1.

a)

```
sqlite> SELECT songID, name, duration, year, artistID
   ...> FROM song
   ...> ;
1|Saved|178|2015|1
2|Oops!... I Did It Again|221|2000|2
3|Don't Start Now|183|2019|3
4|Strangers|233|2017|4
5|I Went Too Far|294|2016|5
6|Blasé|286|2015|1
7|Hot Girl Summer|199|2019|9
8|drivers license|242|2021|13
9|Black Beatles|291|2016|8
10|Nice for What|204|2018|12
11|Work|219|2016|15
12|I'm the One|288|2017|16
13|WAP|187|2020|11
14|Watermelon Sugar|173|2020|21
15|positions|172|2020|22
16|7 rings|178|2019|22
17|thank u, next|217|2018|22
18|Don't Judge Me|242|2017|1
19|Love U Better|183|2017|1
20|Savage Remix|242|2020|9
21|Cardigan|232|2020|26
22|Butter|265|2021|27
23|good 4 u|178|2021|13
24|Love Me|255|2013|20
```

b)

```
sqlite> SELECT name, year
   ...> FROM album
   ...> WHERE year < 2017
   ...> ;
Free TC|2015
Oops!... I Did It Again|2000
All My Demons Greeting Me as a Friend|2016
SremmLife 2|2016
ANTI|2016
I Am Not a Human Being II|2013
```

```
sqlite> SELECT name, year
   ...> FROM song
   ...> WHERE year <= 2020 AND year >= 2018
   ...> ORDER BY year ASC
   ...> ;
Nice for What|2018
thank u, next|2018
Don't Start Now|2019
Hot Girl Summer|2019
7 rings|2019
WAP|2020
Watermelon Sugar|2020
positions|2020
Savage Remix|2020
Cardigan|2020
```

c)

d)

```
sqlite> SELECT artist.name, song.name
   ...> FROM artist, song, featuredOn
   ...> WHERE artist.artistID = featuredOn.artistID AND song.songID = featuredOn.songID
   ...> ORDER BY artist.name ASC, song.name ASC
   ...> ;
Beyoncé|Savage Remix
Chance the Rapper|I'm the One
Drake|Love Me
Drake|Work
E-40|Saved
Future|Blasé
Future|Don't Judge Me
Future|Love Me
Gucci Mane|Black Beatles
Justin Bieber|I'm the One
Lil Wayne|I'm the One
Lil Wayne|Love U Better
Megan Thee Stallion|WAP
Nicki Minaj|Hot Girl Summer
Quavo|I'm the One
Rae Sremmurd|Blasé
Swae Lee|Don't Judge Me
The-Dream|Love U Better
Ty Dolla Sign|Hot Girl Summer
```

e)

```
sqlite> SELECT song.name, album.name, song.year
   ...> FROM song, album, artist, songOnAlbum
   ...> WHERE song.artistID = artist.artistID AND artist.name = "Ariana Grande"
 AND song.songID = songOnAlbum.songID AND songOnAlbum.albumID = album.albumID
   ...> ORDER BY song.year ASC, album.name ASC, song.name ASC
   ...> ;
thank u, next|thank u, next|2018
7 rings|thank u, next|2019
positions|Positions|2020
```

f)

```
sqlite> SELECT DISTINCT MAR.name AS hovedartist, song.name AS sang
   ...> FROM (song JOIN artist AS MAR USING (artistID)) JOIN ((featuredOn JOIN artist AS FAR USING (artistID))) USING (songID)
   ...> WHERE MAR.name = 'Ty Dolla Sign' OR FAR.name = 'Ty Dolla Sign'
   ...> ORDER BY MAR.name ASC, song.name ASC;
+--------------------+-----------------+
|     hovedartist    |      sang       |
+--------------------+-----------------+
| Megan Thee Stallion | Hot Girl Summer |
| Ty Dolla Sign       | Blasé           |
| Ty Dolla Sign       | Don't Judge Me  |
| Ty Dolla Sign       | Love U Better   |
| Ty Dolla Sign       | Saved           |
+--------------------+-----------------+
```

```
sqlite> SELECT artist.name, song.name
   ...> FROM artist INNER JOIN song ON artist.artistID = song.artistID
   ...> WHERE artist.name = "Ty Dolla Sign"
   ...> UNION
   ...> SELECT artist.name, song.name
   ...> FROM featuredOn INNER JOIN artist AS featuredArtist ON featuredOn.artistID = featuredArtist.artistID INNER JOIN
song ON featuredOn.songID = song.songID INNER JOIN artist ON song.artistID = artist.artistID
   ...> WHERE featuredArtist.name = "Ty Dolla Sign"
   ...> ORDER BY artist.name ASC, song.name ASC
   ...> ;
Megan Thee Stallion|Hot Girl Summer
Ty Dolla Sign|Blasé
Ty Dolla Sign|Don't Judge Me
Ty Dolla Sign|Love U Better
Ty Dolla Sign|Saved
```

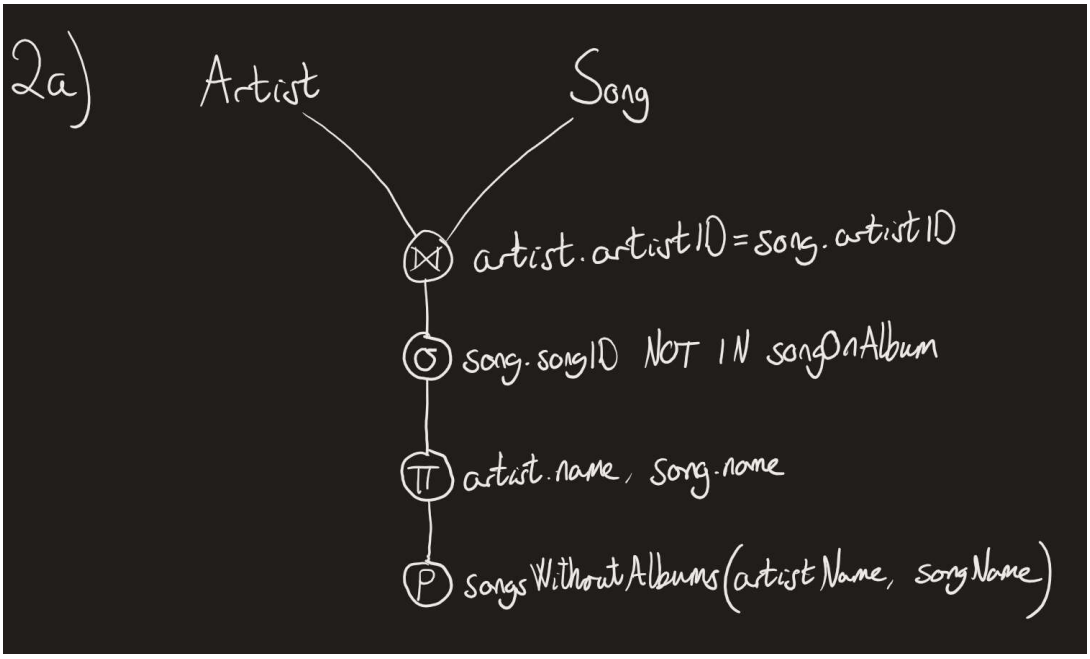
g)

```
sqlite> SELECT artist.name, song.name
   ...> FROM artist INNER JOIN song ON artist.artistID = song.songID
   ...> WHERE song.name LIKE '%the%'
   ...> ;
Drake|I'm the One
```

h)

```
sqlite> SELECT artist.name, COUNT(*) AS AntallFeatures
   ...> FROM artist INNER JOIN featuredOn ON artist.artistID = featuredOn.artistID
   ...> GROUP BY artist.name
   ...> HAVING AntallFeatures > 2
   ...> ;
Future|3
```

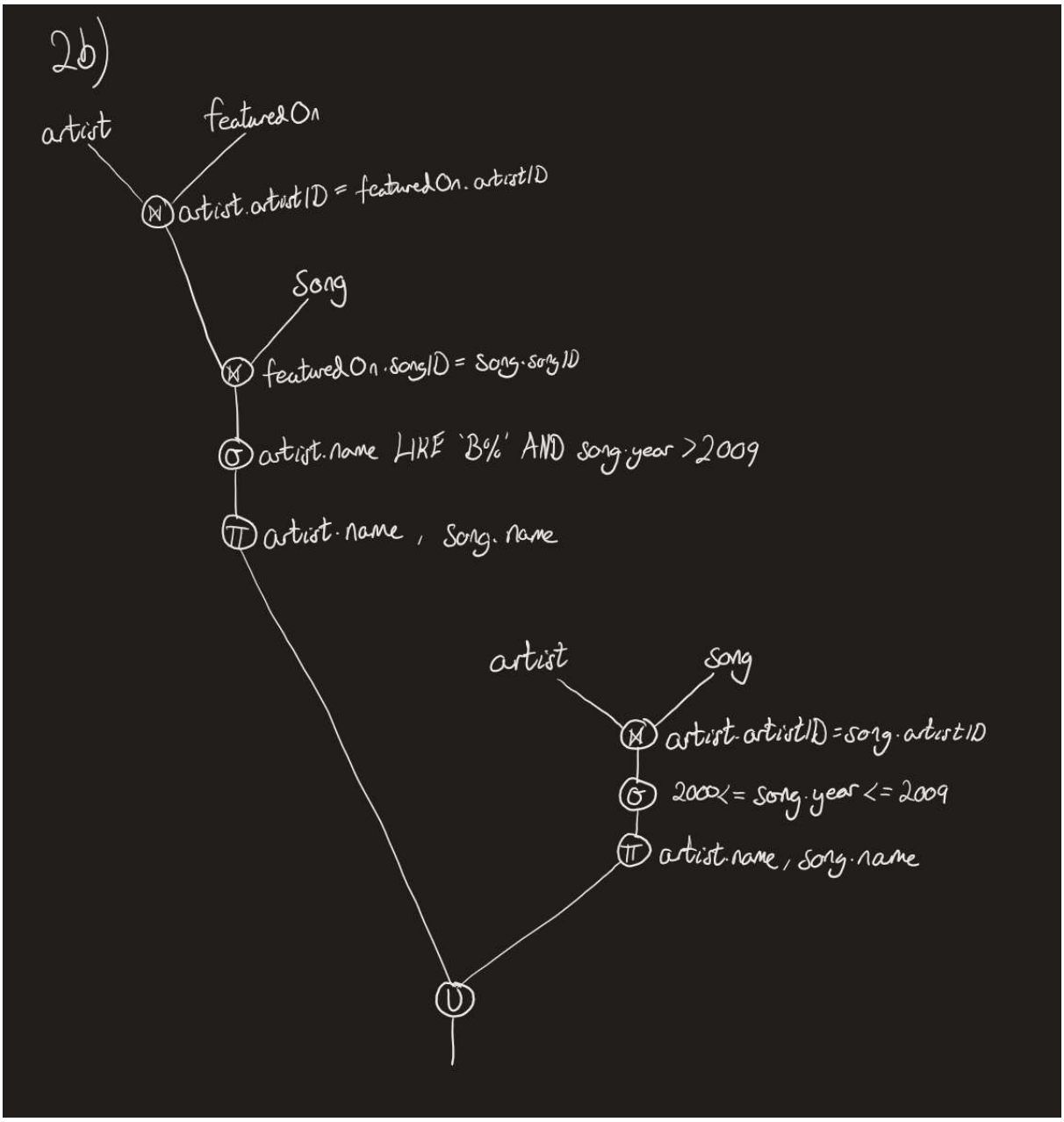
Oppgave 2:
a)




```
sqlite> CREATE VIEW songsWithoutAlbums(artistName, songName) AS
   ...> SELECT artist.name, song.name
   ...> FROM artist INNER JOIN song ON artist.artistID = song.artistID
   ...> WHERE song.songID NOT IN (SELECT songID FROM songOnAlbum);
```

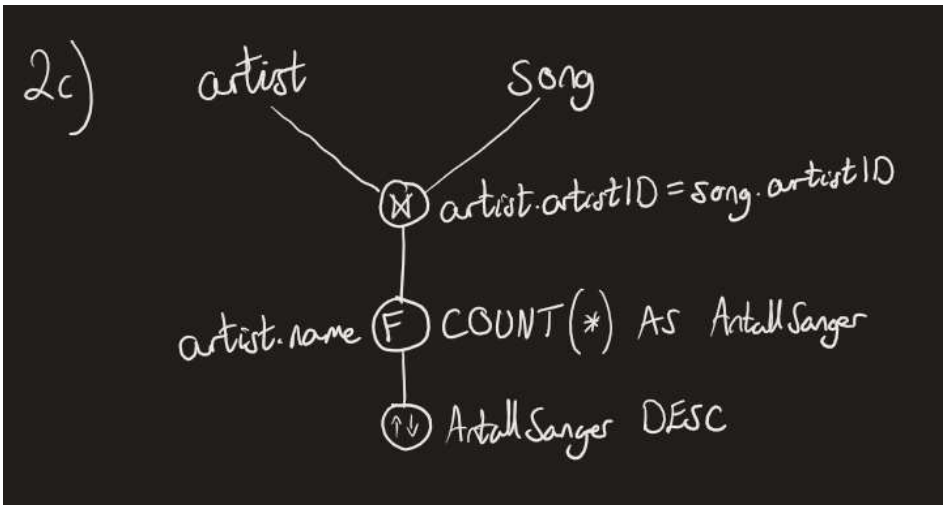
```
sqlite> SELECT * FROM songsWithoutAlbums;
+---------------------+-----------------+
|     artistName      |    songName     |
+---------------------+-----------------+
| Megan Thee Stallion | Hot Girl Summer |
| Cardi B             | WAP             |
| BTS                 | Butter          |
+---------------------+-----------------+
```

b)




```
sqlite> SELECT DISTINCT B2010.name AS Artists, S1.name AS Songs
   ...> FROM (artist AS B2010 INNER JOIN featuredOn ON (B2010.artistID = featuredOn.artistID) INNER JOIN song AS S1 ON (featuredOn.songID = S1.songID)
   ...> WHERE B2010.name LIKE 'B%' AND S1.year > 2009
   ...> UNION
   ...> SELECT DISTINCT A2000.name AS Artists, S2.name AS Songs
   ...> FROM (artist AS A2000 INNER JOIN song AS S2 ON (A2000.artistID = S2.artistID))
   ...> WHERE (S2.year >= 2000 AND S2.year <= 2009);
+----------------+-------------------------+
|    Artists     |          Songs          |
+----------------+-------------------------+
| Beyoncé        | Savage Remix            |
| Britney Spears | Oops!... I Did It Again |
+----------------+-------------------------+
```

c)




```
sqlite> SELECT artist.name, COUNT(*) AS AntallSanger
   ...> FROM artist INNER JOIN song ON artist.artistiD = song.artistID
   ...> GROUP BY artist.name
   ...> ORDER BY AntallSanger DESC;
+---------------------+--------------+
|        name         | AntallSanger |
+---------------------+--------------+
| Ty Dolla Sign       | 4            |
| Ariana Grande       | 3            |
| Olivia Rodrigo      | 2            |
| Megan Thee Stallion | 2            |
| Taylor Swift        | 1            |
| Sigrid              | 1            |
| Rihanna             | 1            |
| Rae Sremmurd        | 1            |
| Lil Wayne           | 1            |
| Harry Styles        | 1            |
| Dua Lipa            | 1            |
| Drake               | 1            |
| DJ Khaled           | 1            |
| Cardi B             | 1            |
| Britney Spears      | 1            |
| BTS                 | 1            |
| Aurora              | 1            |
+---------------------+--------------+
```

Oppgave 3:

a) Vi kan se inn i tabellen og oppdatere selve navnet og fødselsåret. Vi kan telle antall ganger de verdiene forekommer, og finner at antall celler som må oppdateres er 8.

b)

For å gjøre det lettere med oppdateringer kan vi dele opp tabellen i to deltabeller på en slik måte at filmID blir primærnøkkel i den ene tabellen, og den har en fremmednøkkel directorID, som er primærnøkkelen i den andre deltabellen. Tabellene vil dermed se ut som dette:

filmID	name	year	directorID
1	PlayTime	1967	1
2	Mon Oncle	1953	1
3	Spring Breakers	2012	2
4	Monsieur Hulot's Holiday	1953	1
5	Trafic	1971	1
6	The Watermelon Woman	1996	3

directorID	directorName	directorBirthYear
1	Jacques Táti	1908
1	Jacques Táti	1908
2	Harmony Korine	1973
1	Jacques Táti	1908
1	Jacques Táti	1908
3	Cheryl Dunye	1966

Oppgave 4:

2. A -> B er umulig, fordi rad 4 og 5 i A er like, mens rad 4-5 i B er ulike, dermed er ikke B avhengig av A.
5. C -> D er umulig fordi i rad 1 og 2 peker c1 på d1 og d2, fordi alle rader som har samme verdi for c må ha samme verdi for d når c -> d.
6. D -> C umulig av samme grunn som forrige, vi kan ikke ha at c2 OG c4 er avhengig av d2.
8. ABC er ikke en supernøkkel for tabellen, fordi D ikke er inkludert i nøkkelen, og fordi D hverken er avhengig av A, B eller C er det umulig.
9. Umulig fordi D ikke er en nøkkel. Det ser vi fordi $D^+ = D$.
10. Umulig, ABD er en supernøkkel, men det er ikke en minimal supernøkkel fordi B er overflødig. Dette bryter med prinsippet om at en nøkkel er en minimal supernøkkel, AD er derimot en kandidatnøkkel fordi den er minimal.

a) $D^+ = AD \subset R$
$BC^+ = ABCD \subset R$
$AB^+ = ABCD$
$BD^+ = ABCD$
R har 2 kandidatnøkler, AB^+ og BD^+.