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HOMEWORK #1 - SQL

OVERVIEW

The first homework is to construct a set of SQL queries for analysing a dataset that will be provided to you. For this, you will look into MusicBrainz data. This homework is an opportunity to: (1) learn basic and certain advanced SQL features, and (2) get familiar with using a full-featured DBMS, SQLite, that can be useful for you in the future.

This is a single-person project that will be completed individually (i.e., no groups).

Release Date: Sep 02, 2020
Due Date: Sep 13, 2020 @ 11:59pm

SPECIFICATION

The homework contains 10 questions in total and is graded out of 100 points. For each question, you will need to construct a SQL query that fetches the desired data from the SQLite DBMS. It will likely take you approximately 6-8 hours to complete the questions.

PLACEHOLDER FOLDER

Create the placeholder submission folder with the empty SQL files that you will use for each question:

```
$ mkdir placeholder
$ cd placeholder
$ touch q1_sample.sql \
        q2_long_name.sql \
        q3_old_music_nations.sql \
        q4_dubbed_smash.sql \
        q5_vinyl_lover.sql \
        q6_old_is_not_gold.sql \
        q7_release_percentage.sql \
        q8_collaborate_artist.sql \
        q9_dre_and_eminem.sql \
        q10_around_the_world.sql
```

After filling in the queries, you can compress the folder by running the following command:

```
$ zip -j submission.zip placeholder/*.sql
```

The `-j` flag lets you compress all the SQL queries in the zip file without path information. The grading scripts will **not** work correctly unless you do this.

INSTRUCTIONS

SETTING UP SQLITE

You will first need to install SQLite on your development machine.

Make sure that you are using at least SQLite version 3.25! Older releases (prior to 2019) will **not** support the SQL features that you need to complete this assignment.

Please follow the instructions.

INSTALL SQLITE3 ON MAC OS X

On Mac OS Leopard or later, you don't have to! It comes pre-installed. You can upgrade it, if you absolutely need to, with Homebrew.

LOAD THE DATABASE DUMP

Check if `sqlite3` is properly working by following this tutorial.

Download the database dump file:

```
$ wget https://15445.courses.cs.cmu.edu/fall2020/files/musicbrainz-cmudb2020.db.gz
```

Check its MD5 checksum to ensure that you have correctly downloaded the file:

```
$ md5sum musicbrainz-cmudb2020.db.gz
a80fe4365a228d4096225068801771f8  musicbrainz-cmudb2020.db.gz
```

Unzip the database from the provided database dump by running the following commands on your shell. Note that the database file be 550MB after you decompress it.

```
$ gunzip musicbrainz-cmudb2020.db.gz
$ sqlite3 musicbrainz-cmudb2020.db
```

We have prepared a sample of the original dataset for this assignment. Although this is not required to complete the assignment, the complete dataset is available by following the steps here.

Check the contents of the database by running the `.tables` command on the `sqlite3` terminal. You should see **fifteen tables**, and the output should look like this:

```
$ sqlite3 musicbrainz-cmudb2020.db
SQLite version 3.32.3
Enter ".help" for usage hints.
sqlite> .tables
area                artist_credit_name  medium              release_status
artist              artist_type         medium_format       work
artist_alias        gender              release             work_type
artist_credit       language            release_info
```

Create indices using the following commands in SQLite:

```
CREATE INDEX ix_artist_name ON artist (name);
CREATE INDEX ix_artist_area ON artist (area);
CREATE INDEX ix_artist_credit_name ON artist_credit_name (artist_credit);
CREATE INDEX ix_artist_credit_id ON artist_credit (id);
CREATE INDEX ix_artist_alias ON artist_alias(artist);
CREATE INDEX ix_work_name ON work (name);
CREATE INDEX ix_work_type ON work (type);
CREATE INDEX ix_work_type_name ON work_type (name);
CREATE INDEX ix_release_id ON release (id);
CREATE INDEX ix_release_artist_credit ON release (artist_credit);
CREATE INDEX ix_release_info_release ON release_info (release);
CREATE INDEX ix_medium_release ON medium (release);
CREATE INDEX ix_medium_format_id on medium_format (id);
```

CHECK THE SCHEMA

Get familiar with the schema (structure) of the tables (what attributes do they contain, what are the primary and foreign keys). Run the `.schema $TABLE_NAME` command on the `sqlite3` terminal for each table. The output should look like the example below for each table.

AREA

```
sqlite> .schema area
CREATE TABLE [area] (
```

```
   [comment] TEXT
);
```

Contains details for an area. For example, this is a row from the table:

```
95339|Great Neck|village
```

For us, the important field is `name` (e.g., "Great Neck").

ARTIST

```
sqlite> .schema artist
CREATE TABLE [artist] (
   [id] INTEGER,
   [name] TEXT,
   [begin_date_year] INTEGER,
   [begin_date_month] INTEGER,
   [begin_date_day] INTEGER,
   [end_date_year] INTEGER,
   [end_date_month] TEXT,
   [end_date_day] TEXT,
   [type] INTEGER,
   [area] INTEGER,
   [gender] INTEGER,
   [comment] TEXT
);
sqlite> CREATE INDEX ix_artist_name ON artist (name);
sqlite> CREATE INDEX ix_artist_area ON artist (area);
```

Contains details of an artist. For example, this is a row from the table:

```
519|Michael Jackson|1958|8|29|2009|6|25|1|222|1|"King of Pop"
```

For us, the important fields are `name` (e.g., "Michael Jackson") and `area` (e.g., 222).

ARTIST_ALIAS

```
sqlite> .schema artist_alias
CREATE TABLE [artist_alias] (
   [id] INTEGER,
   [artist] INTEGER,
   [name] TEXT
);
sqlite> CREATE INDEX ix_artist_alias ON artist_alias(artist);
```

Contains alternate names for the artists. For example, this is a row from the table:

```
125604|916107|AOA
```

ARTIST_CREDIT

```
sqlite> .schema artist_credit
CREATE TABLE [artist_credit] (
   [id] INTEGER,
   [name] TEXT,
   [artist_count] INTEGER
);
sqlite> CREATE INDEX ix_artist_credit_id ON artist_credit (id);
```

Contains lists of artists. For example, this is a row from the table:

```
966419|Bounty Killer feat. Beenie Man & Dennis Brown|3
```

ARTIST_CREDIT_NAME

```
sqlite> .schema artist_credit_name
CREATE TABLE [artist_credit_name] (
   [artist_credit] INTEGER,
   [position] INTEGER,
```

```
);
sqlite> CREATE INDEX ix_artist_credit_name ON artist_credit_name (artist_credit);
```

Contains mappings from artist credits to artists. For example, this is a row from the table:

```
966419|0|39320|Bounty Killer
```

ARTIST_TYPE

```
sqlite> .schema artist_type
CREATE TABLE [artist_type] (
   [id] INTEGER,
   [name] TEXT
);
```

Contains details of an artist type. For example, this is a row from the table:

```
1|Person
```

GENDER

```
sqlite> .schema gender
CREATE TABLE [gender] (
   [id] INTEGER,
   [name] TEXT,
   [description] TEXT
);
```

Contains details for a gender type. For example, this is a row from the table:

```
1|Male|NULL
```

LANGUAGE

```
sqlite> .schema language
CREATE TABLE [language] (
   [id] INTEGER,
   [name] TEXT
);
```

Contains details for a language type. For example, this is a row from the table:

```
120|English
```

MEDIUM

```
sqlite> .schema medium
CREATE TABLE [medium] (
   [id] INTEGER,
   [release] INTEGER,
   [position] INTEGER,
   [format] INTEGER,
   [name] TEXT
);
sqlite> CREATE INDEX ix_medium_release ON medium (release);
```

Contains details for a medium. For example, this is a row from the table:

```
287750|287750|1|8|NULL
```

For us, the important fields are `release` (e.g., 287750) and `type` (e.g., 8).

MEDIUM_FORMAT

```
sqlite> .schema medium_format
CREATE TABLE [medium_format] (
   [id] INTEGER,
   [name] TEXT,
   [description] TEXT
```

Contains details for a medium format. For example, this is a row from the table:

```
1|CD|NULL
```

RELEASE

```
sqlite> .schema release
CREATE TABLE [release] (
   [id] INTEGER,
   [name] TEXT,
   [artist_credit] INTEGER,
   [status] INTEGER,
   [language] INTEGER,
   [comment] TEXT
);
sqlite> CREATE INDEX ix_release_id ON release (id);
sqlite> CREATE INDEX ix_release_artist_credit ON release (artist_credit);
```

The table contains music releases. For example, this is a row from the table:

```
1671523|Back to the Future, Part III: Original Motion Picture Soundtrack|21443|1|120|25th anniversary edition
```

RELEASE_INFO

```
sqlite> .schema release_info
CREATE TABLE [release_info] (
   [release] INTEGER,
   [area] INTEGER,
   [date_year] INTEGER,
   [date_month] INTEGER,
   [date_day] INTEGER
);
sqlite> CREATE INDEX ix_release_info_release ON release_info (release);
```

The table contains the detailed information of a release. For example, this is a row from the table:

```
1966419|222|2017|1|13
```

RELEASE_STATUS

```
sqlite> .schema release_status
CREATE TABLE [release_status] (
   [id] INTEGER,
   [name] TEXT,
   [description] TEXT
);
```

Contains the details of a release status. For example, this is a row from the table:

```
1|Official|Any release officially sanctioned by the artist and/or their record company. Most releases will fit into this categor
```

WORK

```
sqlite> .schema work
CREATE TABLE [work] (
   [id] INTEGER,
   [name] TEXT,
   [type] INTEGER,
   [comment] TEXT
);
sqlite> CREATE INDEX ix_work_name ON work (name);
sqlite> CREATE INDEX ix_work_type ON work (type);
```

Contains the details of a work. For example, this is a row from the table:

```
12446282|Thousand Miles Behind|17|NULL
```

```
sqlite> .schema work_type
CREATE TABLE [work_type] (
   [id] INTEGER,
   [name] TEXT,
   [description] TEXT
);
sqlite> CREATE INDEX ix_work_type_name ON work_type (name);
```

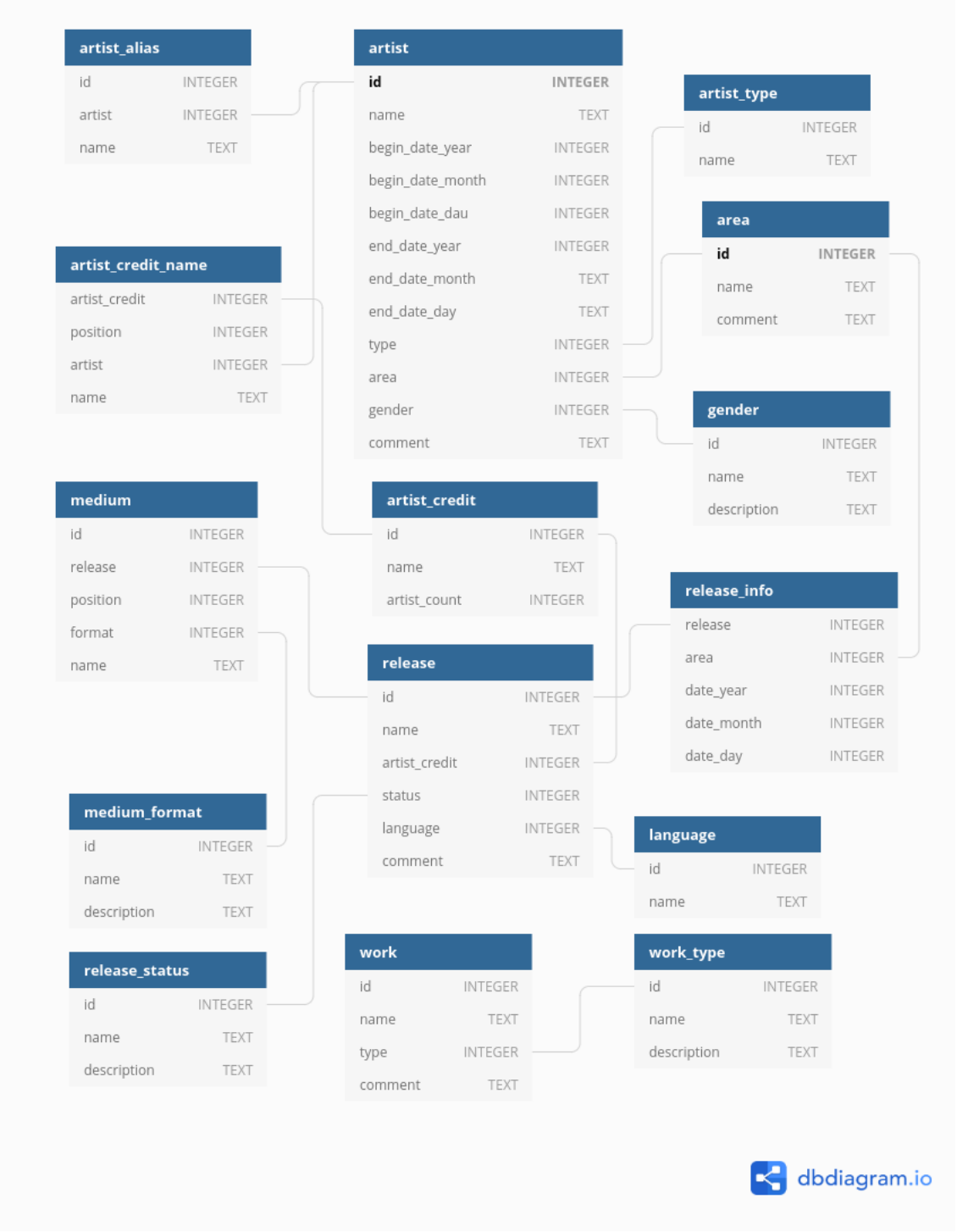
Contains the details of a work type. For example, this is a row from the table:

```
14|Quartet|A quartet is a musical composition scored for four voices or instruments.
```

SANITY CHECK

Count the number of rows in the table

```
sqlite> select count(*) from artist;
1682989
```



CONSTRUCT THE SQL QUERIES

Now, it's time to start constructing the SQL queries and put them into the placeholder files.

Q1 [0 POINTS] (Q1_SAMPLE):

The purpose of this query is to make sure that the formatting of your output matches exactly the formatting of our auto-grading script.

Details: List all types of work ordered by type ascendingly.

Answer: Here's the correct SQL query and expected output:

```
sqlite> select name from work_type order by name;
    Answer:
```

```
Ballet
Beijing opera
Cantata
Concerto
Incidental music
Madrigal
Mass
Motet
Musical
Opera
Operetta
Oratorio
Overture
Partita
Play
Poem
Prose
Quartet
Sonata
Song
Song-cycle
Soundtrack
Suite
Symphonic poem
Symphony
Zarzuela
Etude
```

You should put this SQL query into the appropriate file (`q1_sample.sql`) in the submission directory (`placeholder`).

Q2 [5 POINTS] (Q2_LONG_NAME):

List works with longest name of each type.

Details: For each work type, find works that have the longest names. There might be cases where there is a tie for the longest names - in that case, return all of them. Display work names and corresponding type names, and order it according to work type (ascending) and use work name (ascending) as tie-breaker.

Q3 [5 POINTS] (Q3_OLD_MUSIC_NATIONS):

List top 10 countries with the most classical music artists (born or started before 1850) along with the number of associated artists.

Details: Print country and number of associated arists before 1850. For example, `Russia|191`. Sort by number of artists in descending order.

Q4 [10 POINTS] (Q4_DUBBED_SMASH):

List the top 10 dubbed artist names with the number of dubs.

Details: Count the number of distinct names in `artist_alias` for each artist in the `artist` table, and list only the top ten who's from the United Kingdom and started after 1950 (not included). Print the artist name in the `artist` table and the number of corresponding distinct dubbed artist names in the `artist_alias` table.

Q5 [10 POINTS] (Q5_VINYL_LOVER):

List the distinct names of releases issued in vinyl format by the British band Coldplay.

Details: Vinyl format includes ALL vinyl dimensions excluding `VinylDisc`. Sort the release names by release date ascendingly.

Q6 [10 POINTS] (Q6_OLD_IS_NOT_GOLD):

Which decades saw the most number of official releases? List the number of official releases in every decade since 1900. Like `1970s|57210`.

Details: Print all decades and the number of official releases. Releases with different issue dates or countries are considered different releases. Print the relevant decade in a fancier format by constructing a string that looks like this: `1970s`. Sort the decades in decreasing order with respect to the number of official releases and use decade (descending) as tie-breaker. Remember to exclude releases whose dates are `NULL`.

List the month and the percentage of all releases issued in the corresponding month all over the world in the past year. Display like `2020.01|5.95`.

Details: The percentage of releases for a month is the number of releases issued in that month devided by the total releases in the past year from 07/2019 to 07/2020, both included. Releases with different issue dates or countries are considered different releases. Round the percentage to two decimal places using `ROUND()`. Sort by dates in ascending order.

Q8 [15 POINTS] (Q8_COLLABORATE_ARTIST):

List the number of artists who have collaborated with Ariana Grande.

Details: Print only the total number of artists. An artist is considered a collaborator if they appear in the same artist_credit with Ariana Grande. The answer should include Ariana Grande herself.

Q9 [15 POINTS] (Q9_DRE_AND_EMINEM):

List the rank, artist names, along with the number of collaborative releases of Dr. Dre and Eminem among other most productive duos (as long as they appear in the same release) both started after 1960 (not included). Display like `[rank]|Dr. Dre|Eminem|[# of releases]`.

Details: For example, if you see a release by A, B, and C, it will contribute to three pairs of duos: `A|B|1`, `A|C|1`, and `B|C|1`. You will first need to calculate a rank of these duos by number of collaborated releases (release with artist_credit shared by both artists) sorted descendingly, and then find the rank of `Dr. Dre` and `Eminem`. Only releases in English are considered. Both artists should be solo artists. All pairs of names should have the alphabetically smaller one first. Use artist names (asc) as tie breaker.

Hint: Artist aliases may be used everywhere. When doing aggregation, using artist ids will ensure you get the correct results. One example entry in the rank list is `9|Benj Pasek|Justin Paul|27`

Q10 [15 POINTS] (Q10_AROUND_THE_WORLD):

Concat all dubbed names of The Beatles using comma-separated values(like "`Beetles, fab four`").

Details: Find all dubbed names of artist "`The Beatles`" in artist_alias and order them by id (ascending). Print a single string containing all the dubbed names separated by commas.

Hint: You might find CTEs useful.

GRADING RUBRIC

Each submission will be graded based on whether the SQL queries fetch the expected sets of tuples from the database. Note that your SQL queries will be auto-graded by comparing their outputs (i.e. tuple sets) to the correct outputs. For your queries, the **order** of the output columns is important; their names are not.

LATE POLICY

See the late policy in the syllabus.

SUBMISSION

We use the Autograder from Gradescope for grading in order to provide you with immediate feedback. After completing the homework, you can submit your compressed folder `submission.zip` (only one file) to Gradescope:

https://www.gradescope.com/courses/163907/

Important: Use the Gradescope course code announced on Piazza.

We will be comparing the output files using a function similar to `diff`. You can submit your answers as many times as you like.

COLLABORATION POLICY

Every student has to work individually on this assignment.
Students are allowed to discuss high-level details about the project with others.
Students are **not** allowed to copy the contents of a white-board after a group meeting with other students.

WARNING: All of the code for this project must be your own. You may not copy source code from other students or other sources that you find on the web. Plagiarism **will not** be tolerated. See CMU's **Policy on Academic Integrity** for additional information.

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