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CSC 134-02

Assignment 4

Due: 4/15/22

CSC 134-02 Database Management Systems (Spring 2022)

Assignment 4 (100 points)

Relational Algebra and ER-Relational Mapping

Due at 11:59 pm, Friday April 15, 2022

Question 1 (35 points):

Consider the three tables T1, T2 and T3 as shown below. Show the results of the following operations (assuming T1 and T2 are set-compatible).

Table T1:

P	Q	R
10	**a**	**5**
15	**b**	**8**
25	**a**	**6**
A	B	C
10	**b**	**6**
25	**c**	**3**
10	**b**	**5**

Table T2:

Table T3:

A	C
10	**6**
10	**5**

(1) T1 ⋈ T2

T1.P=T2.A

P	Q	R	A	B	C
10	a	5	10	b	6
25	a	6	25	c	3
10	a	5	10	b	5

(2) T1 ⋈ T2

T1.Q=T2.B

P	Q	R	A	B	C
15	b	8	10	b	6
15	b	8	10	b	5

(3) T1 ∪ T2

P	Q	R
10	a	5
15	b	8
25	a	6
10	b	6
25	c	3
10	b	5

(4) T1 ∩ T2

P	Q	R

(5) T1 − T2

P	Q	R
10	a	5
15	b	8
25	a	6

(6) T1 ⋈ T2
T1.P=T2.A AND T1.R=T2.C

P	Q	R	A	B	C
10	a	5	10	b	5

(7) T2 / T3

B
b

Question 2 (20 points):

Consider the following schema:

Flights (*flno*: integer, *from_city*: string, *to_city*: string, *distance*: integer, *departs*: time, *arrives*: time, *price*: real)
Aircraft (*aid*: integer, *aname*: string, *cruising_range*: integer)
Certified (*eid*: integer, *aid*: integer)
Employees (*eid*: integer, *ename*: string, *salary*: integer)

Note that the Employee relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly. Write the following queries in ***relational algebra***.

Note: for each join, you must specify the join condition to receive credit.

(1) Find the names of pilots certified for the aircraft ‘Boeing-777’.

$$\pi_{Ename}((\sigma_{Aname='Boeing-777'}(AIRCRAFT)\bowtie_{A.Aid=C.Aid} CERTIFIED)\bowtie_{C.Eid=E.Eid} EMPLOYEE))$$

(2) Find the names of pilots who can operate an aircraft with a cruising range greater than 3,000 miles.

$$\pi_{Ename}((\sigma_{Cruising\_range>3000}(AIRCRAFT)\bowtie_{A.Aid=C.Aid} CERTIFIED)\bowtie_{C.Eid=E.Eid} EMPLOYEE))$$

Question 3 (45 points):

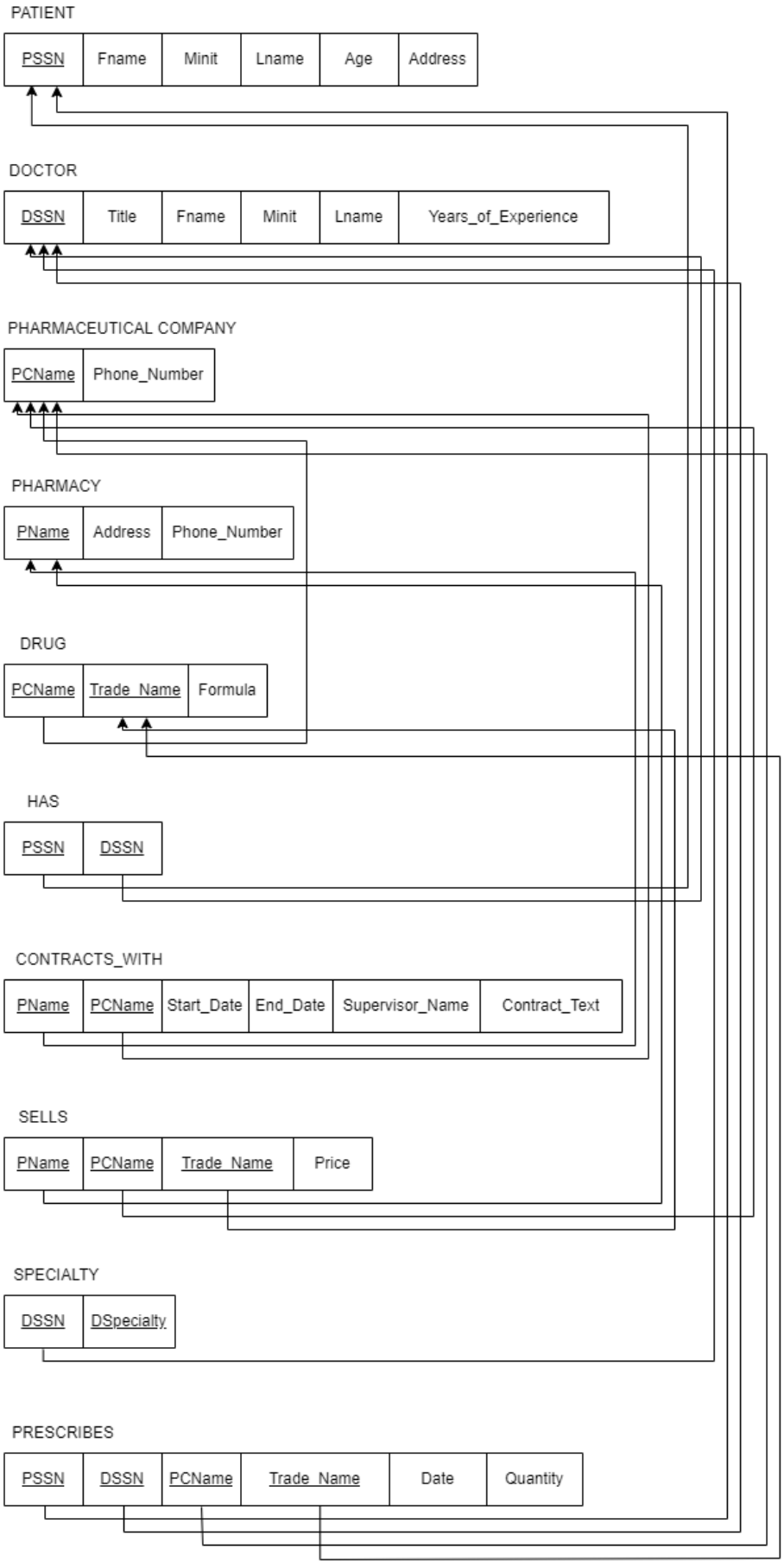
Please convert the ER diagram you achieved for the HEALTHCARE database in Assignment 1 to corresponding relational database schema.

Note:

- You must underline all the primary keys and identify all the foreign keys using arrows in the resulting relational database schema.
- Some primary keys and foreign keys contain more than one attribute.

Assume that only pharmaceutical companies “make” drugs and only pharmacies “sell” drugs.

*Image posted below as it is a bit large!


PATIENT
PSSN
Fname
Minit
Lname
Age
Address
DOCTOR
DSSN
Title
Fname
Minit
Lname
Years_of_Experience
PHARMACEUTICAL COMPANY
PCName
Phone_Number
PHARMACY
PName
Address
Phone_Number
DRUG
PCName
Trade_Name
Formula
HAS
PSSN
DSSN
CONTRACTS_WITH
PName
PCName
Start_Date
End_Date
Supervisor_Name
Contract_Text
SELLS
PName
PCName
Trade_Name
Price
SPECIALTY
DSSN
DSpecialty
PRESCRIBES
PSSN
DSSN
PCName
Trade_Name
Date
Quantity

Deliverables

1. A doc or pdf file containing all your answers.

Requirements on deliverables

1. Your deliverable should be ***FLastname_A4.doc*** or ***FLastname_A4.pdf*** where *F* indicates first letter, in uppercase, of your firstname and *Lastname* indicates your last name where first letter is in uppercase. Please exactly follow the naming rule described above. You will be deducted 5 points for incorrect naming.
2. On the first page, clearly state your name, ID, course title, assignment number, and due date.
3. Submit your doc or pdf file via Canvas.
4. No late submission will be accepted.
5. When grades are returned to you on Canvas, you have 7 days to meet with the instructor for grade changes. Issues and/or disagreements concerning your grade must be resolved in such 7 days window. After 7 days, the grades are written in stone and can't be changed after that point, for whatever reason.