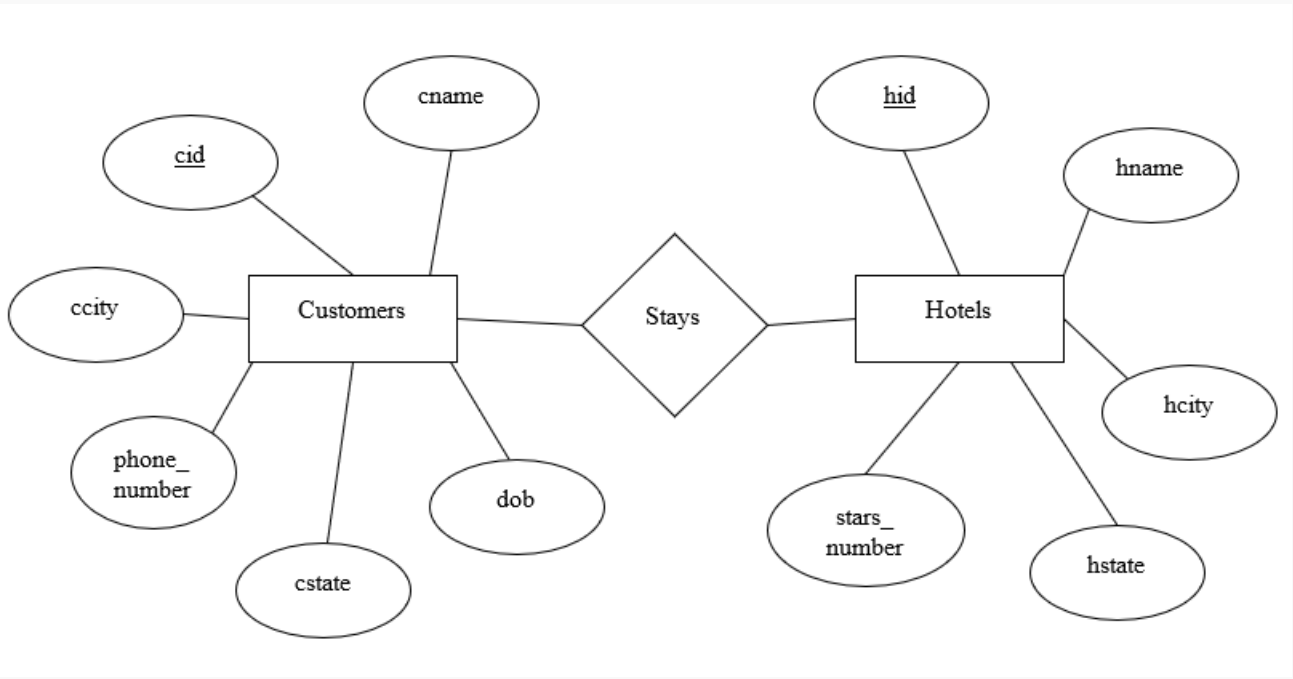
Midterm Prep: Relational Algebra and SQL

Question 1

A travel agency database contains information about customers (identified by `cid`) and information about hotels (identified by `hid`) where customers stay. Each customer also has a name, a date of birth (`dob`), a city, a state, and a phone number. Hotels also have a name, a city, a state, and a stars number. Customers stay in hotels.

a. Draw the ER diagram of this database (as described above). Do not forget about the primary keys. Do not use any other constraints. The ER diagram should strictly follow the notations used in class. No other notations will receive credit.



b. Explain in words how you would change the diagram to add the constraint for each hotel there must be at least one customer that stayed in.

You would add a thick line from the *Stays* relation to the *Hotels* relation.

c. Write the DB schema for this database.

- *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, `rentdate`: date)

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

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

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.

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

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 who rented all instruments of type ‘piano’.

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.