CS425 MIDTERM EXAM
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Relational Algebra Key
$E \leftarrow \Pi \bowtie \sigma G$
$\Pi = Projection$
$\bowtie = Natural\,Join$
$\sigma = Select$
$G = Aggregate$
$\wedge / \vee = and/or$

I, Tiffany Wong, will work on my own on the exam and I will not share my answers or discuss it with anyone even after completing the exam.
X Tiffany Wong, Signature

I. Relational Algebra (last page (I wrote them all out))

I.1. Write a relational algebra expression that returns the patient's name and cost that had heart or lung procedure.

I.2. Write a relational algebra expression that returns the patient's name that had the procedure performed in hospital located in a different county than their residence.

I.3. Write a relational algebra expression that returns the patient's age for all patients with lung disease (had a lung procedure)

I.4. Write a relational algebra expression that returns the patient's name and recovery time needed for each procedure they have done.

II. SQL Queries

II.1. Write an SQL statement that creates a new table treatment that stores the hospitalname, the procedure and the patientname. Furthermore, we want to store a hospitalFee for each assignment. The combination of procedure, hospitalname and patientname uniquely identifies an assignment. Each assignment has a hospitalFee that is bigger than 0 and smaller than 1,000,000 dollars. When hospitalname is removed from the hospital table it gets deleted from the treatment table.

```
create table treatment (
        hospitalname varchar(20) not null unique,
        pName varchar(20) not null unique,
        patient varchar(20) not null unique,
        hospitalfee money check(0<hospitalfee<1,000,000),
        primary key (hopsitalname, pName,
        foreign key (hospitalname) references hospital,
        foreign key (pName) references procedure,
        foreign key (pName) references patient,
);

delete hospital
from hospital
inner join treatment on hospital.hospitalname not in treatment.hospitalname
```

2.2.1. Write an SQL query that returns the county for which the average age of patients is below 35.

```
select county
from treatment
where avg(age) < 35;
```

2.2.2. Write an SQL query that returns the name and rate for all doctors that support HMO combined with each patient they are taking care of.

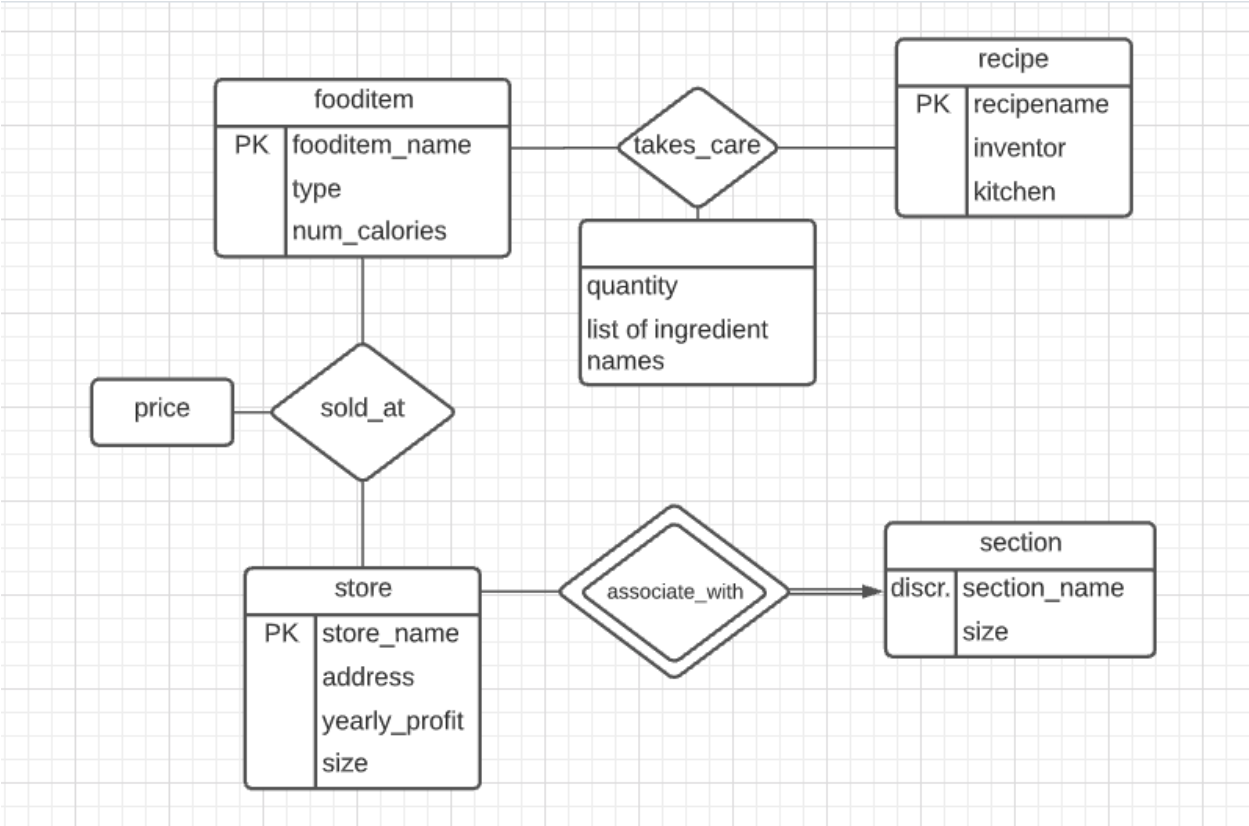
```
select docName, rate, pName
from patient join doctor
where patient.insurance = ‘HMO’ and doctor.insurance = ‘HMO’ ;
```

2.3.2. Increase the rate of all doctors for HMO insurances by 1,000.

```
update doctor set rate=rate+1,000;
```

III. ER_diagram

III.1.



- section is weak entity
- takes_Care relationship has shared attributes
- sold_at relationship also has shared attribute
- store to section is total because every section partakes in an associate_with relation with a store, but not every store is associated with a section

111.2. Reduce the ER diagram using the reduction rules to get the schema for the clinic system. State the rules used.

Rule1) Translate strong entities + unnest composite attributes
fooditem(fooditem_name, type, num_calories)
recipe(recipename, inventor, kitchen)
store(store_name, address, yearly_profit, size)

Rule2) Translate weak entities
section(store_name, section_name, size)

Rule3) Translated multi-valued attributes
none

Rule4) Translate relationships
One-to-One:
none

One-to-Many:
store(store_name, address, yearly_profit, size) (the entity being referred to)
section(store_name, section_name, size)

Many-to-Many:
takes_care(recipename, fooditem_name)
sold_at(fooditem_name, store_name)

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1. RELATIONAL ALGEBRA

① $\Pi_{patient.pName, rate}(\sigma_{procedure.pName='Heart' \vee procedure.pName='Lung'}(patient \bowtie takeCare \bowtie doctor))$

② $\Pi_{pName}(\sigma_{patient.County != hospital.County}(patient \bowtie takeCare \bowtie hospital))$

③ $\Pi_{age}(\sigma_{pName='Lung'}(patient \bowtie takeCare))$

(with division instead is answer below)

$\Pi_{patient.age}[patient \div (\Pi_{takeCare.patient}(\sigma_{takeCare.pName='Lung'}(takeCare)))]$

④ $\Pi_{takeCare.patient, procedure.Recovery\_Time}(procedure \bowtie takeCare))$