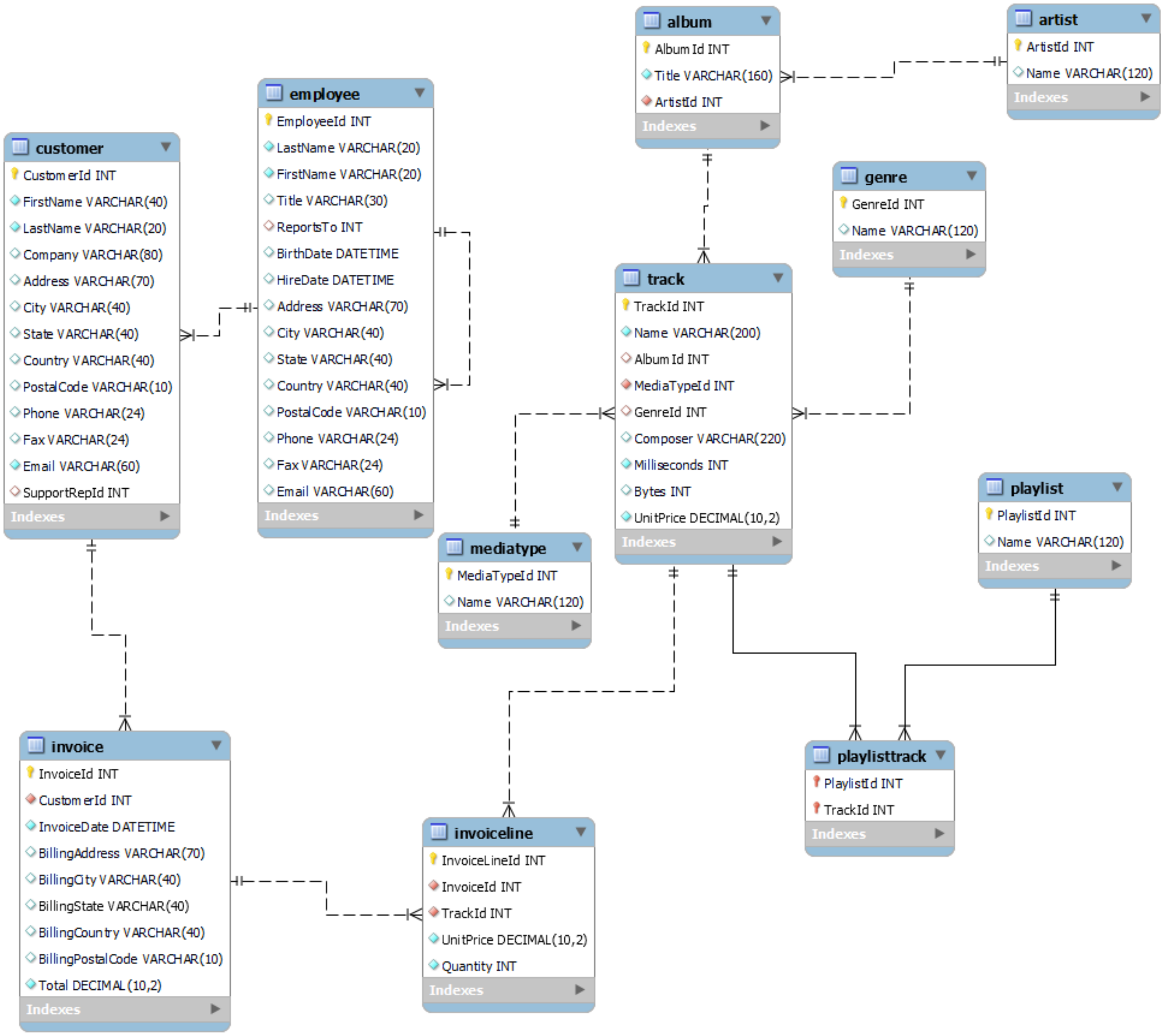
SQL FINAL CLASS PROJECT

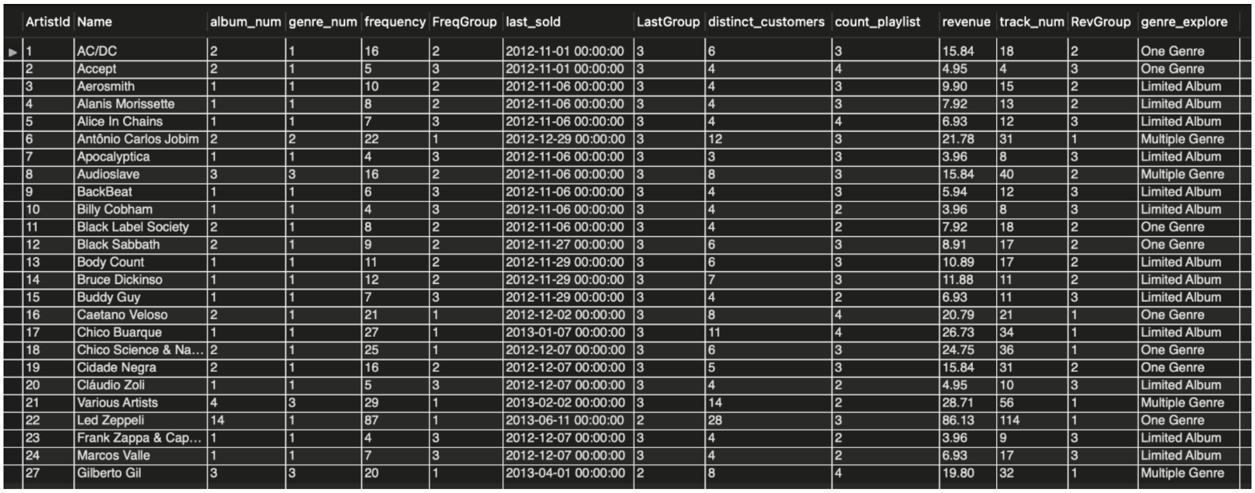


Please put all of your work into **this single Word doc and also submit a Tableau Workbook file .twb and the Excel file of your Data Warehouse that you used for Tableau visualizations**. Please see instructions for Tableau below in the question 3.

1. **(160 points)** Design and create a data warehouse for the provided database. The decisions about which fields to include and how to aggregate the data are left to you. You do not need to include every single data point from the 11 tables given. Use your judgement as to what will be interesting/useful for the organization. But please make sure that you pull (combine) data from **at least six tables** and compute relevant aggregate statistics. Please compute relevant aggregate statistics for each table that you join. In your queries later in part 2, you may join your Data Warehouse with other tables to answer useful questions. Please see many examples from class lectures and you may adapt those codes for your purpose (for this dataset).

Submit a screenshot of the first 25 rows of your data warehouse (paste into this Word document) and the SQL code that you used to create it. Please copy and paste your SQL code into this Word document. If you PC does not show 25 rows of data, please submit what you have (i.e., rows you can see on a screenshot) with a comment that you cannot show 25 rows of data. Please add a description of what your Data Warehouse will be tracking for a company.

Screenshot:



	ArtistId	Name	album_num	genre_num	frequency	FreqGroup	last_sold	LastGroup	distinct_customers	count_playlist	revenue	track_num	RevGroup	genre_explore
▶	1	AC/DC	2	1	16	2	2012-11-01 00:00:00	3	6	3	15.84	18	2	One Genre
	2	Accept	2	1	5	3	2012-11-01 00:00:00	3	4	4	4.95	4	3	One Genre
	3	Aerosmith	1	1	10	2	2012-11-06 00:00:00	3	4	3	9.90	15	2	Limited Album
	4	Alanis Morissette	1	1	8	2	2012-11-06 00:00:00	3	4	3	7.92	13	2	Limited Album
	5	Alice In Chains	1	1	7	3	2012-11-06 00:00:00	3	4	4	6.93	12	3	Limited Album
	6	Antônio Carlos Jobim	2	2	22	1	2012-12-29 00:00:00	3	12	3	21.78	31	1	Multiple Genre
	7	Apocalyptica	1	1	4	3	2012-11-06 00:00:00	3	3	3	3.96	8	3	Limited Album
	8	Audioslave	3	3	16	2	2012-11-06 00:00:00	3	8	3	15.84	40	2	Multiple Genre
	9	BackBeat	1	1	6	3	2012-11-06 00:00:00	3	4	3	5.94	12	3	Limited Album
	10	Billy Cobham	1	1	4	3	2012-11-06 00:00:00	3	4	2	3.96	8	3	Limited Album
	11	Black Label Society	2	1	8	2	2012-11-06 00:00:00	3	4	2	7.92	18	2	One Genre
	12	Black Sabbath	2	1	9	2	2012-11-27 00:00:00	3	6	3	8.91	17	2	One Genre
	13	Body Count	1	1	11	2	2012-11-29 00:00:00	3	6	3	10.89	17	2	Limited Album
	14	Bruce Dickinso	1	1	12	2	2012-11-29 00:00:00	3	7	3	11.88	11	2	Limited Album
	15	Buddy Guy	1	1	7	3	2012-11-29 00:00:00	3	4	2	6.93	11	3	Limited Album
	16	Caetano Veloso	2	1	21	1	2012-12-02 00:00:00	3	8	4	20.79	21	1	One Genre
	17	Chico Buarque	1	1	27	1	2013-01-07 00:00:00	3	11	4	26.73	34	1	Limited Album
	18	Chico Science & Na…	2	1	25	1	2012-12-07 00:00:00	3	6	3	24.75	36	1	One Genre
	19	Cidade Negra	2	1	16	2	2012-12-07 00:00:00	3	5	3	15.84	31	2	One Genre
	20	Cláudio Zoli	1	1	5	3	2012-12-07 00:00:00	3	4	2	4.95	10	3	Limited Album
	21	Various Artists	4	3	29	1	2013-02-02 00:00:00	3	14	2	28.71	56	1	Multiple Genre
	22	Led Zeppeli	14	1	87	1	2013-06-11 00:00:00	2	28	3	86.13	114	1	One Genre
	23	Frank Zappa & Cap…	1	1	4	3	2012-12-07 00:00:00	3	4	2	3.96	9	3	Limited Album
	24	Marcos Valle	1	1	7	3	2012-12-07 00:00:00	3	4	2	6.93	17	3	Limited Album
	27	Gilberto Gil	3	3	20	1	2013-04-01 00:00:00	2	8	4	19.80	32	1	Multiple Genre

ArtistId: ID number for each artist

Name: Name of each Artist

Album_num: how many albums each artist has

Genre_num: How many genres each artist has

Frequency: how many times the artist's song has been sold

FreqGroup: Artists are divided into 5 groups according to the frequency their tracks are sold. Those with most tracks sold are in group 1, those with least tracks sold are in group 5.

Last_sold: Date the song was last sold

LastGroup: After sorting Last_sold, divide them into 5 groups, where group 1 contains the artists, whose works have been purchased recently, and group 5 contains the artists whose works haven’t been purchased for a long time.

Distinct_customers: How many customers have bought this artist’s songs

Count_playlist: how many playlists this artist’s songs have been included in

Revenue: total revenue this artist made

Track_num: how many songs the artist has

RevGroup: Artists are divided into 5 groups according to the revenue earned by selling their tracks. Those with most revenues are in group 1, those with least revenues are in group 5.

Genre_explore: Indicates whether one artist with more than one album explores more genres. Limited Album means this artist only has one album. Multiple Genres means this artist has released more than 1 album and covers more than one genre. One Genre means this artist has released more than 1 album but focuses on only one genre.

SQL code:

```
USE Final_project;


CREATE OR REPLACE VIEW final_dw_dm AS

SELECT a.ArtistId, a.Name , al_num.album_num,

genre_num.genre_num, freq.frequency, freq.FreqGroup, freq.last_sold, freq.LastGroup,

tot_cust.distinct_customers, playlist.count_playlist, artist_revenue.revenue, track_count.track_num,
artist_revenue.RevGroup,

CASE WHEN genre_num.genre_num > 1 THEN 'Multiple Genre' WHEN al_num.album_num = 1 THEN
'Limited Album' ELSE 'One Genre' END AS genre_explore

FROM artist AS a

  JOIN (   SELECT art.ArtistId, COUNT(AlbumId) AS album_num
          FROM album AS al JOIN artist AS art
          ON al.ArtistId= art.ArtistId
          group by ArtistId
           ) AS al_num
    ON a.ArtistId= al_num.ArtistId
   JOIN(   SELECT art.ArtistId, COUNT(DISTINCT GenreId) AS genre_num
FROM artist AS art JOIN album AS al
          ON art.ArtistId= al.ArtistId JOIN track AS t
          ON al.AlbumId= t.AlbumId
          group by art.ArtistId
           ) AS genre_num
        ON a.ArtistId= genre_num.ArtistId
JOIN(    SELECT art.ArtistId, COUNT(il.InvoiceLineId) AS frequency,
 NTILE(5) OVER (ORDER BY COUNT(il.InvoiceLineId) DESC) AS FreqGroup,
 MAX(InvoiceDate) AS last_sold,
           NTILE(5) OVER (ORDER BY MAX(InvoiceDate) DESC) AS LastGroup
           FROM artist AS art JOIN album AS al
           ON art.ArtistId= al.ArtistId LEFT JOIN track AS t
           ON al.AlbumId= t.AlbumId LEFT JOIN invoiceline AS il
           ON t.TrackId= il.TrackId LEFT JOIN invoice AS i
           ON il.InvoiceId= i.InvoiceId
           GROUP BY art.ArtistId
           ) AS freq
    ON a.ArtistId= freq.ArtistId
    JOIN(   SELECT art.ArtistId, COUNT(DISTINCT c.CustomerId) AS distinct_customers
           FROM artist AS art JOIN album AS al
           ON art.ArtistId= al.ArtistId LEFT JOIN track AS t
           ON al.AlbumId= t.AlbumId LEFT JOIN invoiceline AS il
           ON t.TrackId= il.TrackId LEFT JOIN invoice AS i
           ON il.InvoiceId= i.InvoiceId LEFT JOIN customer AS c
           ON i.CustomerId= c.CustomerId
           GROUP BY art.ArtistId
           ) as tot_cust
       ON a.ArtistId= tot_cust.ArtistId
JOIN (   SELECT art.ArtistId, COUNT(DISTINCT PlaylistId) AS count_playlist
FROM artist AS art JOIN album AS al
          ON art.ArtistId= al.ArtistId JOIN track AS t
          ON al.AlbumId= t.AlbumId JOIN playlisttrack AS p
          ON t.TrackId= p.TrackId
          GROUP BY art.ArtistId
) AS playlist
     ON a.ArtistId = playlist.ArtistId
JOIN (SELECT art.ArtistId, SUM(il.UnitPrice * Quantity) AS revenue,
NTILE(5) OVER (ORDER BY SUM(il.UnitPrice * Quantity) DESC) AS RevGroup
FROM artist art JOIN album al
ON art.ArtistId = al.ArtistId
LEFT JOIN track t ON al.AlbumId = t.AlbumId
LEFT JOIN invoiceline il ON t.TrackId = il.TrackId
GROUP BY art.ArtistId) AS artist_revenue
     ON a.ArtistId = artist_revenue.ArtistId

     JOIN (SELECT art.ArtistId, COUNT( DISTINCT t.trackId) AS track_num
FROM artist AS art JOIN album AS al
          ON art.ArtistId= al.ArtistId JOIN track AS t
          ON al.AlbumId= t.AlbumId
          GROUP BY art.ArtistId) AS track_count
ON a.ArtistId  = track_count.ArtistId
```

```
   GROUP BY ArtistId

   ORDER BY ArtistId;


SELECT * FROM final_dw_dm;
```

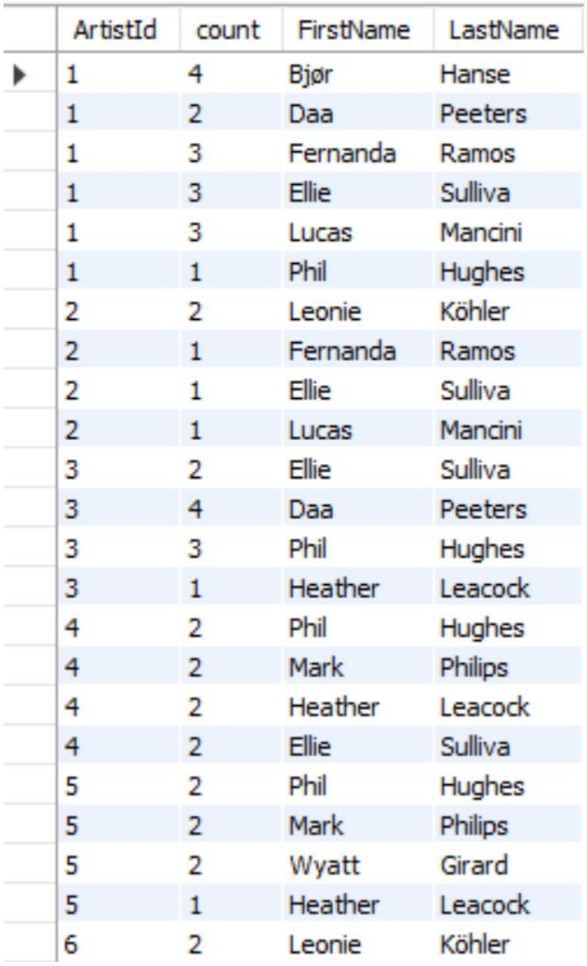
2. **(140 points)** Create **eight** SQL queries **on your data warehouse** (not on the original dataset) that answer interesting questions. At least **6** queries should be more complex queries. For example, more complex queries could include Joins, a Group By, UNION elements or a subquery or use some aggregate functions and summary calculations (see examples in the class lectures' slides).

Submit a copy of each query SQL code (paste into this Word document), and the screenshot of each query results (or the first 25 rows if it is longer or how many rows you can get on your PC) and full description of the question your SQL code was addressing and what you found in the results. The question that each query answers should be useful for a company to make decisions and act upon.

1. **The company wants to know for each artist how many times each customer purchased his/her songs.**

   For example, from the screenshot, Bjor Hanse purchased Artist 1's song 4 times while Daa peeters purchased Artist 1's song for 2 times. The graph is useful for the company to locate which customer is the top fan of which Artist. If the company wants to give back the fan benefits, they can choose a list from this, depending on how many fans from each artist they want to pick up.

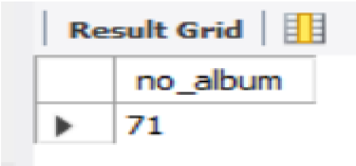
```
SELECT fdd.ArtistId, count(c.CustomerId) as count, c.FirstName, c.LastName

FROM final_dw_dm as fdd join album as al on al.ArtistId = fdd.ArtistId

join track as t on t.AlbumId = al.AlbumId

join invoiceline as il on t.TrackId = il.TrackId

join invoice as i on i.InvoiceId = il.InvoiceId

join customer as c on c.CustomerId = i.CustomerId

        group by c.CustomerId, fdd.ArtistId

        order by fdd.artistId;
```



	ArtistId	count	FirstName	LastName
▶	1	4	Bjør	Hanse
	1	2	Daa	Peeters
	1	3	Fernanda	Ramos
	1	3	Ellie	Sulliva
	1	3	Lucas	Mancini
	1	1	Phil	Hughes
	2	2	Leonie	Köhler
	2	1	Fernanda	Ramos
	2	1	Ellie	Sulliva
	2	1	Lucas	Mancini
	3	2	Ellie	Sulliva
	3	4	Daa	Peeters
	3	3	Phil	Hughes
	3	1	Heather	Leacock
	4	2	Phil	Hughes
	4	2	Mark	Philips
	4	2	Heather	Leacock
	4	2	Ellie	Sulliva
	5	2	Phil	Hughes
	5	2	Mark	Philips
	5	2	Wyatt	Girard
	5	1	Heather	Leacock
	6	2	Leonie	Köhler

2. How many artists do not have an album

```
SELECT (COUNT(artist.ArtistId)- COUNT(art.ArtistId)) AS no_album

FROM artist AS artist LEFT JOIN final_dw_dm AS art

ON artist.ArtistId=art.ArtistId;
```

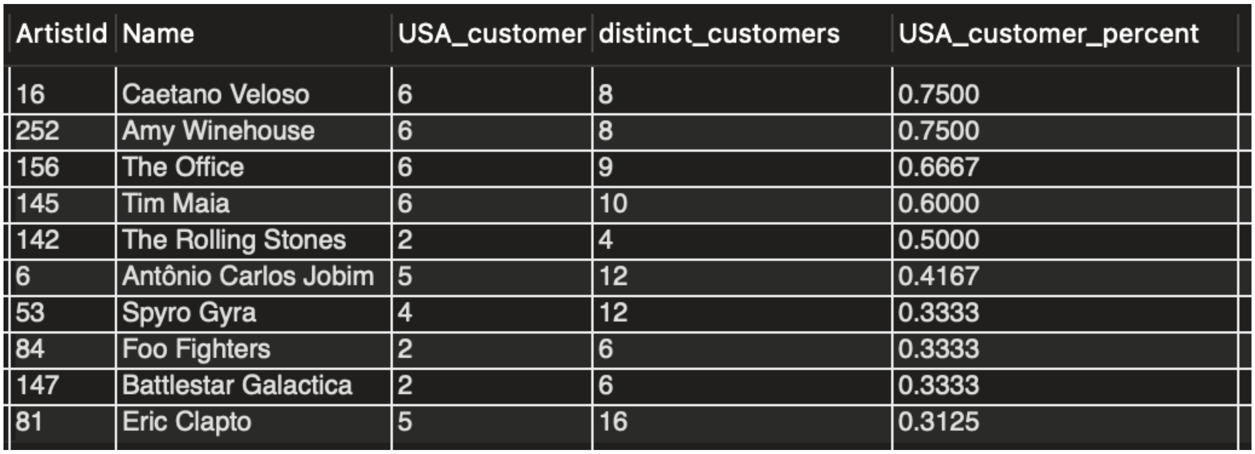


	no_album
▶	71

As we are tracking everything by artist, while making the warehouse we realized not all the artists have albums, this shows the difference between the artist in the warehouse and in the total table, which 71

3. **What are the top 10 artists with most percentage of customers in USA in Revenue Group 1?**

```
SELECT f.ArtistId, f.Name, COUNT(DISTINCT c.CustomerId) AS USA_customer, distinct_customers,
COUNT(DISTINCT c.CustomerId)/distinct_customers AS USA_customer_percent
FROM final_dw_dm AS f JOIN album AS al
ON f.ArtistId= al.ArtistId LEFT JOIN track AS t
ON al.AlbumId= t.AlbumId LEFT JOIN invoiceline AS il
ON t.TrackId= il.TrackId LEFT JOIN invoice AS i
ON il.InvoiceId= i.InvoiceId LEFT JOIN customer AS c
ON i.CustomerId= c.CustomerId
WHERE c.Country = 'USA' AND RevGroup = 1
GROUP BY f.ArtistId
ORDER BY USA_customer_percent DESC, USA_customer DESC LIMIT 10;
```



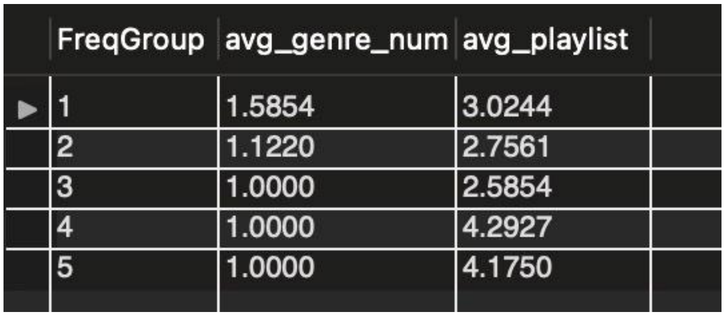
ArtistId	Name	USA_customer	distinct_customers	USA_customer_percent
16	Caetano Veloso	6	8	0.7500
252	Amy Winehouse	6	8	0.7500
156	The Office	6	9	0.6667
145	Tim Maia	6	10	0.6000
142	The Rolling Stones	2	4	0.5000
6	Antônio Carlos Jobim	5	12	0.4167
53	Spyro Gyra	4	12	0.3333
84	Foo Fighters	2	6	0.3333
147	Battlestar Galactica	2	6	0.3333
81	Eric Clapto	5	16	0.3125

From the outcome, the 10 artists in the most earning group have the most percentage of customers in USA. Among them, Caetano Veloso and Amy Winehouse have the most percentage of customers which is 75%, followed by The Office, whose number is 66.67%. Those artists are very potential since they are the most earning ones, and they have large proportion of fans in USA local.

4. **Do artists whose tracks are sold more tend to cover more genres? Do their tracks tend to appear in more playlists?**

```
SELECT FreqGroup, AVG(genre_num) AS avg_genre_num, AVG(count_playlist) AS avg_playlist
```

```
    FROM final_dw_dm

    GROUP BY FreqGroup

ORDER BY FreqGroup;
```

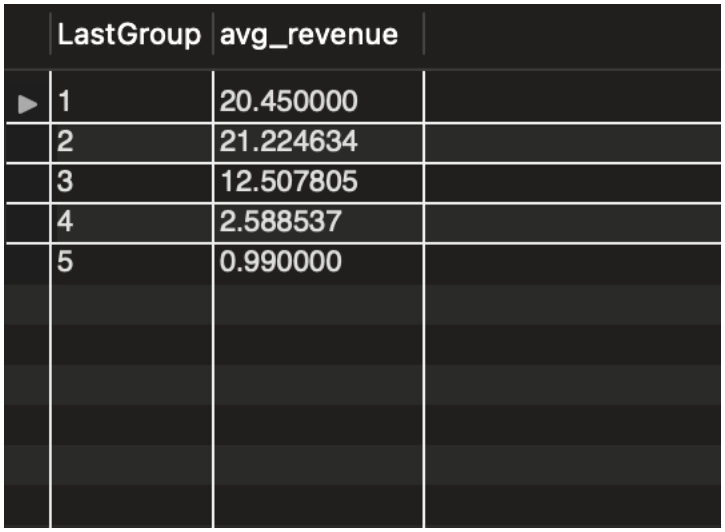


	FreqGroup	avg_genre_num	avg_playlist
▶	1	1.5854	3.0244
	2	1.1220	2.7561
	3	1.0000	2.5854
	4	1.0000	4.2927
	5	1.0000	4.1750

It is true that those artists with higher sales in their tracks tend to cover more genres on average. The first frequency groups on average covers 1.59 genre, while the last 3 groups of artists only focus on one genre. However, this phenomenon does not hold when it comes to playlist. Those most popular artists' tracks don't show up in more playlists than those unpopular artists.

5. **What is the average revenue for each LastGroup (the 5 groups for each artists' track last sold date)?**

```
SELECT LastGroup, AVG(revenue) AS avg_revenue

FROM final_dw_dm

GROUP BY LastGroup

ORDER BY LastGroup;
```

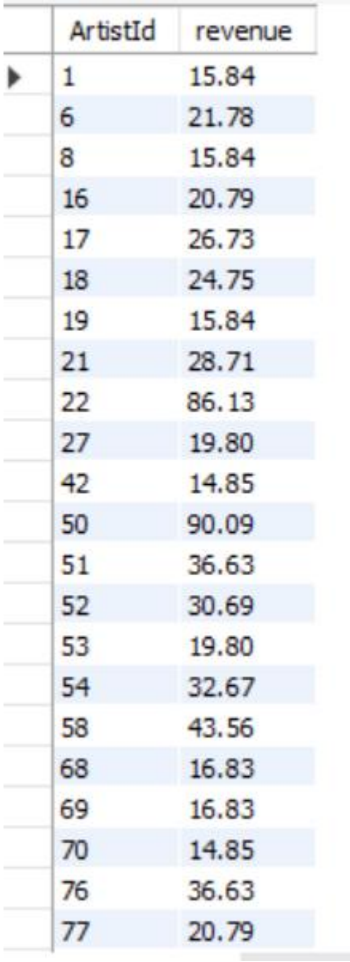


	LastGroup	avg_revenue
▶	1	20.450000
	2	21.224634
	3	12.507805
	4	2.588537
	5	0.990000

The group of artists whose tracks were sold most recently and those whose tracks were sold second most recently have the largest average revenue per artist and their number is close. Those artists in the 4th and 5th LastGroups have relatively low average revenue. This shows artists whose tracks are still sold recently tend to be more profitable.

6. ARTISTS BRINGING IN MORE THAN AVERAGE REVENUE AND HOW MUCH?

```
SELECT ArtistId, revenue

FROM final_dw_dm

WHERE revenue> (SELECT AVG(revenue) FROM final_dw_dm);
```

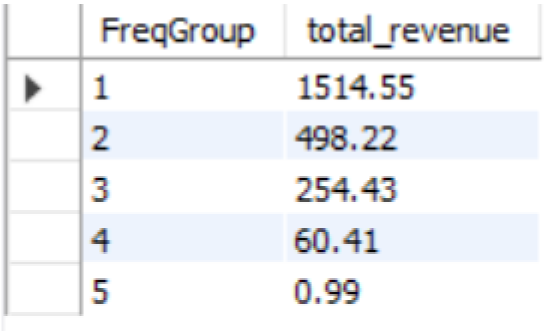


ArtistId	revenue
1	15.84
6	21.78
8	15.84
16	20.79
17	26.73
18	24.75
19	15.84
21	28.71
22	86.13
27	19.80
42	14.85
50	90.09
51	36.63
52	30.69
53	19.80
54	32.67
58	43.56
68	16.83
69	16.83
70	14.85
76	36.63
77	20.79

These are artists bringing in more than average of the total revenue and the amount of their revenue is also shown. The company should more focus on the artists with above average revenues like artist 50 whose average revenue reaches $90.

7. sum of revenue brought in by each freqgroup

```
SELECT FreqGroup, SUM(revenue) AS total_revenue

FROM final_dw_dm

GROUP BY FreqGroup

ORDER BY FreqGroup;
```

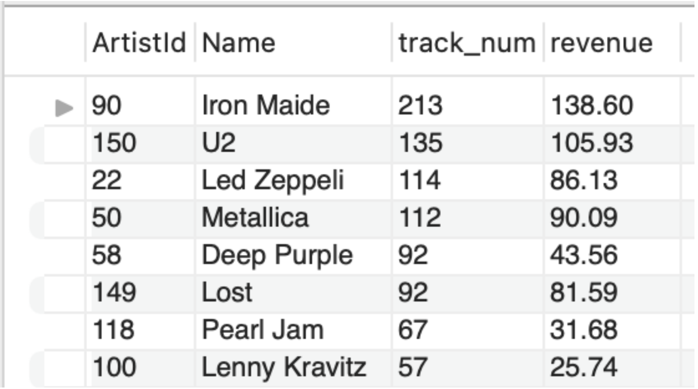


FreqGroup	total_revenue
1	1514.55
2	498.22
3	254.43
4	60.41
5	0.99

We can see from the table that groups with higher buying frequency have a higher total revenue. And, group-1, containing the artists with highest buying frequency, have a total revenue that is way higher than all the other groups. And the total revenue for group-5 is extremely low. Which might indicate that the company should give up on group-5 artists and collaborate more with group-1 artists.

8. Who are the five most productive artists? What are the revenue they bring?

```
SELECT ArtistId, Name, track_num, revenue

FROM final_dw_dm

ORDER BY track_num DESC;
```



ArtistId	Name	track_num	revenue
90	Iron Maide	213	138.60
150	U2	135	105.93
22	Led Zeppeli	114	86.13
50	Metallica	112	90.09
58	Deep Purple	92	43.56
149	Lost	92	81.59
118	Pearl Jam	67	31.68
100	Lenny Kravitz	57	25.74

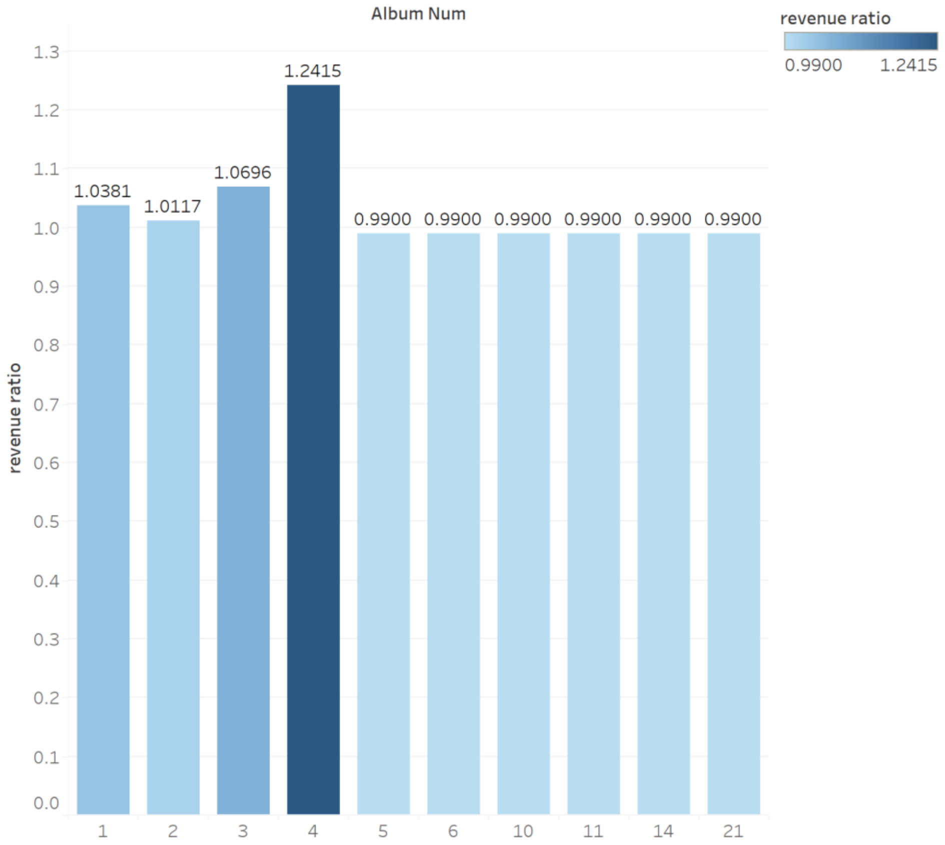
Iron Maide, U2, Led Zeppeli, Metallica and Deep Purple are the most productive five artists. And their revenue are shown in the screen shot above.

3. (**100 points**) Create **five** Tableau individual visualizations (graphs) **on your data warehouse** with valuable information to present findings to senior management of the company. Save each visualization as a png file (as we will practice in the lab 5) and paste each individual visualization png file **into this Word** document with the full explanation of what the visualizations show, how they are useful to a company and how company management could make decisions based on what you show. Finally, combine those **five** visualizations into one **Dashboard** (as we will practice in the lab 5), and save this Dashboard as a png file and **paste the Dashboard into this Word** document.

Please also save the whole Tableau project as a Tableau Workbook file .twb (In Tableau use File - Save as) and submit to the Final Team Project folder on Blackboard together with this Word document and together with the Excel file of your Data Warehouse which you uploaded to Tableau and used for visualizations. If you cannot attach the Tableau Workbook .twb file and the Excel file for your Data Warehouse to the Final Team Project folder on Blackboard, please email the Tableau Workbook .twb file and the Excel file for your Data Warehouse to me at mlysyako@simon.rochester.edu indicating your class section and your team name from Blackboard and all members in the email.

1. The company's operations are thinking about whether to encourage its artists to release more albums to create more receivables. This graph provides useful information on decision making. Looking at the chart, artists with more than five albums did not earn higher earnings. In the sample, artists with 4 albums had the highest earnings, while artists with only 1-3 albums all had an earnings ratio of more than 1. which means that more albums don't increase revenue.

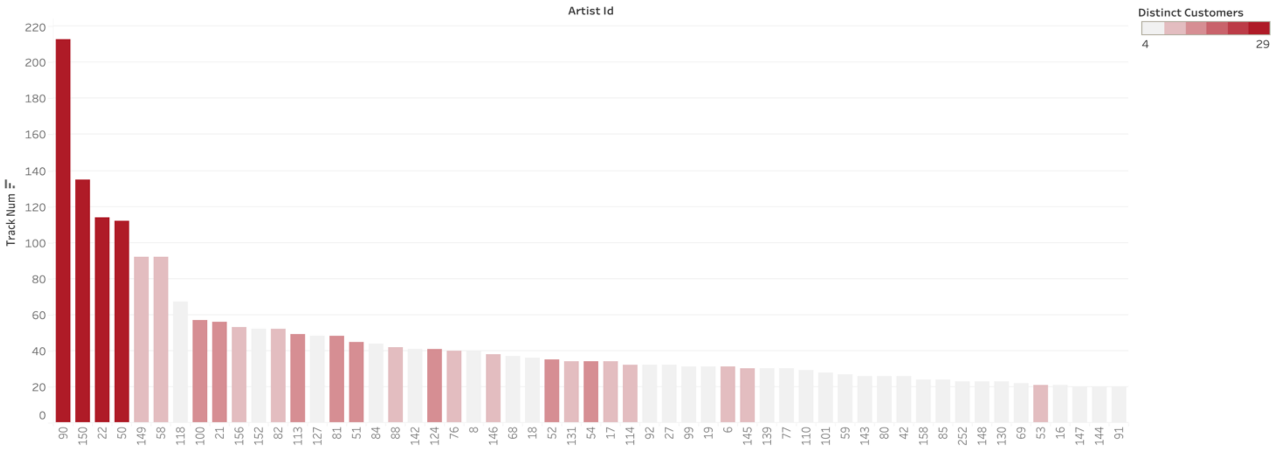
Profit ratio = sum{[revenue]}/ sum{[frequency]} revenue ratio of different album number



Revenue ratio for each Album Num. Color shows revenue ratio. The marks are labeled by revenue ratio.

2. Is it true that more productive artists are welcomed by more people? In other words, do artists with higher track_num also have more distinct customers? (With track_num larger than 20)

Track Number VS Distinct Customers

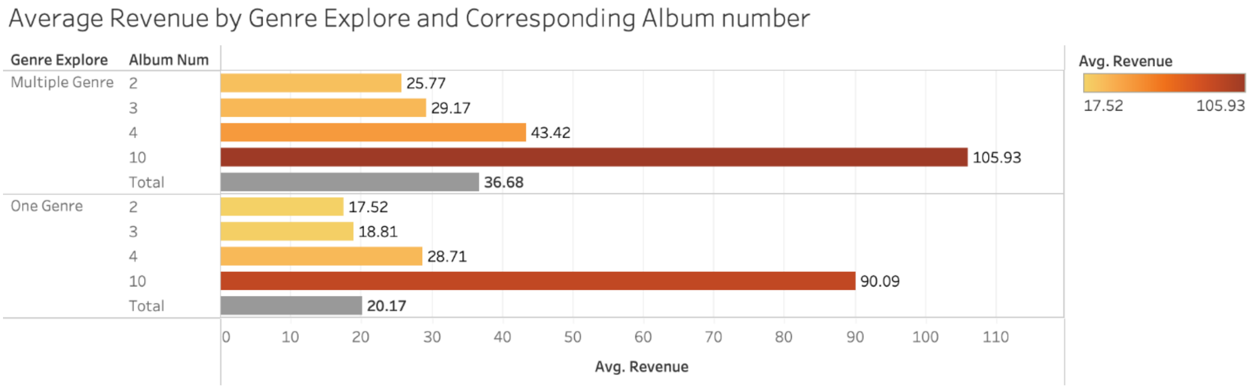


Sum of Track Num for each Artist Id. Color shows sum of Distinct Customers. The view is filtered on sum of Track Num, which includes values greater than or equal to 20.

We can see from the chart that, for the first few most productive artists, this statement is true. However, for those artists who have less than 92 tracks, higher productivity doesn't always mean more welcomed by customers.

Each track that is on sale causes its own part of operation costs. The company needs to decide wisely for choosing which artists' works to sale, productivity shouldn't be the only criterial, so that the cost-revenue ratio can be improved.

3. Do artists who have released several albums and explored more than one genres on average earn more than those who only focus on one single genre though having released several albums?

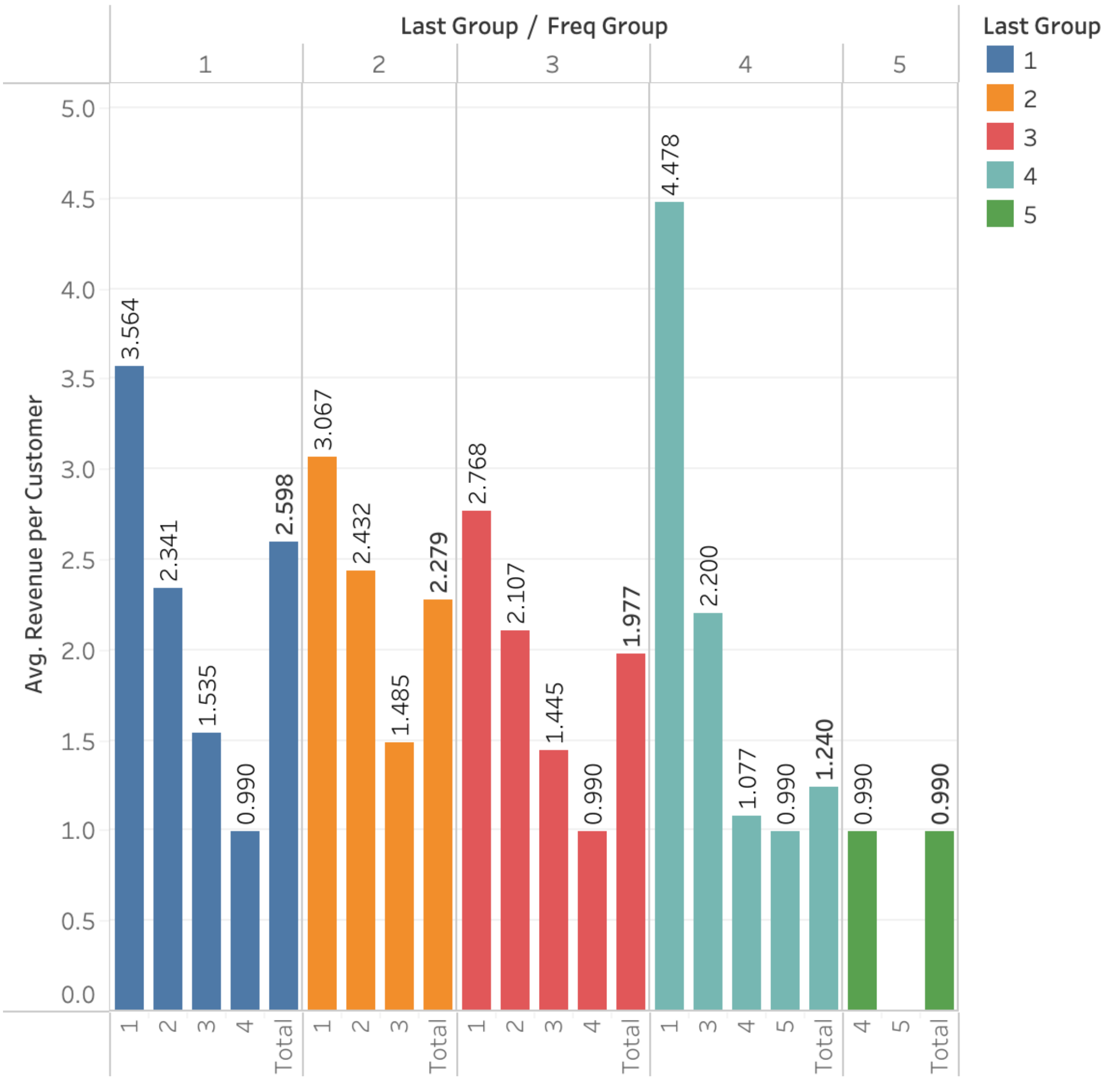


Average of Revenue for each Album Num broken down by Genre Explore. Color shows average of Revenue. The marks are labeled by average of Revenue. The view is filtered on Genre Explore and Album Num. The Genre Explore filter keeps Multiple Genre and One Genre. The Album Num filter keeps 2, 3, 4 and 10.

This visualization shows the average revenue for artists who explore multiple genres and focus on one genre in corresponding album number level. From the graph, it holds true that those artists who explore more genres earn more revenue on average than those only focus on one single genre at every corresponding level of album number. This means artists with diversified works can be more profitable than others.

4. Are the fans of artists whose tracks are most recently bought more loyal so that more profitable than the fans of artists whose tracks are not bought recently? What about the fans of the most popular artists?

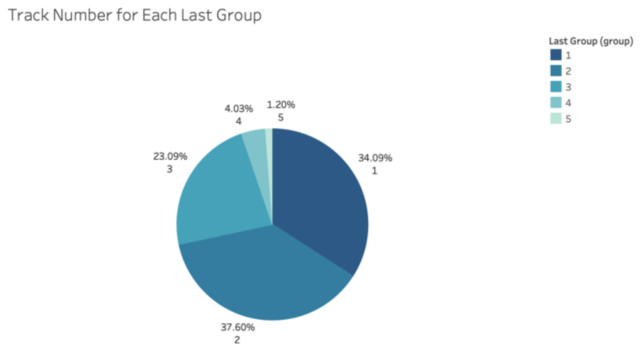
Average Revenue per Customer by Last Group and Frequency Group



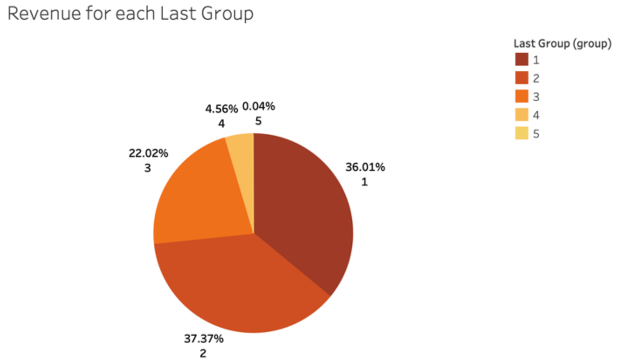
Average of Revenue per Customer for each Freq Group broken down by Last Group. Color shows details about Last Group. The marks are labeled by average of Revenue per Customer.

This shows the average revenue per customer of each Last Group and Frequency Group. The average revenue per customer shows how profitable one artist's fans are. This graph shows very clear trend that the more frequently an artist's track is bought, the more profitable their customers are. Generally, the artists with tracks being more recently bought tend to have more profitable fans, though the first frequency group in the fourth last group has especially high average revenue per customer.

5. Compare the percentage Revenue and Track Number each Last Group take in total?


Track Number for Each Last Group

% of Total Track Num and Last Group (group). Color shows details about Last Group (group). The marks are labeled by % of Total Track Num and Last Group (group).


Revenue for each Last Group

% of Total Revenue for each Last Group and Last Group (group). Color shows details about Last Group (group). The marks are labeled by % of Total Revenue for each Last Group and Last Group (group).

Comparing these two pie-plots we can see that:

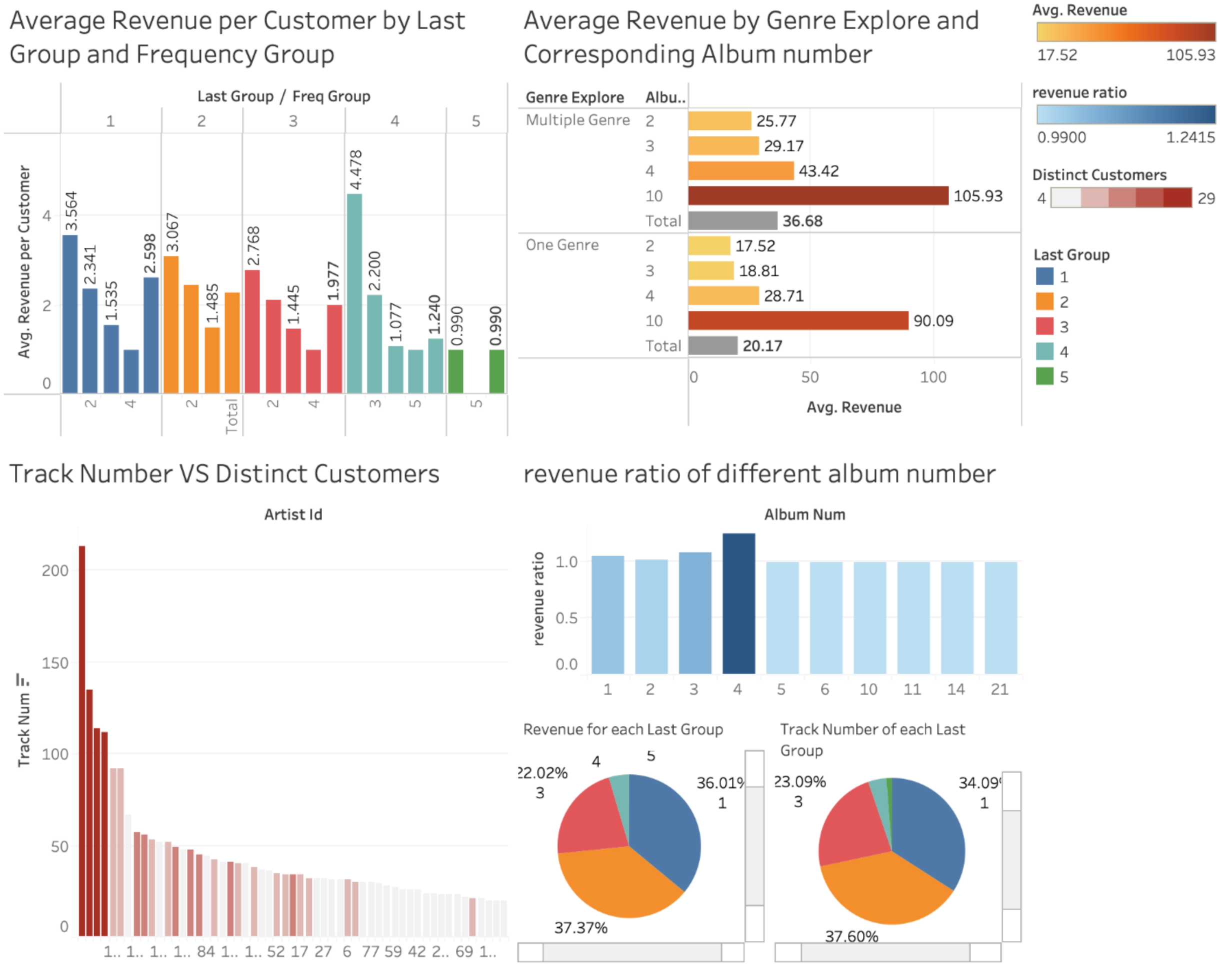
Although the revenue brought by artists from group-5 (whose works haven’t been purchased for a long time) takes only 0.04% in total, the number of tracks sold of group-5 takes 1.20% in total track sales, which is significantly larger than 0.04%.

Then looking at group-1, the revenue percentage (36.01%) is significantly larger than the track number percentage (34.09%).

Intuitively, the company might need to reduce the number of tracks on sale created by group-5 artists, and do promotions on tracks created by group-1 artists since they have higher ability of making profits.

Please also save the whole Tableau project as a Tableau Workbook file .twb (In Tableau use File - Save as) and submit to the Final Team Project folder on Blackboard together with this Word document and together with the Excel file of your Data Warehouse which you uploaded to Tableau and used for visualizations. If you cannot attach the Tableau Workbook .twb file and the Excel file for your Data Warehouse to the Final Team Project folder on Blackboard, please email the Tableau Workbook .twb

file and the Excel file for your Data Warehouse to me at mlysyako@simon.rochester.edu indicating your class section and your team name from Blackboard and all members in the email.



General grading criteria: Your completed work will be evaluated using the criteria below. I encourage you to use your creativity and other business skills (communication, presentation, critical thinking) in addition to the data management concepts and the SQL and Tableau skills that we have covered in CIS467.

High score	**Score between high and good**	**Good/medium score**	**Low score**
All required parts of the final project are complete and technically correct. Queries are useful/interesting and provide valuable	All required parts of the final project are complete and technically correct (with possibly a few minor errors). Queries are	Some required parts of the final project are missing and/or there are more significant errors. Some queries appear random and do not	The final project has large portions missing and/or major conceptual errors. Most/all queries (if any) appear random and do not answer

information for senior management to act upon. Not just random queries. Tableau visualizations provide interesting useful information based on which senior management of the company can make important decisions.	useful/interesting and provide valuable information for senior management to act upon. Not just random queries (with possibly a few minor errors). Tableau visualizations provide interesting useful information based on which senior management of the company can make important decisions (with possibly a few minor errors).	answer any useful/interesting questions. Tableau visualizations are very simple but may still provide interesting useful information based on which senior management of the company can make important decisions.	any useful/interesting questions. Tableau visualizations are very simple and **do not** provide interesting useful information based on which senior management of the company can make important decisions.