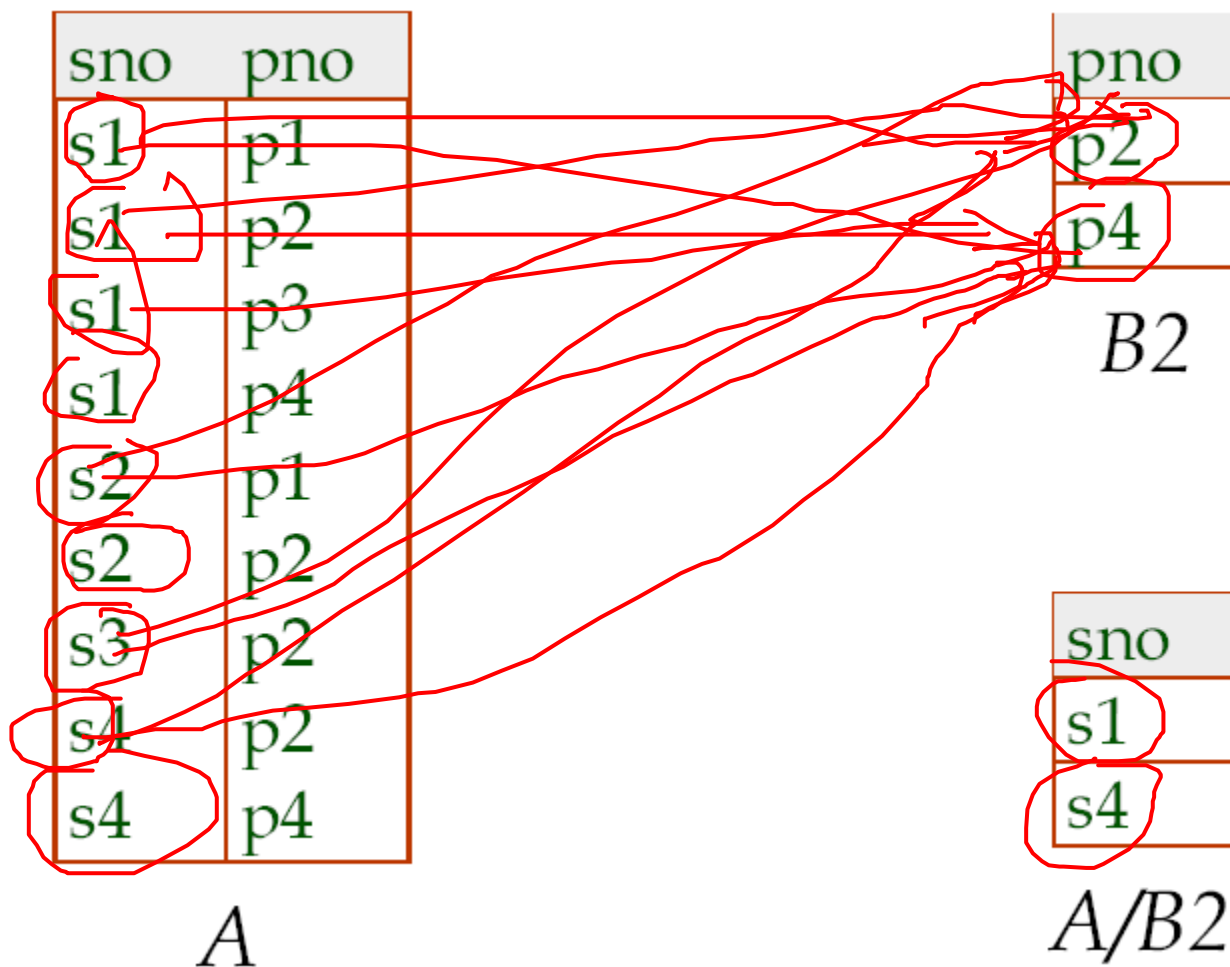
B1

sno
s1
s2
s3
s4

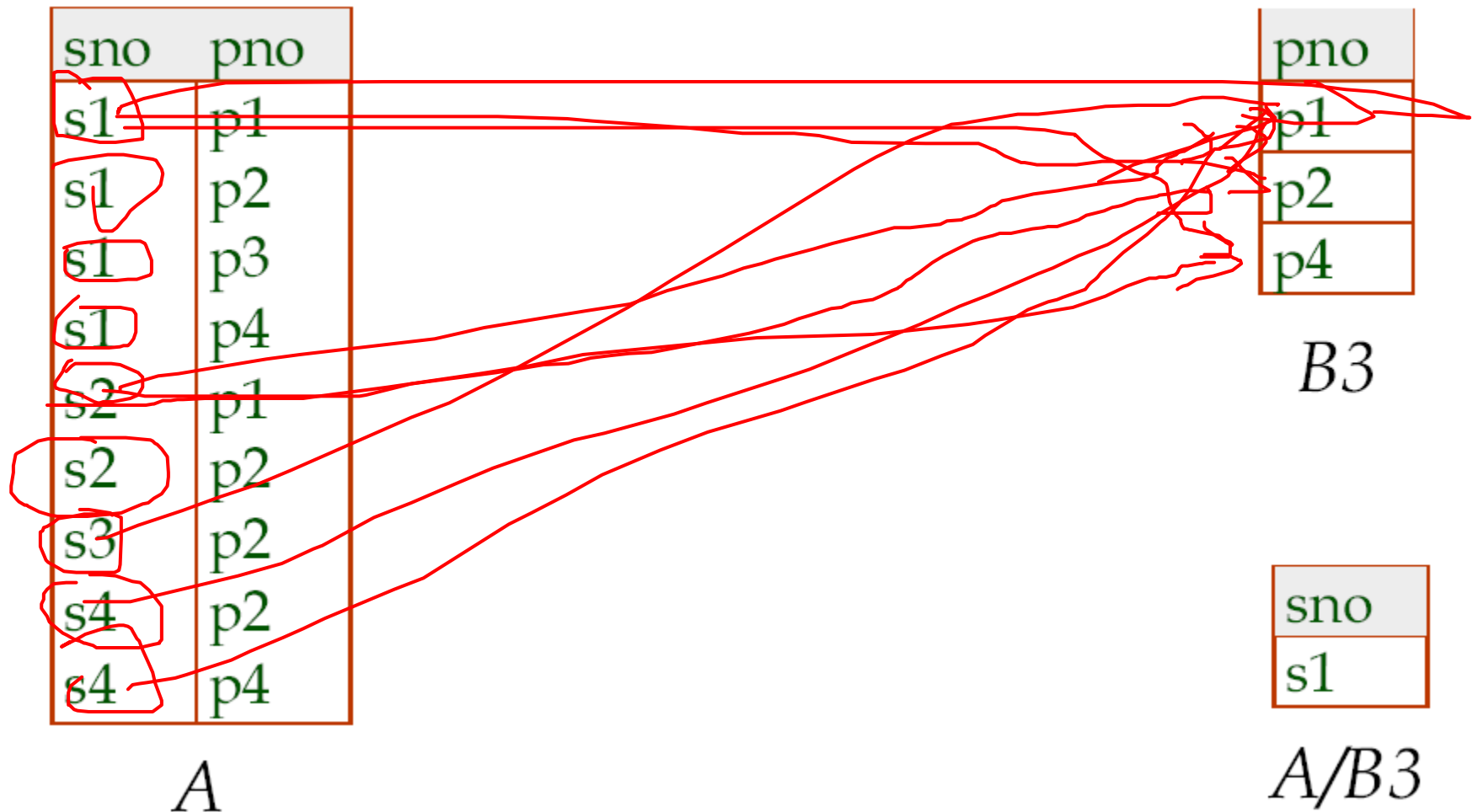
A/B1



Division: Examples



Division: Examples



Exercise: A / B4 = ?

SNO	PNO	Qty
S1	P1	1
S1	P2	2
S1	P3	3
S1	P4	4
S2	P1	5
S2	P2	5
S2	P3	4

A

PNO
P1
P2

B4



Expressing A/B Using Basic Opts (FYI)

- Division is not essential op; just a useful shorthand.
 - (Also true of joins, but joins are so common that systems implement joins specially.)



Summary of Today's Lecture

- More advanced RA operations:
 - Division
- Exercises

