Review for Midterm

Midterm Overview: More details

- ER Diagrams (34 pts)
  - Translate English description into ER diagram (20)
  - Generate CREATE TABLE statement from ER diagram fragment (8)
  - Reason about ER diagram (6)
- Query writing (36 pts)
  - Write RA queries from English description
- Query execution (12 pts)
  - Manually execute queries over relation instances & discuss
- General questions (18 pts)
  - Fill in the blank, T/F, etc.
- Extra Credit (2 pts)

Material for you to get ready for Midterm…

- These slides.
- Solutions of HW1a, HW1b, HW2;
- You should:
  - Review the lectures' slides and hws;
  - Do the readings in the textbook;
  - Do exercises at the end of chapters.

HW 2 Answers

1. ■ RA

$$\pi_{sname}(\pi_{sid}((\pi_{pid}\sigma_{color='red'}Parts) \bowtie Catalog) \bowtie Suppliers)$$

3. ■ RA

$$\rho(R1, \pi_{sid}((\pi_{pid}\sigma_{color='red'}Parts) \bowtie Catalog))$$
$$\rho(R2, \pi_{sid}\sigma_{address='221PackerStreet'}Suppliers)$$
$$R1 \cup R2$$

4. ■ RA

$$\rho(R1, \pi_{sid}((\pi_{pid}\sigma_{color='red'}Parts) \bowtie Catalog))$$
$$\rho(R2, \pi_{sid}((\pi_{pid}\sigma_{color='green'}Parts) \bowtie Catalog))$$
$$R1 \cap R2$$

HW 2 Answers

7. ■ RA

$$(\pi_{sid,pid}Catalog)/(\pi_{pid}\sigma_{color='red' \vee color='green'}Parts)$$

8. ■ RA

$$\rho(R1, ((\pi_{sid,pid}Catalog)/(\pi_{pid}\sigma_{color='red'}Parts)))$$
$$\rho(R2, ((\pi_{sid,pid}Catalog)/(\pi_{pid}\sigma_{color='green'}Parts)))$$
$$R1 \cup R2$$

10. ■ RA

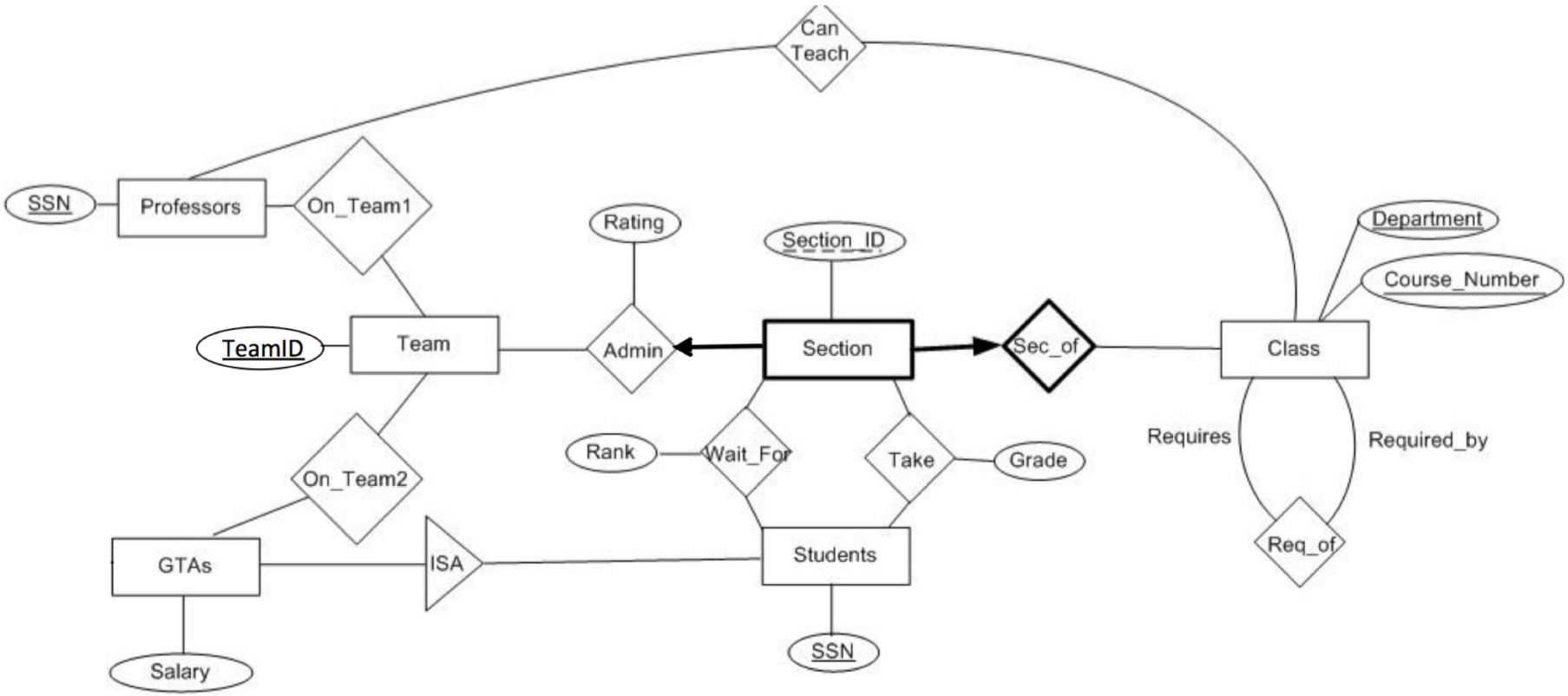
$$\rho(R1, Catalog)$$
$$\rho(R2, Catalog)$$
$$\pi_{R1.pid}\sigma_{R1.pid=R2.pid \wedge R1.sid \neq R2.sid}(R1 \times R2)$$

HW 2 Answers

11. ■ RA

$$\rho(R1, \pi_{sid}\sigma_{sname='YosemiteSham'} Suppliers)$$
$$\rho(R2, R1 \bowtie Catalog)$$
$$\rho(R3, R2)$$
$$\rho(R4(1 \to sid, 2 \to pid, 3 \to cost), \sigma_{R3.cost<R2.cost}(R3 \times R2))$$
$$\pi_{pid}(R2 - \pi_{sid,pid,cost} R4)$$

HW 1b ER



ER Diagram does not document that Wait_For Rank attribute must be <= 10

HW 1b Schema (Slightly Different Naming)

1-Students(SSN:String)

2-Professors(SSN:String)

3-GTAs(SSN:String, Salary:Integer)

4-Class(Department:String, Course_Number:Integer)

5-Section(Department:String, Course_Number:Integer, Section_ID:Integer, Team_ID: Integer, Rating:Integer)

6- Req_of(Course_Department:String, Course_Course_Number:Integer,
PreReq_Department:String, PreReq_Course_Number:Integer)

7- Team(Team_ID:Integer)

8- CanTeach(SSN:String, Department:String, Course_Number:Integer)

9- Takes(SSN:Integer, Department:String, Course_Number:Integer, Section_ID:Integer,
Grade:String)

10- Waits_For(SSN:Integer, Department:String, Course_Number:Integer,
Section_ID:Integer, Rank:Integer)

11- On_Team_Prof(SSN:String, Team_ID:Integer)

12- On_Team_GTA(SSN:String, Team_ID:Integer)

Problem 2.7

- Exercise 2.7 The Prescriptions-R-X chain of pharmacies has offered to give you a free lifetime supply of medicine if you design its database. Given the rising cost of health care, you agree. Here's the information that you gather:
  - Patients are identified by an SSN, and their names, addresses, and ages must be recorded.
  - Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded.
  - Each pharmaceutical company is identified by name and has a phone number.
  - For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceutical company is deleted, you need not keep track of its products any longer.
  - Each pharmacy has a name, address, and phone number.
  - Every patient has a primary physician. Every doctor has at least one patient.

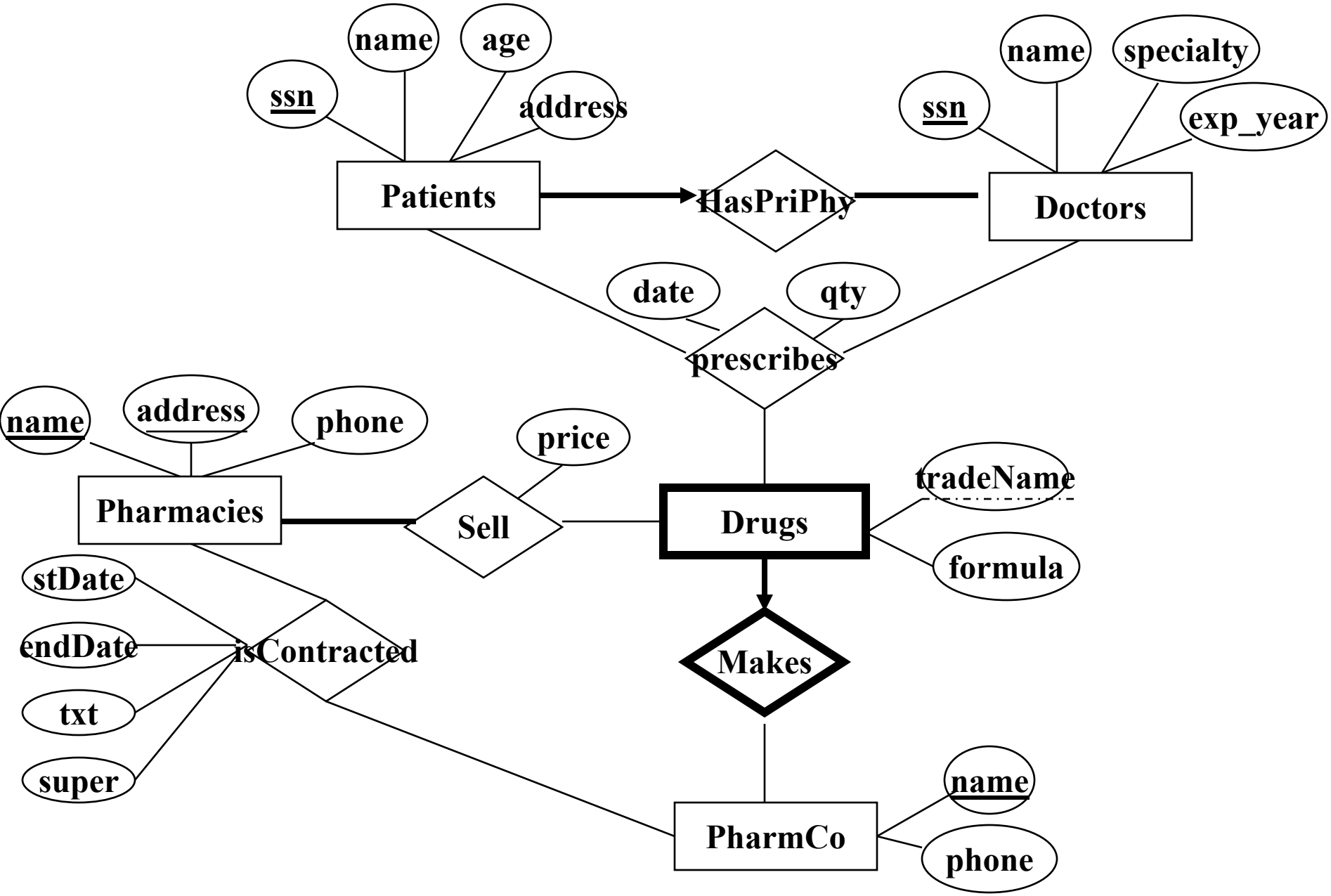
Problem 2.7

- Exercise 2.7 Here's the information that you gather (continued):
  - Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.
  - Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors.
  - Each prescription has a date and a quantity associated with it. You can assume that, if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored.
  - Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract.
  - Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

Problem 2.7

1. Draw an ER diagram that captures the preceding information. Identify any constraints not captured by the ER diagram.
2. How would your design change if each drug must be sold at a fixed price by all pharmacies?
3. How would your design change if the design requirements change as follows: If a doctor prescribes the same drug for the same patient more than once, several such prescriptions may have to be stored.

Problem 2.7


name
age
ssn
address
Patients
HasPriPhy
name
specialty
ssn
exp_year
Doctors
date
qty
prescribes
name
address
phone
price
Pharmacies
Sell
Drugs
tradeName
formula
stDate
endDate
txt
super
isContracted
Makes
PharmCo
name
phone

Relational Database Schema

Doctors(***ssn***:integer,***name***:string, ***specialty:***string,***year_exp***:integer)
PK: ssn

Patients(***ssn***:integer,***name***:string,***age***:integer,***address***:string,***ssnDoctor***:integer)
PK: ssn FK: ssnDoctor references Doctors

Pharmacies(***name***:string, ***phone***:integer, ***address***:string)
PK: name

PharmCo(***name***:string, ***phone***:integer)
PK: name

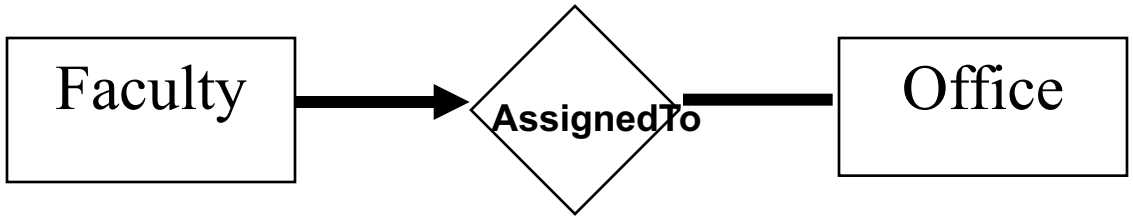
Drugs(***tradeName***: string,***formula***:string,***pharmCoName***: string)
PK: pharmCoName, tradeName FK: pharmCoName references PharmCo

Prescribes(***ssnPatient***:integer, ***ssnDoctor***:integer, ***pharmCoName***: string , ***tradeName***:sring, ***date***:date, ***qty***:integer)
PK: ssnPatient,ssnDoctor,pharCoName,tradeName
FK: ssnPatient references Patients
FK: ssnDoctor references Doctors
FK: (pharCoName,tradeName) referencesDrugs

Sells(***pharmCoName***: string, ***tradeName***: string, ***pharmacyName***: string , ***price***:float)
PK: pharmCoName,tradeName,pharmacyName
FK: (pharmCoName,tradeName) references Drugs
FK: pharmacyName references Pharmacies

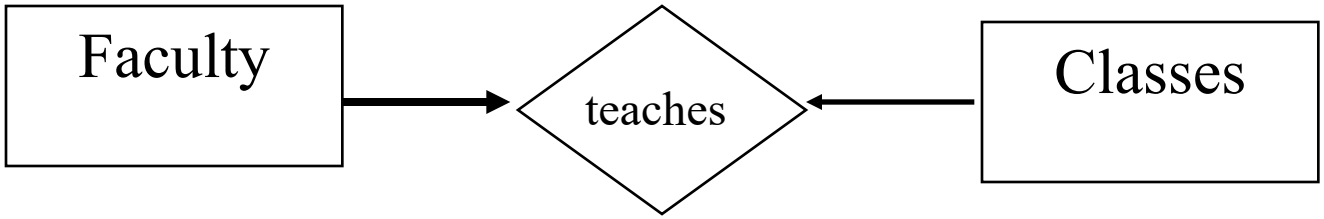
Contracts(***pharmCoName***: string,***pharmacyName***: string , ***startDate***:date, ***endDate***:date, ***text***:string, ***supervisor***:string)
PK: pharCoName,pharmacyName
FK: pharmCoName references PharmCo
FK: pharmacyName references Pharmacies

Each faculty is assigned to exactly one office room. An office room is assigned to at least one faculty. Is the following E-R diagram correct?
If your answer is NO, indicate what is wrong in this E-R diagram.



Answer: Correct!

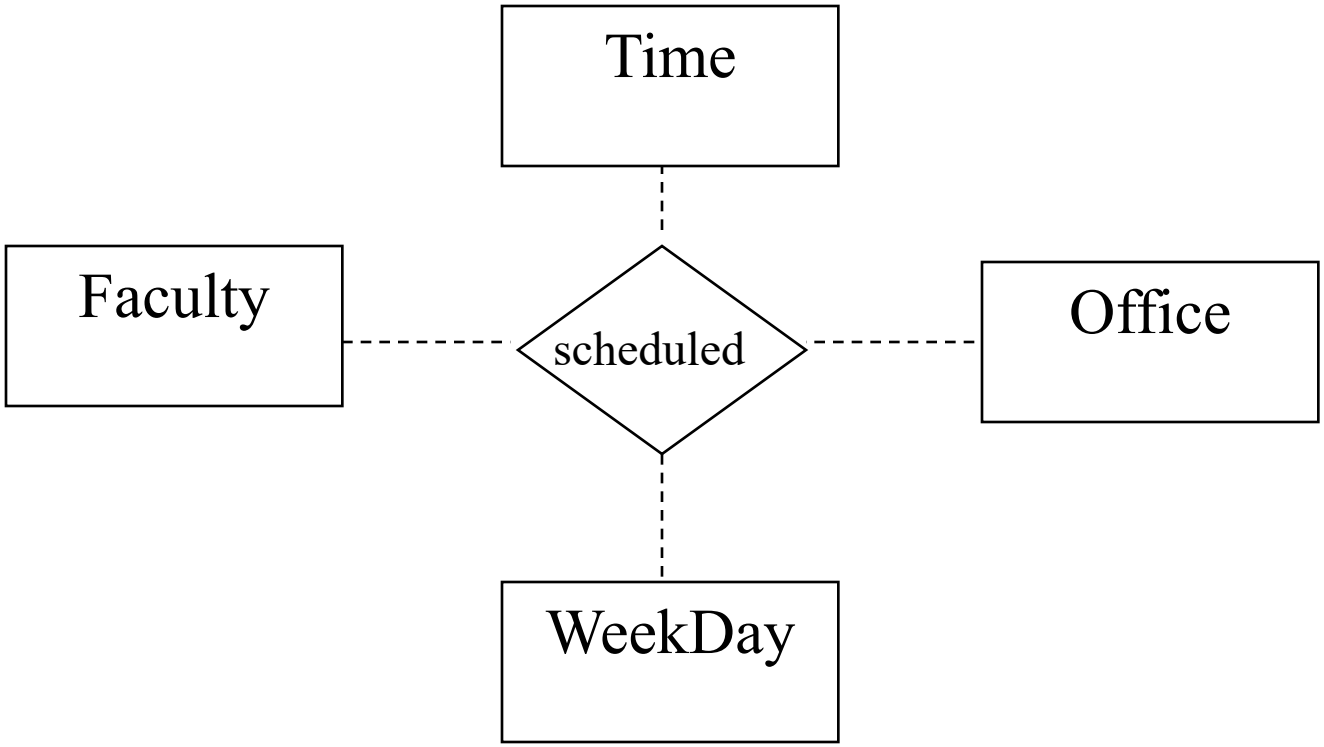
A faculty teaches at most three classes, but a class is taught by exactly one faculty. Is the following E-R diagram correct?
If your answer is NO, indicate what is wrong in this E-R diagram.



Answer: NO

- Total participation of Faculty w.r.t teaches.
- Key Constraint on Faculty w.r.t teaches.
- Partial participation of Classes w.r.t teaches.

A faculty schedules office hours in exactly one office room at a weekday and time, and this information must be recorded. An office may be assigned to several faculties' office hours at different days and times. All offices are assigned to faculty's office hours. In the following E-R Diagram, **complete the dashed lines** to reflect the appropriated participation and key constraints.



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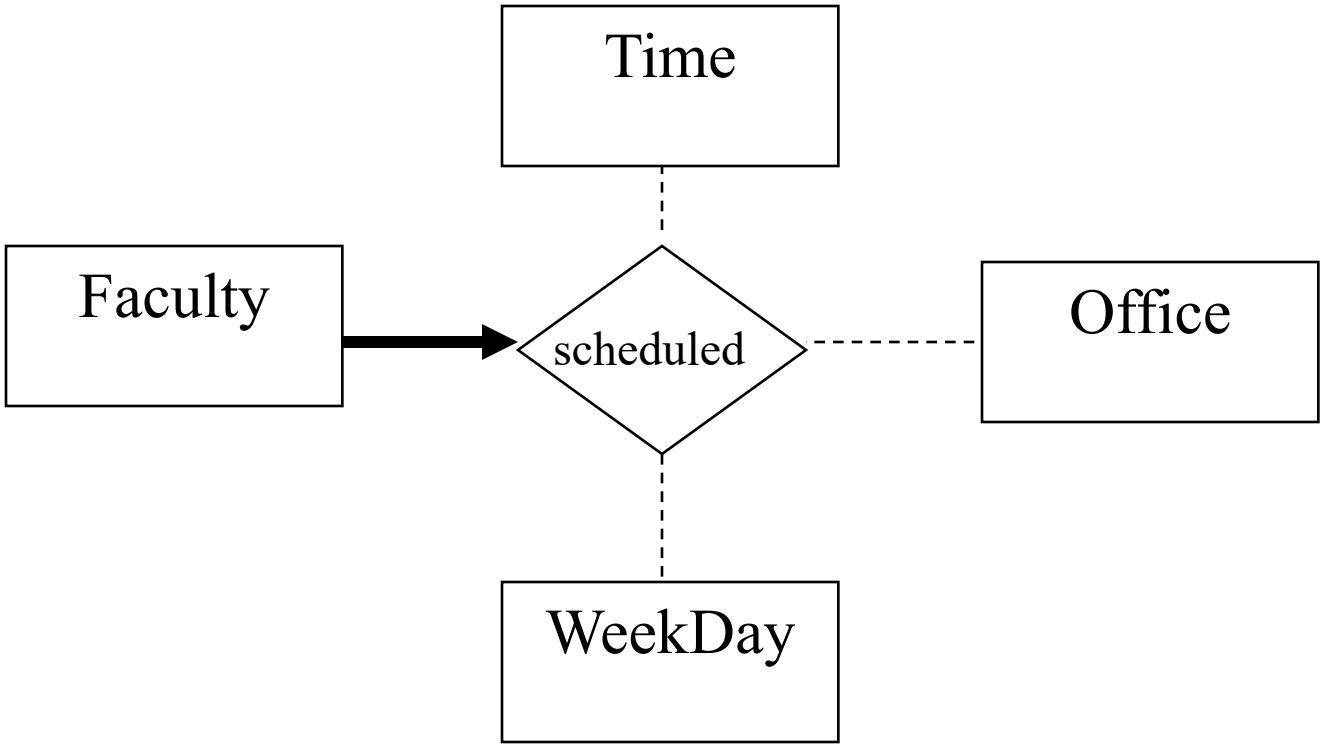

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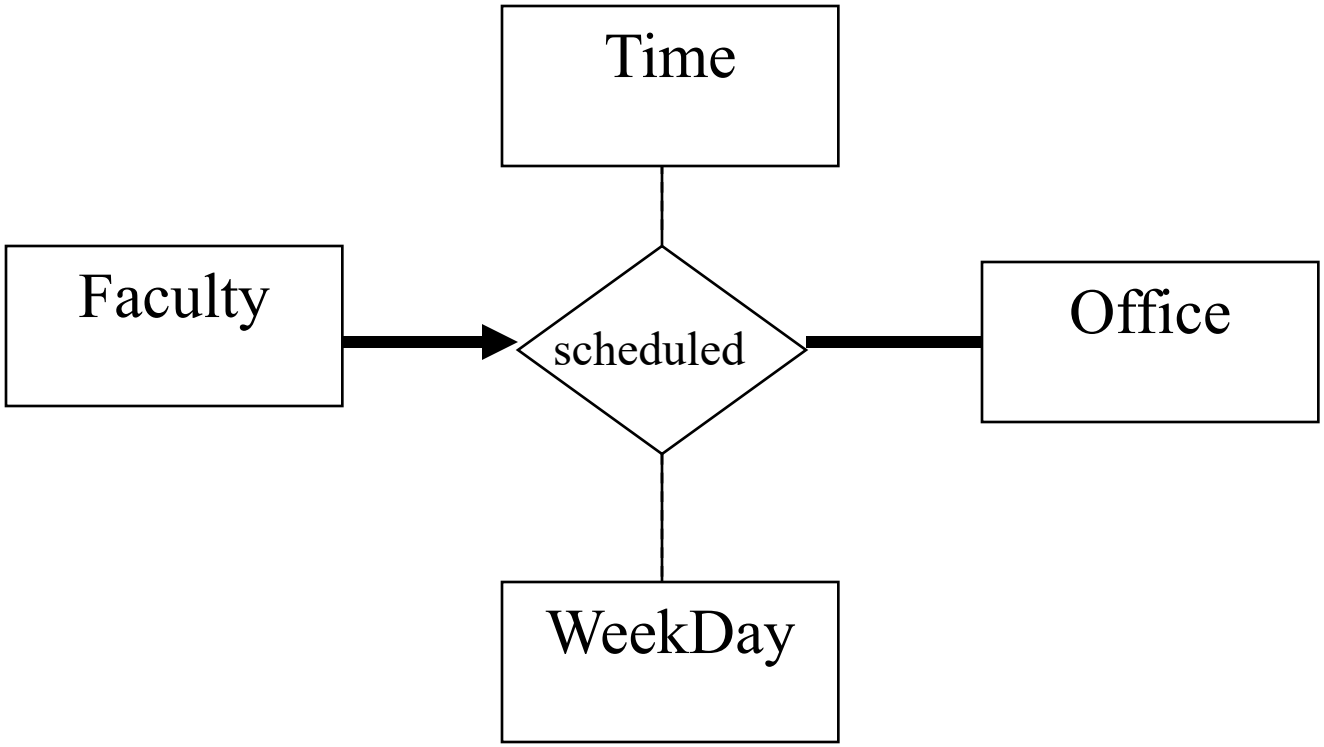


Problem 4.2

Given two relations $R1$ and $R2$, where $R1$ contains $N1$ tuples and $R2$ contains $N2$ tuples, with $N2>N1>0$, give the minimum and maximum possible sizes (in tuples) for the resulting relation produced by each of the following relational algebra expressions. In each case, state any assumptions about the schemas for $R1$ and $R2$ needed to make the expression meaningful.

$$|R1| = N1, \quad |R2| = N2, \quad 0 < N1 < N2$$

Expression	Assumption	Min	Max
$R1 \cup R2$	R1 and R2 are union-compatible	N2	N1 + N2
$R1 \cap R2$	R1 and R2 are union-compatible	0	N1
$R1 - R2$	R1 and R2 are union-compatible	0	N1
$R1 \times R2$	none	N1 * N2	N1 * N2
$s_{a=5}(R1)$	R1 has an attribute named a	0	N1
$p_a(R1)$	R1 has an attribute named a, N1 > 0	1	N1
$R1/R2$	The set of attributes of R2 is a subset of the set of attributes of R1	0	0
$R2/R1$	The set of attributes of R1 is a subset of the set of attributes of R2	0	$\lfloor N2/N1 \rfloor$

Problem 4.4

Consider the following schema:

Suppliers(sid:integer, sname:string, address:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

The Catalog relation lists the prices charged for Parts by Suppliers.

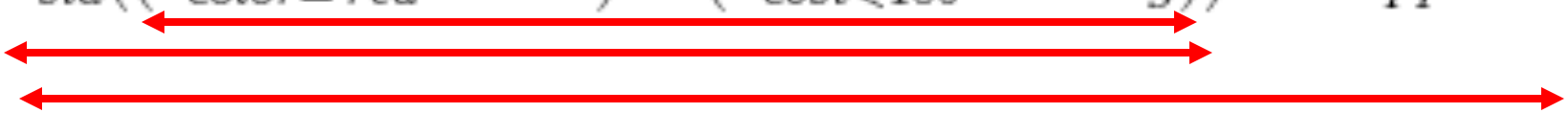
State what the following queries compute.

Suppliers(sid:integer, sname:string, address:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

$$\pi_{sname}(\pi_{sid}((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog)) \bowtie Suppliers)$$



Answer: Find the Supplier names of the suppliers who supply a red part that costs less then 100 dollars.

Suppliers(sid:integer, sname:string, address:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

$$\pi_{sname}(\pi_{sid}((\sigma_{color='red'} Parts) \bowtie (\sigma_{cost<100} Catalog) \bowtie Suppliers))$$

Answer: This Relational Algebra statement does not return anything because of the sequence of projection operators. Once the sid is projected, it is the only field in the set. Therefore, projecting on sname will not return anything.

Suppliers(sid:integer, sname:string, address:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

$$(\pi_{sname}((\sigma_{color='red'} Parts) \bowtie (\sigma_{cost<100} Catalog) \bowtie Suppliers)) \cap$$

$$(\pi_{sname}((\sigma_{color='green'} Parts) \bowtie (\sigma_{cost<100} Catalog) \bowtie Suppliers))$$

Answer: Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.

Suppliers(sid:integer, sname:string, address:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

$$(\pi_{sid}((\sigma_{color='red'} Parts) \bowtie (\sigma_{cost<100} Catalog) \bowtie Suppliers)) \cap$$

$$(\pi_{sid}((\sigma_{color='green'} Parts) \bowtie (\sigma_{cost<100} Catalog) \bowtie Suppliers))$$

Answer: Find the Supplier ids of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.

Suppliers(sid:integer, sname:string, address:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

$$\pi_{sname}((\pi_{sid,sname}((\sigma_{color='red'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)) \cap (\pi_{sid,sname}((\sigma_{color='green'}Parts) \bowtie (\sigma_{cost<100}Catalog) \bowtie Suppliers)))$$

Answer: Find the Supplier names of the suppliers who supply a red part that costs less than 100 dollars and a green part that costs less than 100 dollars.