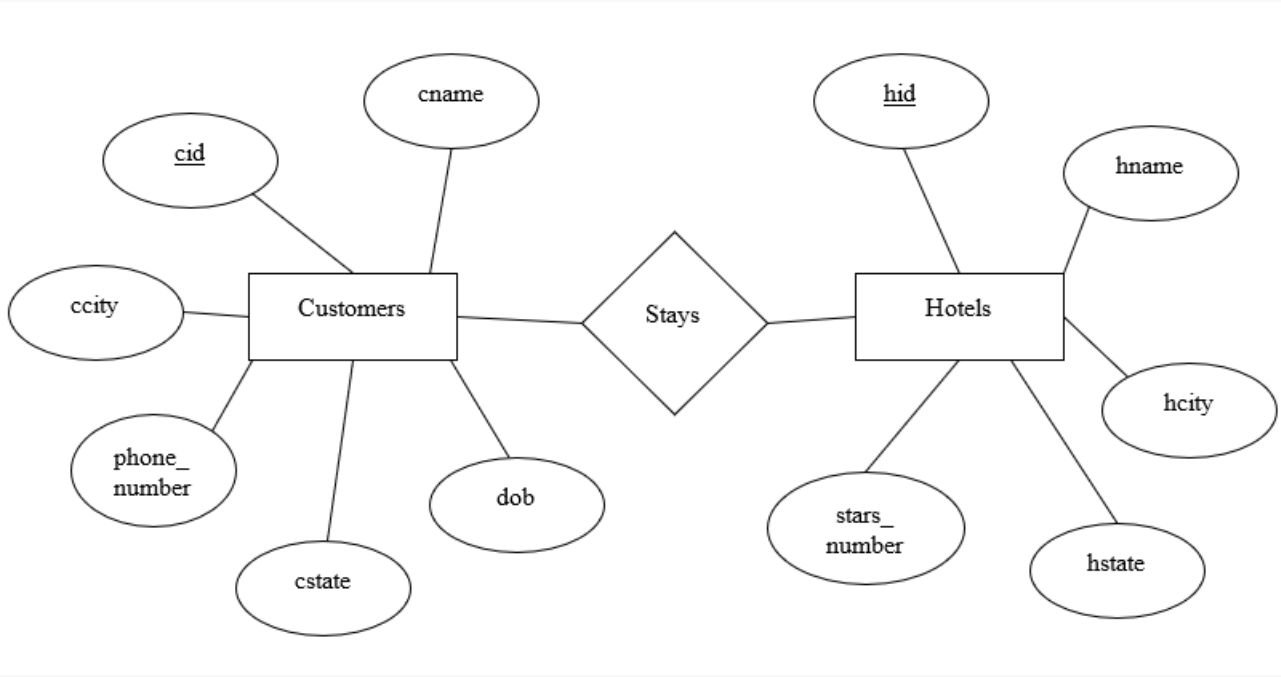
Midterm Prep: Relational Algebra and SQL

Question 1

Consider a database which keeps track of customers and the hotels that they stay at. A customer has an identifier (`cid`). A customer also has a name, city, state, date of birth, and phone number. Customers stay at hotels. Hotels also have a unique identifier. In addition, they have name, city, and state. Hotels also are rated with a star rating.

a. Draw the EF diagram for the above description.



b. Write the DB schema for the above description.

- *Customers* (`cid`: int, `cname`: string, `ccity`: string, `cstate`: string, `dob`: date, `phone_number`: string)
- *Hotels* (`hid`: int, `hname`: string, `hcity`: string, `hstate`: string, `star_rating`: int)
- *Stays* (`cid`: int, `hid`: int)

Question 2

Given the following DB schema:

- *Musicians* (`mid`: int, `name`: string, `city`: string, `state`: string, `dob`: date, `rating`: real)
- *Instruments* (`iid`: int, `brand`: string, `model`: string, `myear`: int, `category`: string, `dailyfee`: real)
- *Rents* (`mid`: int, `iid`: int)

a. Get the id, name, and city of all musicians that are from MA.

$$\pi_{mid,name,city}\left(\sigma_{state=\text{'MA'}}Musicians\right)$$

b. Get the id and name of the musicians and the id and category of the instruments they rented.

$$\pi_{mid,name,iid,category}\left(Musicians \bowtie Rents \bowtie Instruments\right)$$

c. Get the id and name of musicians that rented instruments of the category guitar and piano.

$$\rho\left(GuitarRentals, \pi_{mid,name}\left(Musicians \bowtie Rents \bowtie \left(\sigma_{category=\text{'guitar'}}Instruments\right)\right)\right)$$

$$\rho\left(PianoRentals, \pi_{mid,name}\left(Musicians \bowtie Rents \bowtie \left(\sigma_{category=\text{'piano'}}Instruments\right)\right)\right)$$

$$GuitarRentals \cap PianoRentals$$

Question 3

Write the SQL statements for the following queries given the schema used for Question 2.

a. The information of musicians whose name contains the string ‘an’.

b. The number of musicians for all ratings in the database.

c. Save the id, name, city, and state of the youngest musicians into a view called *YoungestMusicians*.

d. The id, brand, and model of all instruments that were manufactured in the year 2020 from either ‘yamaha’ or ‘roland’ (which are brands).

e. The average daily fee for each instrument category in the database. Only keep categories that have more than 3 instruments.

f. The id and name of musicians that only rented pianos.

g. The total amount of daily fees for all instruments that have been rented by each musician in the database. Also, include the id and name of the musicians.

h. Add a phone number column to the *Musicians* table.

i. Explain the primary key constraint. How is it used in databases? How does it affect the creation and altering of data? Show an example of a violation of this constraint.