For all problems, use the following schema:

Musician(**id**, first_name, last_name, instrument, *band_id*)
Band(**id**, name, years_together)
Show(**id**, *venue_id*, date)
Played_in(***band_id***, ***show_id***)
Venue(**id**, name, address)
Album(**id**, name, year, *band_id*, *genre_id*)
Genre(**id**, name, description)
Song(**id**, name, *album_id*)

Primary keys are in bold, foreign keys are in italics.

For each problem, write a query once using relational algebra, and again using SQL. Each problem is worth two possible points (one for each language), for a total of 30 possible points.

You can apply the points you receive to any past assignment or exam, distributed in any way you'd like, without going over the maximum points for that assignment or exam. The EC points cannot be saved for the final exam.

Problems:

Answer:

1. Find the names of bands who have played together at least once.

$$\pi_{name}(\sigma_{count(show\_id)>='1'}(Band \bowtie Played\_in)$$

SQL :

```
SELECT b.name
FROM Band b
WHERE b.id in (SELECT p.band_id FROM Played_in p WHERE p.show_id in
(SELECT p1.show_id FROM Played_in p1 GROUP BY show_id HAVING
count(band_id)>='1'))
```

2. Find the names of bands who have played together more than once.

$$\pi_{name}(\sigma_{count(show\_id)>'1'}(Band \bowtie Played\_in))$$

SQL :

```
SELECT b.name
FROM Band b
WHERE b.id in (SELECT p.band_id FROM Played_in p WHERE p.show_id in
```

(SELECT p1.show_id FROM Played_in p1 GROUP BY p1.show_id HAVING count(*)>'1'))

3. Find the names of all songs that come from an album that fits into the genre "rock".

$$\pi_{name}(\sigma_{name='rock'}(Song \bowtie Album \bowtie Genre))$$

SQL:

SELECT s.name
FROM Song s
WHERE s.album_id in (SELECT a.id FROM Album a WHERE a.genre_id in (SELECT g.id FROM Genre g WHERE g.name='rock'))

4. Find the ids of bands who have a member with the first name "John".

$$\pi_{band\_id}(\sigma_{First\_name='John'}(Musician))$$

SQL :

SELECT m.band_id
FROM Musician m
WHERE m.first_name='John'

5. Find the names of all albums by bands who have played at the venue "The Hi-Dive".

$$\pi_{Album.name}(\sigma_{Venue.name='The\ Hi-Dive'}(Album \bowtie Played\_in \bowtie Show \bowtie Venue))$$

SQL:

SELECT a.name
FROM Album a
WHERE a.band_id in (SELECT p.band_id FROM Played_in p WHERE p.show_id in (SELECT s.id FROM Show s WHERE s.venue_id in (SELECT v.id FROM Venue v WHERE v.name='The Hi-Dive')))

6. Find the names of all songs by bands who have played at "The Gothic" and at "The Hi-Dive".

$$\pi_{Album.name}(\sigma_{Venue.name='The\ Hi-Dive' \wedge Venue.name='The\ Gothic'}(Album \bowtie Played\_in \bowtie Show \bowtie Venue))$$

SQL:

SELECT s.name
FROM Song s
WHERE s.album_id in (SELECT a.id FROM Album a WHERE a.band_id in

(SELECT p.band_id FROM Played_in p WHERE p.show_id in (SELECT s.id FROM Show s WHERE s.venue_id in (SELECT v.id FROM Venue v WHERE v.name='The Hi-Dive' and? V.name= ' The Gothic'))))

7. Find the names of albums that fit in the genre "Reggae" by bands containing a member whose instrument is "Saxophone".

$$\pi_{Album.name}(\pi_{id,name}(\sigma_{m.instrument='Saxophone'}(Album \bowtie Musician)) \wedge (\pi_{name,id}(\sigma_{g.name='Reggae'}(Album \bowtie Genre)))$$

SQL:

SELECT a.name
FROM Album a
WHERE a.genre_id in (SELECT g.id FROM Genre g WHERE g.name ='Reggae') and a.band_id in (SELECT m.band_id FROM Musician m WHERE m.instrument='Saxophone')

8. Find the name of bands who have been together 4 or more years, AND who have an album with more than 10 songs.

$$\pi_{bands.name}(\sigma_{count(song.id)>'10'}(\sigma_{b.year\_together>='4'}(Band) \bowtie Album \bowtie Song))$$

SQL:

SELECT b.name
FROM Band b
WHERE b.years_together>='4' and b.id in (SELECT a.band_id FROM Album a WHERE a.id in (SELECT s.album_id FROM Song s GROUP BY album_id HAVING count(*)>'10'))

9. Find the names of the musicians in all bands who played at "The Gothic" on 01-02-2018.

$$\pi_{frist\_name,\ last\_name}(\sigma_{s.date='01-02-2018' \wedge v.name='The\ Gothic'}(Musician \bowtie Played\_id \bowtie Show \bowtie Venue))$$

SQL :

SELECT m.first name, m.last name
FROM Musician m
WHERE m.band_id in (SELECT p.band_id FROM Played_in p WHERE p.show_id in (SELECT s.id FROM Show s WHERE s.date='01-02-2018' and s.venue_id in (SELECT v.id FROM Venue v WHERE v.name='The Gothic')))

10. Find the names of all the venues that have hosted shows with a band that put out an album that fits into the genre "Pop".

$$\pi_{v.name}(\sigma_{g.name='Pop'}(Venue \bowtie Show \bowtie Played\_in \bowtie Genre))$$

SQL:

```
SELECT v.name
FROM Venue v
WHERE v.id in (SELECT s.venue_id FROM Show s WHERE s.id in (SELECT p.show_id FROM Played_in p WHERE p.band_id in (SELECT a.band_id FROM Album a WHERE a.genre_id in (SELECT g.id FROM Genre g WHERE g.name='Pop'))))
```

11. Find the descriptions of all genres for albums put out by the band "The Databases".

$$\pi_{g.description}(\sigma_{b.name='The\ Databases'}(Genre \bowtie Album \bowtie Band))$$

SQL:

```
SELECT g.description
FROM Genre g
WHERE g.id in (SELECT a.genre_id FROM Album a WHERE a.band_id in (SELECT b.id FROM Band b WHERE b.name ='The Databases'))
```

12. Find the names of all bands that have a member who plays "Guitar", OR have a member that plays "Keyboard".

$$\pi_{b.name}(\sigma_{instrument='Guitar' \vee instrument='Keyboard'}(Musician \bowtie Band))$$

SQL:

```
SELECT b.name
FROM Band b
WHERE b.id in (SELECT m.band_id FROM Musician m WHERE m.instrument='Guitar' or m.instrument='Keyboard')
```

13. Find the id of all shows that includes a band who has been together more than 5 years.

$$\pi_{show.id}(\sigma_{band.\text{years\_together}>'5'}(Played\_in \bowtie Band \bowtie Show))$$

SQL:

```
SELECT p.show_id
FROM Played_in p
```

WHERE p.band_id in(SELECT b.id FROM Band b WHERE b.years_together>’5’)

14. Find the instruments of all members of bands who have played at "The Bluebird".

$$\pi_{musician.instrument}(\sigma_{venue.name='The\ Bluebird'}(Musician \bowtie Playe\_in \bowtie Show \bowtie Venue))$$

SQL:

SELECT m.instrument
FROM Musician m
WHERE m.band_id in (SELECT p.band_id FROM Played_in p WHERE p.show_id in (SELECT s.id FROM Show s WHERE s.venue_id in (SELECT v.id FROM Venue v WHERE v.name=’The Bluebird’)))

15. Find the names of all genres for albums put out by bands who played at "The Gothic".

$$\pi_{genres.name}(\sigma_{venue.name='The\ Gothic'}(Venue \bowtie show \bowtie played\_in \bowtie album \bowtie Genre))$$

SQL:

SELECT g.name
FROM Genre g
WHERE g.id in (SELECT a.genre_id FROM Album a WHERE a.band_id in (SELECT p.band_id FROM Played_id p WHERE p.show_id in (SELECT s.id FROM Show s WHERE s.venue_id in (SELECT v.id FROM Venue v WHERE v.name=’The Gothic’))))