

# Twitter Sentiment Analysis for US Airlines

October 5, 2023

## 1 Setup

```
[46]: import warnings
warnings.filterwarnings('ignore')

import pandas as pd
import numpy as np
from plotnine import *
import seaborn as sn
import matplotlib.pyplot as plt

%matplotlib inline
```

```
[2]: from google.colab import files
uploaded = files.upload()
```

<IPython.core.display.HTML object>

Saving Tweets.csv to Tweets.csv

```
[47]: import io
myDF = pd.read_csv(io.BytesIO(uploaded['Tweets.csv']))
myDF
```

```
[47]:
```

	tweet_id	airline_sentiment	airline_sentiment_confidence	\
0	570306133677760513	neutral	1.0000	
1	570301130888122368	positive	0.3486	
2	570301083672813571	neutral	0.6837	
3	570301031407624196	negative	1.0000	
4	570300817074462722	negative	1.0000	
...	...	...	...	
14635	569587686496825344	positive	0.3487	
14636	569587371693355008	negative	1.0000	
14637	569587242672398336	neutral	1.0000	
14638	569587188687634433	negative	1.0000	
14639	569587140490866689	neutral	0.6771	
	negativereason	negativereason_confidence	airline	\

0		NaN		NaN	Virgin America
1		NaN		0.0000	Virgin America
2		NaN		NaN	Virgin America
3		Bad Flight		0.7033	Virgin America
4		Can't Tell		1.0000	Virgin America
...		...		...	...
14635		NaN		0.0000	American
14636	Customer Service Issue			1.0000	American
14637		NaN		NaN	American
14638	Customer Service Issue			0.6659	American
14639		NaN		0.0000	American

	airline_sentiment_gold	name	negativereason_gold	\
0	NaN	cairdin	NaN	
1	NaN	jnardino	NaN	
2	NaN	yvonnalynn	NaN	
3	NaN	jnardino	NaN	
4	NaN	jnardino	NaN	
...	...	...	...	
14635	NaN	KristenReenders	NaN	
14636	NaN	itsropes	NaN	
14637	NaN	sanyabun	NaN	
14638	NaN	SraJackson	NaN	
14639	NaN	daviddtwu	NaN	

	retweet_count	text	\
0	0	@VirginAmerica What @dhepburn said.	
1	0	@VirginAmerica plus you've added commercials t...	
2	0	@VirginAmerica I didn't today... Must mean I n...	
3	0	@VirginAmerica it's really aggressive to blast...	
4	0	@VirginAmerica and it's a really big bad thing...	
...	...	...	
14635	0	@AmericanAir thank you we got on a different f...	
14636	0	@AmericanAir leaving over 20 minutes Late Flig...	
14637	0	@AmericanAir Please bring American Airlines to...	
14638	0	@AmericanAir you have my money, you change my ...	
14639	0	@AmericanAir we have 8 ppl so we need 2 know h...	

	tweet_coord	tweet_created	tweet_location	\
0	NaN	2015-02-24 11:35:52 -0800	NaN	
1	NaN	2015-02-24 11:15:59 -0800	NaN	
2	NaN	2015-02-24 11:15:48 -0800	Lets Play	
3	NaN	2015-02-24 11:15:36 -0800	NaN	
4	NaN	2015-02-24 11:14:45 -0800	NaN	
...	...	...	...	
14635	NaN	2015-02-22 12:01:01 -0800	NaN	
14636	NaN	2015-02-22 11:59:46 -0800	Texas	

14637	NaN	2015-02-22 11:59:15 -0800	Nigeria,lagos
14638	NaN	2015-02-22 11:59:02 -0800	New Jersey
14639	NaN	2015-02-22 11:58:51 -0800	dallas, TX

	user_timezone
0	Eastern Time (US & Canada)
1	Pacific Time (US & Canada)
2	Central Time (US & Canada)
3	Pacific Time (US & Canada)
4	Pacific Time (US & Canada)
...	...
14635	NaN
14636	NaN
14637	NaN
14638	Eastern Time (US & Canada)
14639	NaN

[14640 rows x 15 columns]

```
[4]: print(myDF.isnull().sum())
myDF = myDF.drop(columns = ["airline_sentiment_gold", "negativereason_gold",
↪ "tweet_coord"])
myDF.head()
```

tweet_id	0
airline_sentiment	0
airline_sentiment_confidence	0
negativereason	5462
negativereason_confidence	4118
airline	0
airline_sentiment_gold	14600
name	0
negativereason_gold	14608
retweet_count	0
text	0
tweet_coord	13621
tweet_created	0
tweet_location	4733
user_timezone	4820
dtype:	int64

```
[4]:      tweet_id  airline_sentiment  airline_sentiment_confidence  \
0  570306133677760513          neutral          1.0000
1  570301130888122368        positive          0.3486
2  570301083672813571          neutral          0.6837
3  570301031407624196         negative          1.0000
4  570300817074462722         negative          1.0000
```

	negativereason	negativereason_confidence	airline	name \
0	NaN	NaN	Virgin America	cairdin
1	NaN	0.0000	Virgin America	jnardino
2	NaN	NaN	Virgin America	yvonnalynn
3	Bad Flight	0.7033	Virgin America	jnardino
4	Can't Tell	1.0000	Virgin America	jnardino

	retweet_count	text \
0	0	@VirginAmerica What @dhepburn said.
1	0	@VirginAmerica plus you've added commercials t...
2	0	@VirginAmerica I didn't today... Must mean I n...
3	0	@VirginAmerica it's really aggressive to blast...
4	0	@VirginAmerica and it's a really big bad thing..

	tweet_created	tweet_location	user_timezone
0	2015-02-24 11:35:52 -0800	NaN	Eastern Time (US & Canada)
1	2015-02-24 11:15:59 -0800	NaN	Pacific Time (US & Canada)
2	2015-02-24 11:15:48 -0800	Lets Play	Central Time (US & Canada)
3	2015-02-24 11:15:36 -0800	NaN	Pacific Time (US & Canada)
4	2015-02-24 11:14:45 -0800	NaN	Pacific Time (US & Canada)

All tweets were created in February 2015

```
[5]: print(myDF["airline"].value_counts())
```

```
United          3822
US Airways      2913
American        2759
Southwest       2420
Delta           2222
Virgin America   504
Name: airline, dtype: int64
```

```
[6]: United_DF = myDF.loc[myDF['airline'] == "United"]
print("United DF:", United_DF.shape)

US_Airways_DF = myDF.loc[myDF['airline'] == "US Airways"]
print("US Airways DF:", US_Airways_DF.shape)

American_DF = myDF.loc[myDF['airline'] == "American"]
print("American DF:", American_DF.shape)

Southwest_DF = myDF.loc[myDF['airline'] == "Southwest"]
print("Southwest DF:", Southwest_DF.shape)

Delta_DF = myDF.loc[myDF['airline'] == "Delta"]
```

```
print("Delta DF:", Delta_DF.shape)

Virgin_America_DF = myDF.loc[myDF['airline'] == "Virgin America"]
print("Virgin America DF:", Virgin_America_DF.shape)
```

```
United DF: (3822, 12)
US Airways DF: (2913, 12)
American DF: (2759, 12)
Southwest DF: (2420, 12)
Delta DF: (2222, 12)
Virgin America DF: (504, 12)
```

```
[7]: temp_DF = myDF[["negativereason", "text"]]
temp_DF
```

```
[7]:
```

	negativereason	text
0	NaN	
1	NaN	
2	NaN	
3	Bad Flight	
4	Can't Tell	
...	...	
14635	NaN	
14636	Customer Service Issue	
14637	NaN	
14638	Customer Service Issue	
14639	NaN	
...	...	
0		@VirginAmerica What @dhepburn said.
1		@VirginAmerica plus you've added commercials t...
2		@VirginAmerica I didn't today... Must mean I n...
3		@VirginAmerica it's really aggressive to blast...
4		@VirginAmerica and it's a really big bad thing...
...		...
14635		@AmericanAir thank you we got on a different f...
14636		@AmericanAir leaving over 20 minutes Late Flig...
14637		@AmericanAir Please bring American Airlines to...
14638		@AmericanAir you have my money, you change my ...
14639		@AmericanAir we have 8 ppl so we need 2 know h...

[14640 rows x 2 columns]

We will ignore the “Can’t Tell” section since the model used to detect the sentiment was unable to find a reasoning

The breakdown of reasons are listed in the dataframe above, and while some are self explanatory (late flight, cancelled flight, lost luggage, damaged luggage, long line, flight attendant complaints),

others require a deeper dive into the actual texts (customer service issue, bad flight, flight booking problems)

Customer Service Issue Common Reasons:

- issues with website/ applications crashing
- late response times to inquiries/ not able to talk to representatives
- issues with transferring tickets
- rude employees

Bad Flight Common Reasons: - customer centric mechanical issues (seat, headphone jack, entertainment system) - spotty wifi - issues with seats, seat placement, and amount of space - issues with food/ drink options - flight delays

Flight Booking Problems Common Reasons:

- rewards points not working
- website crashing/ no confirmation emails
- unhelpful staff

## 1.1 United Airlines Data

```
[8]: United_DF.head()
```

```
[8]:
```

	tweet_id	airline_sentiment	airline_sentiment_confidence	
504	570307876897628160	positive	1.0000	
505	570307847281614848	positive	1.0000	
506	570307109704900608	negative	1.0000	
507	570307026263384064	negative	1.0000	
508	570306733010264064	positive	0.3441	

	negativereason	negativereason_confidence	airline	name	
504	NaN	NaN	United	rdowning76	
505	NaN	NaN	United	CoreyAStewart	
506	Cancelled Flight	0.703	United	CoralReefer420	
507	Late Flight	1.000	United	lsalazar11	
508	NaN	0.000	United	rombaa	

	retweet_count	text	
504	0	@united thanks	
505	0	@united Thanks for taking care of that MR!! Ha...	
506	0	@united still no refund or word via DM. Please...	
507	0	@united Delayed due to lack of crew and now de...	
508	0	@united thanks -- we filled it out. How's our ...	

	tweet_created	tweet_location	
504	2015-02-24 11:42:48 -0800	usa	
505	2015-02-24 11:42:41 -0800	Richmond, VA	
506	2015-02-24 11:39:45 -0800	Bay Area, California	
507	2015-02-24 11:39:25 -0800	NaN	

```
508 2015-02-24 11:38:15 -0800 NaN
```

```
user_timezone
504 NaN
505 Eastern Time (US & Canada)
506 Alaska
507 Mountain Time (US & Canada)
508 NaN
```

```
[9]: (United_DF["retweet_count"]).describe()
```

```
[9]: count    3822.000000
mean      0.110152
std       0.368416
min       0.000000
25%       0.000000
50%       0.000000
75%       0.000000
max       7.000000
Name: retweet_count, dtype: float64
```

```
[10]: print(United_DF["airline_sentiment"].value_counts())

United_Sentiment_Frequency = {'Sentiment': ['Negative', 'Neutral', 'Positive'],
                                'Counts': [2633, 697, 492]}

United_Sentiments_DF = pd.DataFrame(United_Sentiment_Frequency)

wedges, texts, autotexts = plt.pie(United_Sentiments_DF['Counts'],
                                    labels = United_Sentiments_DF['Sentiment'],
                                    autopct='%1.0f%%',
                                    wedgeprops = {"edgecolor": "black",
                                                    'linewidth': 2,
                                                    'antialiased': True})

plt.title('Frequency of Sentiments')

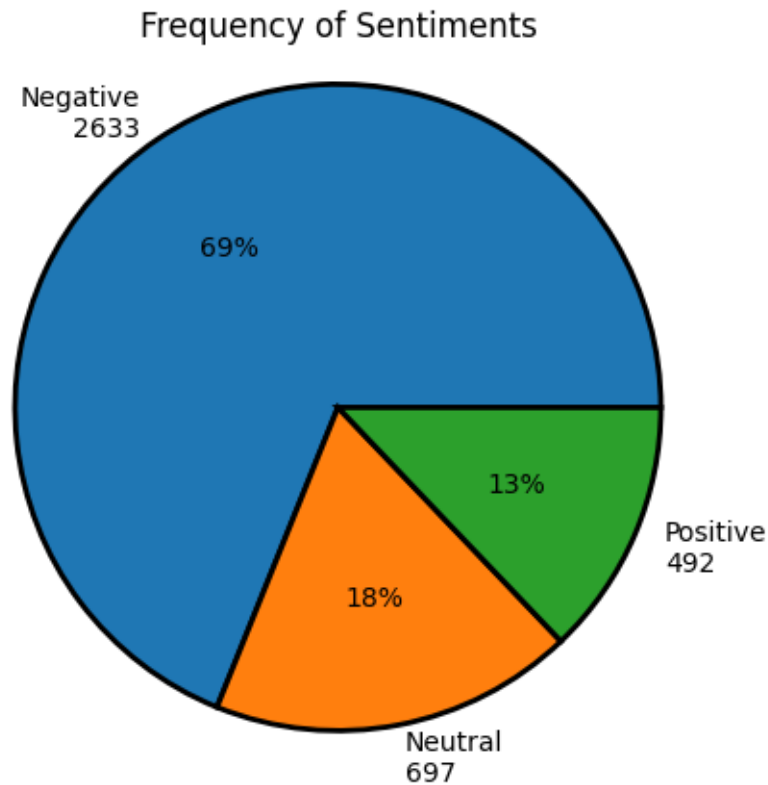
for i, count in enumerate(United_Sentiments_DF['Counts']):
    texts[i].set_text(f'{United_Sentiments_DF["Sentiment"][i]}\n{count}')

plt.axis('equal')

plt.show()
```

```
negative    2633
neutral     697
```

```
positive      492
Name: airline_sentiment, dtype: int64
```



```
[11]: print(United_DF["negativereason"].value_counts())

United_Negative_Sentiment_Frequency = {'Negative Reason': ['Customer Service_Issue', 'Late Flight', 'Lost Luggage', 'Bad Flight', 'Cancelled Flight', 'Flight Attendant Complaints', 'Flight Booking_Problems', 'Long Lines', 'Damaged Luggage'],
                                         'Counts': [681, 525, 269, 216, 181, 168, 144, 48, 22]}
United_Negative_Sentiment_Frequency_DF = pd.DataFrame(United_Negative_Sentiment_Frequency)
United_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_Sentiments"] = United_Negative_Sentiment_Frequency_DF["Counts"] / 2633
United_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_Sentiments"] = United_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_Sentiments"].round(3)
```



```

United_Negative_Sentiment_Frequency_DF["Percentage of Total Negative_
↳Sentiments"] = United_Negative_Sentiment_Frequency_DF["Percentage Value of_
↳Total Negative Sentiments"].map('{:.2%}'.format)
United_Negative_Sentiment_Frequency_DF

```

```

Customer Service Issue      681
Late Flight                  525
Can't Tell                   379
Lost Luggage                 269
Bad Flight                   216
Cancelled Flight             181
Flight Attendant Complaints  168
Flight Booking Problems      144
longlines                    48
Damaged Luggage              22
Name: negativereason, dtype: int64

```

```

[11]:          Negative Reason  Counts  \
0      Customer Service Issue    681
1              Late Flight      525
2              Lost Luggage     269
3              Bad Flight       216
4      Cancelled Flight         181
5  Flight Attendant Complaints   168
6      Flight Booking Problems   144
7              Long Lines        48
8      Damaged Luggage           22

```

```

          Percentage Value of Total Negative Sentiments  \
0                                                    0.259
1                                                    0.199
2                                                    0.102
3                                                    0.082
4                                                    0.069
5                                                    0.064
6                                                    0.055
7                                                    0.018
8                                                    0.008

```

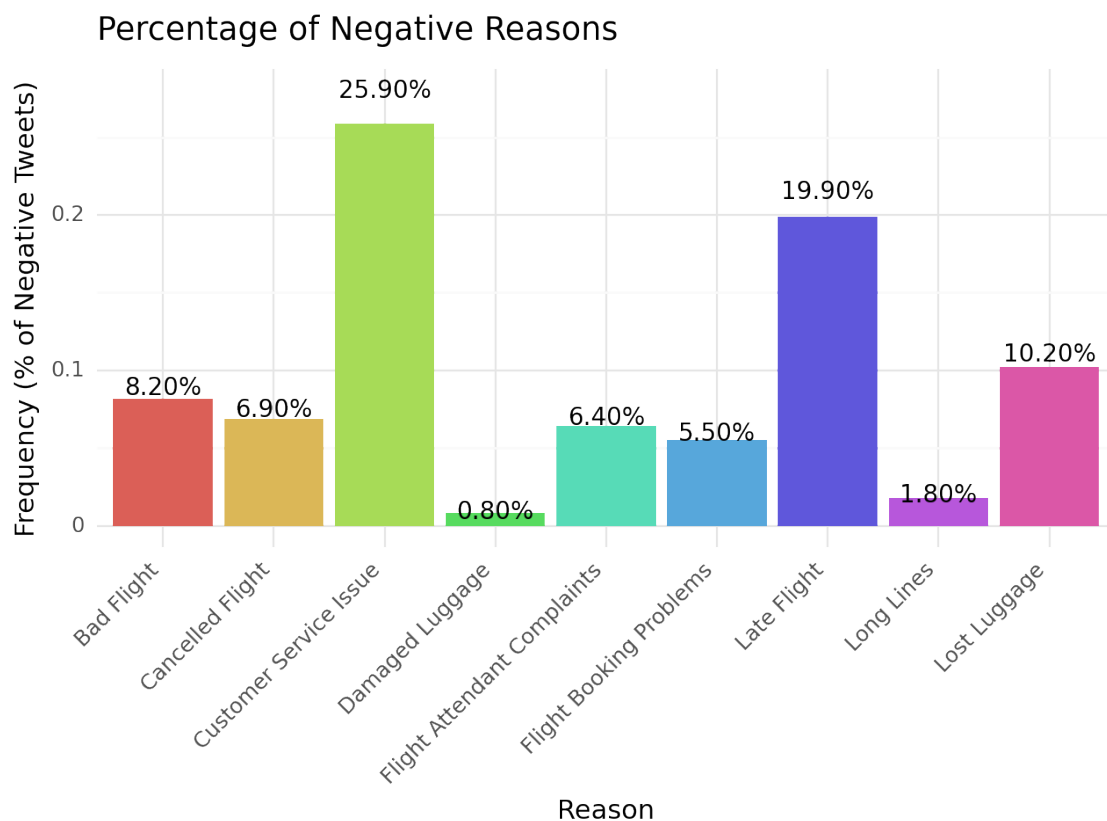
```

          Percentage of Total Negative Sentiments
0                        25.90%
1                        19.90%
2                        10.20%
3                         8.20%
4                         6.90%
5                         6.40%
6                         5.50%

```

7 1.80%  
8 0.80%

```
[12]: print(ggplot(United_Negative_Sentiment_Frequency_DF, aes(x = "Negative Reason",  
↪y = "Percentage Value of Total Negative Sentiments", fill = "Negative_  
↪Reason" )) +  
      geom_bar(stat = "identity") +  
      geom_text(aes(label = "Percentage of Total Negative Sentiments"),  
↪position = position_stack(vjust = 1.08), size = 10) +  
      theme_minimal() +  
      labs(title = "Percentage of Negative Reasons",  
           x = "Reason",  
           y = "Frequency (% of Negative Tweets)") +  
      theme(axis_text_x = element_text(angle = 45, ha = "right"),  
            legend_position = "none"))
```



Of the 3822 tweets centered around United Airlines → 2633 of the tweets had a negative sentiment

## 1.2 US Airways Data

```
[13]: US_Airways_DF.head()
```

```
[13]:      tweet_id airline_sentiment  airline_sentiment_confidence \
8966  570310600460525568      negative                0.6292
8967  570310144459972608      negative                1.0000
8968  570309340952993796      neutral                1.0000
8969  570309000279023616      neutral                1.0000
8970  570308799950692353      negative                1.0000

      negativereason  negativereason_confidence  airline \
8966  Flight Booking Problems                0.3146  US Airways
8967  Customer Service Issue                1.0000  US Airways
8968      NaN                                NaN    US Airways
8969      NaN                                NaN    US Airways
8970  Customer Service Issue                0.6452  US Airways

      name  retweet_count \
8966    jhazelnut          0
8967    GAKotsch          0
8968  DebbiMcGinnis          0
8969  AshleyKatherton          0
8970  retardedlarry          0

      text \
8966 @USAirways is there a better time to call? My...
8967 @USAirways and when will one of these agents b...
8968 @USAirways is a DM possible if you aren't foll...
8969 @USAirways Fortunately you have staff like Lyn...
8970 @USAirways just hung up on me again. Another ...

      tweet_created tweet_location  user_timezone
8966  2015-02-24 11:53:37 -0800      NaN          NaN
8967  2015-02-24 11:51:48 -0800      NaN  Atlantic Time (Canada)
8968  2015-02-24 11:48:37 -0800  Missouri          Hawaii
8969  2015-02-24 11:47:16 -0800      NaN  Central Time (US & Canada)
8970  2015-02-24 11:46:28 -0800      NaN          NaN
```

```
[14]: (US_Airways_DF["retweet_count"]).describe()
```

```
[14]: count      2913.000000
mean         0.085479
std          1.172269
min          0.000000
25%          0.000000
50%          0.000000
```

```
75%          0.000000
max          44.000000
Name: retweet_count, dtype: float64
```

```
[15]: print(US_Airways_DF["airline_sentiment"].value_counts())

US_Airways_Sentiment_Frequency = {'Sentiment': ['Negative', 'Neutral', 'Positive'],
                                   'Counts': [2263, 381, 269]}

US_Airways_Sentimnts_DF = pd.DataFrame(US_Airways_Sentiment_Frequency)

wedges, texts, autotexts = plt.pie(US_Airways_Sentimnts_DF['Counts'],
                                   labels = US_Airways_Sentimnts_DF['Sentiment'],
                                   autopct='%1.0f%%',
                                   wedgeprops = {"edgecolor": "black",
                                                  'linewidth': 2,
                                                  'antialiased': True})

plt.title('Frequency of Sentiments')

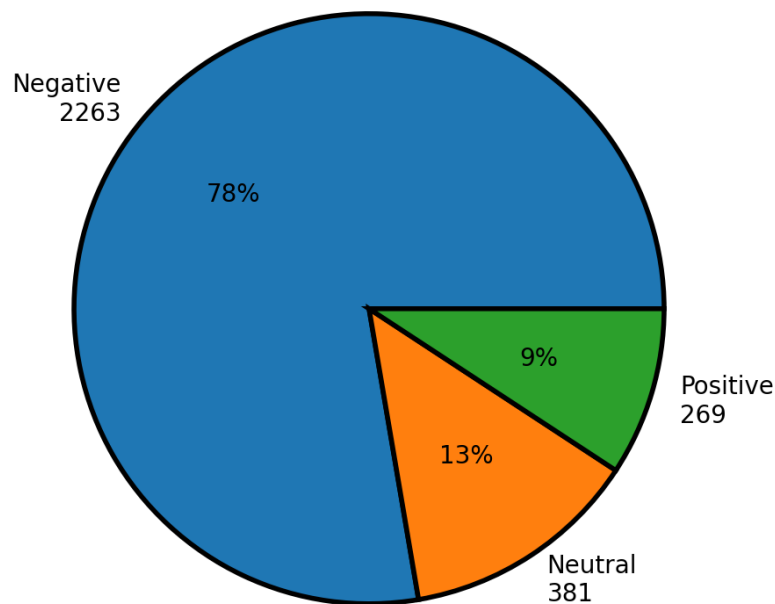
for i, count in enumerate(US_Airways_Sentimnts_DF['Counts']):
    texts[i].set_text(f'{US_Airways_Sentimnts_DF["Sentiment"][i]}\n{count}')

plt.axis('equal')

plt.show()
```

```
negative    2263
neutral     381
positive    269
Name: airline_sentiment, dtype: int64
```

Frequency of Sentiments



```
[16]: print(US_Airways_DF["negativereason"].value_counts())

US_Airways_Negative_Sentiment_Frequency = {'Negative Reason': ['Customer_
↳Service Issue', 'Late Flight', 'Lost Luggage', 'Bad Flight', 'Cancelled_
↳Flight', 'Flight Attendant Complaints',
                                                    'Flight Booking_
↳Problems', 'Long Lines', 'Damaged Luggage'],
                                             'Counts': [811, 453, 154, 104, 189,
↳123, 122, 50, 11]}
US_Airways_Negative_Sentiment_Frequency_DF = pd.
↳DataFrame(US_Airways_Negative_Sentiment_Frequency)
US_Airways_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_
↳Sentiments"] = US_Airways_Negative_Sentiment_Frequency_DF["Counts"] / 2263
US_Airways_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_
↳Sentiments"] = US_Airways_Negative_Sentiment_Frequency_DF["Percentage Value
↳of Total Negative Sentiments"].round(3)
US_Airways_Negative_Sentiment_Frequency_DF["Percentage of Total Negative_
↳Sentiments"] = US_Airways_Negative_Sentiment_Frequency_DF["Percentage Value
↳of Total Negative Sentiments"].map('{:.2%}'.format)
US_Airways_Negative_Sentiment_Frequency_DF
```

Customer Service Issue	811
Late Flight	453
Can't Tell	246
Cancelled Flight	189
Lost Luggage	154
Flight Attendant Complaints	123
Flight Booking Problems	122
Bad Flight	104
longlines	50
Damaged Luggage	11

Name: negativereason, dtype: int64

```
[16]:
```

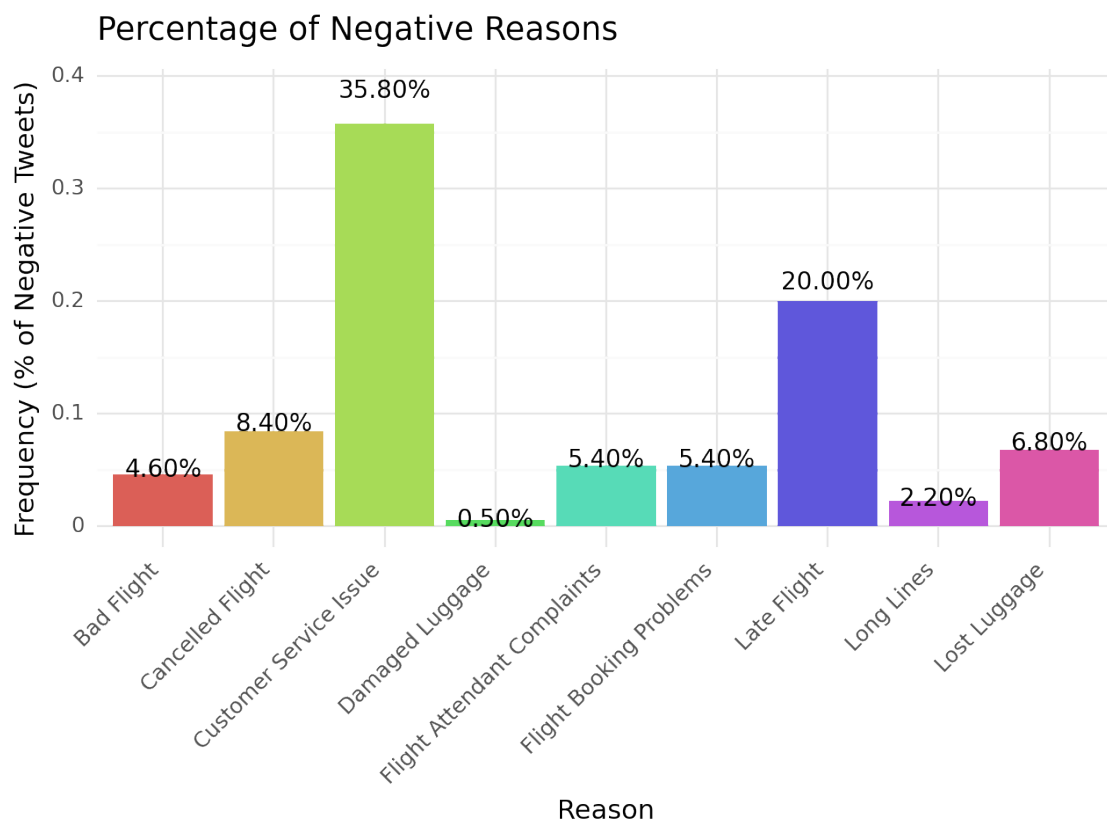
	Negative Reason	Counts \
0	Customer Service Issue	811
1	Late Flight	453
2	Lost Luggage	154
3	Bad Flight	104
4	Cancelled Flight	189
5	Flight Attendant Complaints	123
6	Flight Booking Problems	122
7	Long Lines	50
8	Damaged Luggage	11

	Percentage Value of Total Negative Sentiments \
0	0.358
1	0.200
2	0.068
3	0.046
4	0.084
5	0.054
6	0.054
7	0.022
8	0.005

	Percentage of Total Negative Sentiments
0	35.80%
1	20.00%
2	6.80%
3	4.60%
4	8.40%
5	5.40%
6	5.40%
7	2.20%
8	0.50%

```
[17]:
```

```
print(ggplot(US_Airways_Negative_Sentiment_Frequency_DF, aes(x = "Negative_Reason", y = "Percentage Value of Total Negative Sentiments", fill = "Negative Reason" )) +
  geom_bar(stat = "identity") +
  geom_text(aes(label = "Percentage of Total Negative Sentiments"),
    position = position_stack(vjust = 1.08), size = 10) +
  theme_minimal() +
  labs(title = "Percentage of Negative Reasons",
    x = "Reason",
    y = "Frequency (% of Negative Tweets)" ) +
  theme(axis_text_x = element_text(angle = 45, ha = "right"),
    legend_position = "none"))
```



Of the 2913 tweets centered around US Airways → 2263 of the tweets had a negative sentiment

### 1.3 American Airlines Data

```
[18]: American_DF.head()
```

```
[18]:
```

	tweet_id	airline_sentiment	airline_sentiment_confidence	\
11879	570308309682675712	negative	1.0000	
11880	570308064185880577	neutral	0.6667	
11881	570307949614256128	negative	0.6316	
11882	570307948171423745	negative	0.6846	
11883	570307434113310720	negative	0.6547	

	negativereason	negativereason_confidence	airline	\
11879	Customer Service Issue	1.0000	American	
11880	NaN	NaN	American	
11881	Bad Flight	0.3164	American	
11882	Flight Booking Problems	0.6846	American	
11883	Late Flight	0.3331	American	

	name	retweet_count	\
11879	SweeLoTmac	0	
11880	LancasterPattie	0	
11881	ELLLORRAC	0	
11882	SweeLoTmac	0	
11883	LauraMolito	0	

	text	\
11879	@AmericanAir why would I even consider continu...	
11880	@AmericanAir we've already made other arrangem...	
11881	@AmericanAir thanks for getting back to me. Bu...	
11882	@AmericanAir why would I pay \$200 to reactivat...	
11883	@AmericanAir stranded for 24 hours in MIA, Pat...	

	tweet_created	tweet_location	user_timezone
11879	2015-02-24 11:44:31 -0800	NaN	Quito
11880	2015-02-24 11:43:32 -0800	NaN	NaN
11881	2015-02-24 11:43:05 -0800	NaN	Central Time (US & Canada)
11882	2015-02-24 11:43:05 -0800	NaN	Quito
11883	2015-02-24 11:41:02 -0800	New York, NY	Atlantic Time (Canada)

```
[19]: (American_DF["retweet_count"]).describe()
```

```
[19]: count    2759.000000
      mean      0.042407
      std      0.304688
      min      0.000000
      25%      0.000000
      50%      0.000000
      75%      0.000000
      max      5.000000
      Name: retweet_count, dtype: float64
```



```
[20]: print(American_DF["airline_sentiment"].value_counts())

American_Sentiment_Frequency = {'Sentiment': ['Negative', 'Neutral', 'Positive'],
                                'Counts': [1960, 463, 336]}

American_Sentimnts_DF = pd.DataFrame(American_Sentiment_Frequency)

wedges, texts, autotexts = plt.pie(American_Sentimnts_DF['Counts'],
                                   labels = American_Sentimnts_DF['Sentiment'],
                                   autopct='%1.0f%%',
                                   wedgeprops = {"edgecolor": "black",
                                                'linewidth': 2,
                                                'antialiased': True})

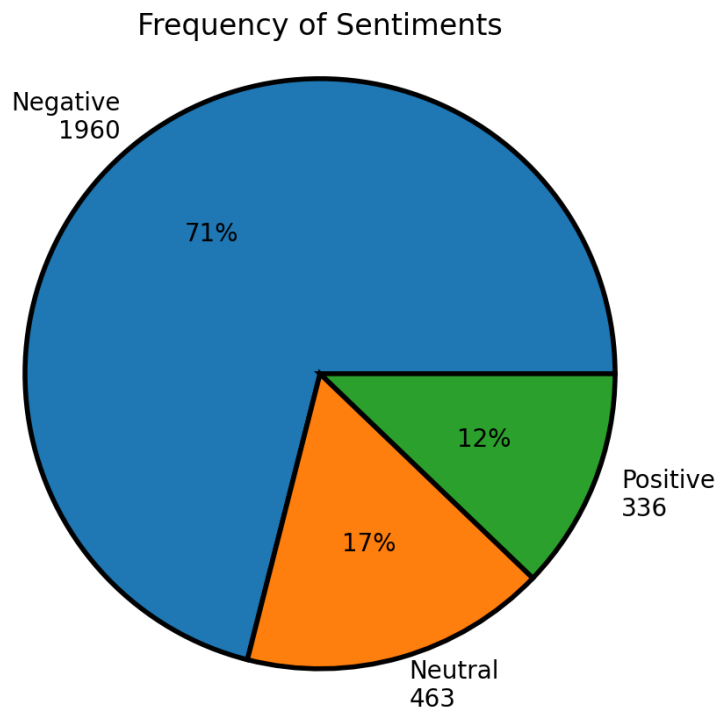
plt.title('Frequency of Sentiments')

for i, count in enumerate(American_Sentimnts_DF['Counts']):
    texts[i].set_text(f'{American_Sentimnts_DF["Sentiment"][i]}\n{count}')

plt.axis('equal')

plt.show()
```

```
negative    1960
neutral     463
positive    336
Name: airline_sentiment, dtype: int64
```



```
[21]: print(American_DF["negativereason"].value_counts())

American_Negative_Sentiment_Frequency = {'Negative Reason': ['Customer Service_
↳Issue', 'Late Flight', 'Lost Luggage', 'Bad Flight', 'Cancelled Flight',
↳'Flight Attendant Complaints',
                                                                    'Flight Booking_
↳Problems', 'Long Lines', 'Damaged Luggage'],
                                           'Counts': [768, 249, 149, 87, 246, 87,
↳130, 34, 12]}
American_Negative_Sentiment_Frequency_DF = pd.
↳DataFrame(American_Negative_Sentiment_Frequency)
American_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_
↳Sentiments"] = American_Negative_Sentiment_Frequency_DF["Counts"] / 1960
American_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_
↳Sentiments"] = American_Negative_Sentiment_Frequency_DF["Percentage Value of
↳Total Negative Sentiments"].round(3)
American_Negative_Sentiment_Frequency_DF["Percentage of Total Negative_
↳Sentiments"] = American_Negative_Sentiment_Frequency_DF["Percentage Value of
↳Total Negative Sentiments"].map('{:.2%}'.format)
American_Negative_Sentiment_Frequency_DF
```

Customer Service Issue	768
Late Flight	249
Cancelled Flight	246
Can't Tell	198
Lost Luggage	149
Flight Booking Problems	130
Bad Flight	87
Flight Attendant Complaints	87
longlines	34
Damaged Luggage	12

Name: negativereason, dtype: int64

```
[21]:
```

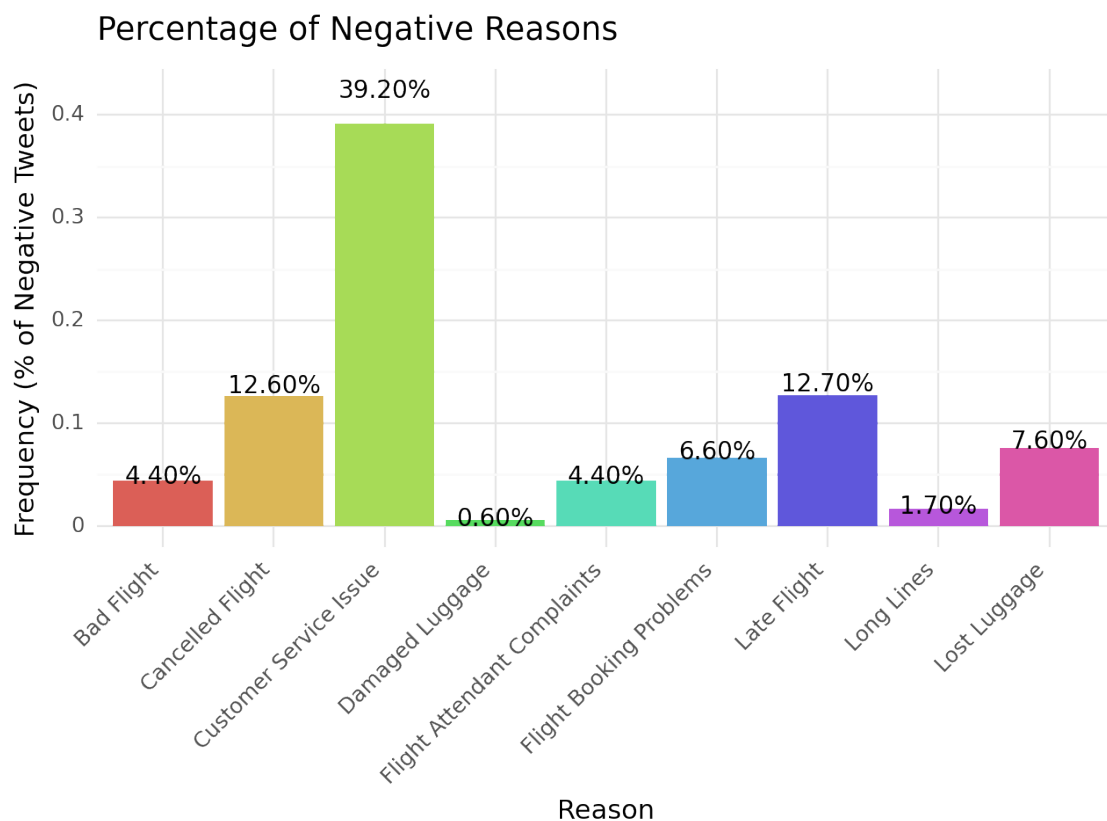
	Negative Reason	Counts	\
0	Customer Service Issue	768	
1	Late Flight	249	
2	Lost Luggage	149	
3	Bad Flight	87	
4	Cancelled Flight	246	
5	Flight Attendant Complaints	87	
6	Flight Booking Problems	130	
7	Long Lines	34	
8	Damaged Luggage	12	

	Percentage Value of Total Negative Sentiments	\
0	0.392	
1	0.127	
2	0.076	
3	0.044	
4	0.126	
5	0.044	
6	0.066	
7	0.017	
8	0.006	

	Percentage of Total Negative Sentiments
0	39.20%
1	12.70%
2	7.60%
3	4.40%
4	12.60%
5	4.40%
6	6.60%
7	1.70%
8	0.60%

```
[22]:
```

```
print(ggplot(American_Negative_Sentiment_Frequency_DF, aes(x = "Negative_Reason", y = "Percentage Value of Total Negative Sentiments", fill = "Negative Reason" )) +
  geom_bar(stat = "identity") +
  geom_text(aes(label = "Percentage of Total Negative Sentiments"),
    position = position_stack(vjust = 1.08), size = 10) +
  theme_minimal() +
  labs(title = "Percentage of Negative Reasons",
    x = "Reason",
    y = "Frequency (% of Negative Tweets)" ) +
  theme(axis_text_x = element_text(angle = 45, ha = "right"),
    legend_position = "none"))
```



Of the 2759 tweets centered around American Airlines → 1960 of the tweets had a negative sentiment

## 1.4 Southwest Airlines Data

```
[23]: Southwest_DF.head()
```

```
[23]:      tweet_id airline_sentiment  airline_sentiment_confidence \
4326  570309156290367488      negative                      1.0000
4327  570309145276125185      negative                      0.6361
4328  570307615189835777      negative                      1.0000
4329  570306086475075585      neutral                      0.6443
4330  570305647759265793      negative                      1.0000
```

```
      negativereason  negativereason_confidence  airline \
4326      longlines                      0.6624  Southwest
4327  Cancelled Flight                      0.6361  Southwest
4328  Customer Service Issue                  1.0000  Southwest
4329      NaN                             NaN  Southwest
4330  Customer Service Issue                  1.0000  Southwest
```

```
      name  retweet_count \
4326  thisradlove          0
4327   tomcblock          0
4328  cindyjwhitaker        0
4329  liveseasoned          0
4330  cindyjwhitaker        0
```

```
      text \
4326  @SouthwestAir still waiting. Just hit one hour.
4327  @SouthwestAir although I'm not happy you Cance...
4328  @SouthwestAir Hello - been on hold for extreme...
4329  @SouthwestAir I'm teaching new #travelers how ...
4330  @SouthwestAir Very frustrated for the looooooon...
```

```
      tweet_created      tweet_location \
4326  2015-02-24 11:47:53 -0800  Today I'm in: Maryland
4327  2015-02-24 11:47:50 -0800  ÜT: 38.965477,-77.428287
4328  2015-02-24 11:41:45 -0800      NaN
4329  2015-02-24 11:35:41 -0800      NaN
4330  2015-02-24 11:33:56 -0800      NaN
```

```
      user_timezone
4326  Atlantic Time (Canada)
4327  Eastern Time (US & Canada)
4328  Central Time (US & Canada)
4329      NaN
4330  Central Time (US & Canada)
```

```
[24]: (Southwest_DF["retweet_count"]).describe()
```

```
[24]: count      2420.000000
      mean        0.059917
      std         0.549460
      min         0.000000
      25%         0.000000
      50%         0.000000
      75%         0.000000
      max         22.000000
      Name: retweet_count, dtype: float64
```

```
[25]: print(Southwest_DF["airline_sentiment"].value_counts())

Southwest_Sentiment_Frequency = {'Sentiment': ['Negative', 'Neutral', 'Positive'],
                                   'Counts': [1186, 664, 570]}

Southwest_Sentimnts_DF = pd.DataFrame(Southwest_Sentiment_Frequency)

wedges, texts, autotexts = plt.pie(Southwest_Sentimnts_DF['Counts'],
                                   labels = Southwest_Sentimnts_DF['Sentiment'],
                                   startangle = 40,
                                   autopct='%1.0f%%',
                                   wedgeprops = {"edgecolor": "black",
                                                  'linewidth': 2,
                                                  'antialiased': True})

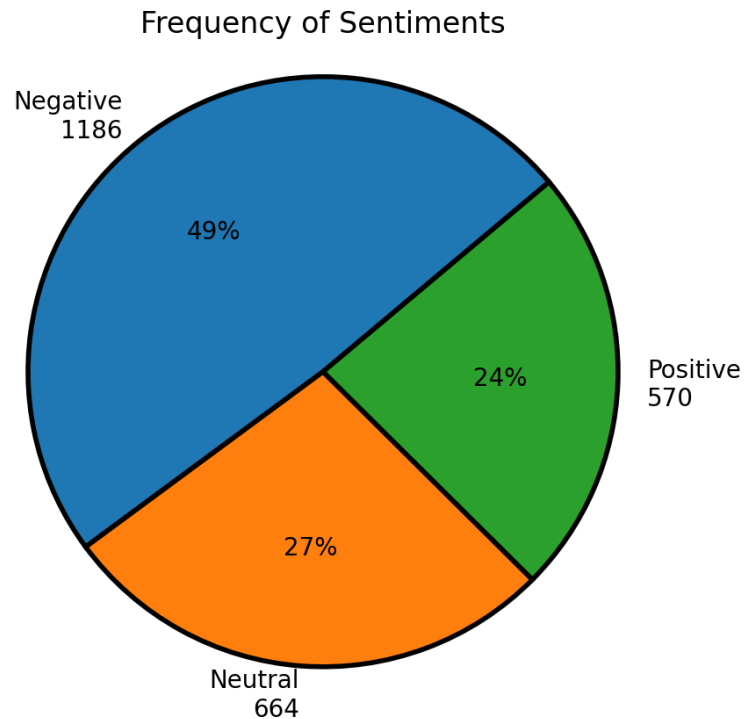
plt.title('Frequency of Sentiments')

for i, count in enumerate(Southwest_Sentimnts_DF['Counts']):
    texts[i].set_text(f'{Southwest_Sentimnts_DF["Sentiment"][i]}\n{count}')

plt.axis('equal')

plt.show()
```

```
negative      1186
neutral       664
positive       570
Name: airline_sentiment, dtype: int64
```



```
[26]: print(Southwest_DF["negativereason"].value_counts())

Southwest_Negative_Sentiment_Frequency = {'Negative Reason': ['Customer Service_
↳Issue', 'Late Flight', 'Lost Luggage', 'Bad Flight', 'Cancelled Flight',
↳'Flight Attendant Complaints',
                                                    'Flight Booking_
↳Problems', 'Long Lines', 'Damaged Luggage'],
                                           'Counts': [391, 152, 90, 90, 162, 38,
↳61, 29, 14]}

Southwest_Negative_Sentiment_Frequency_DF = pd.
↳DataFrame(Southwest_Negative_Sentiment_Frequency)

Southwest_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_
↳Sentiments"] = Southwest_Negative_Sentiment_Frequency_DF["Counts"] / 1186

Southwest_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_
↳Sentiments"] = Southwest_Negative_Sentiment_Frequency_DF["Percentage Value
↳of Total Negative Sentiments"].round(3)

Southwest_Negative_Sentiment_Frequency_DF["Percentage of Total Negative_
↳Sentiments"] = Southwest_Negative_Sentiment_Frequency_DF["Percentage Value
↳of Total Negative Sentiments"].map('{:.2%}'.format)

Southwest_Negative_Sentiment_Frequency_DF
```

Customer Service Issue	391
Cancelled Flight	162
Can't Tell	159
Late Flight	152
Bad Flight	90
Lost Luggage	90
Flight Booking Problems	61
Flight Attendant Complaints	38
longlines	29
Damaged Luggage	14

Name: negativereason, dtype: int64

[26]:

	Negative Reason	Counts	\
0	Customer Service Issue	391	
1	Late Flight	152	
2	Lost Luggage	90	
3	Bad Flight	90	
4	Cancelled Flight	162	
5	Flight Attendant Complaints	38	
6	Flight Booking Problems	61	
7	Long Lines	29	
8	Damaged Luggage	14	

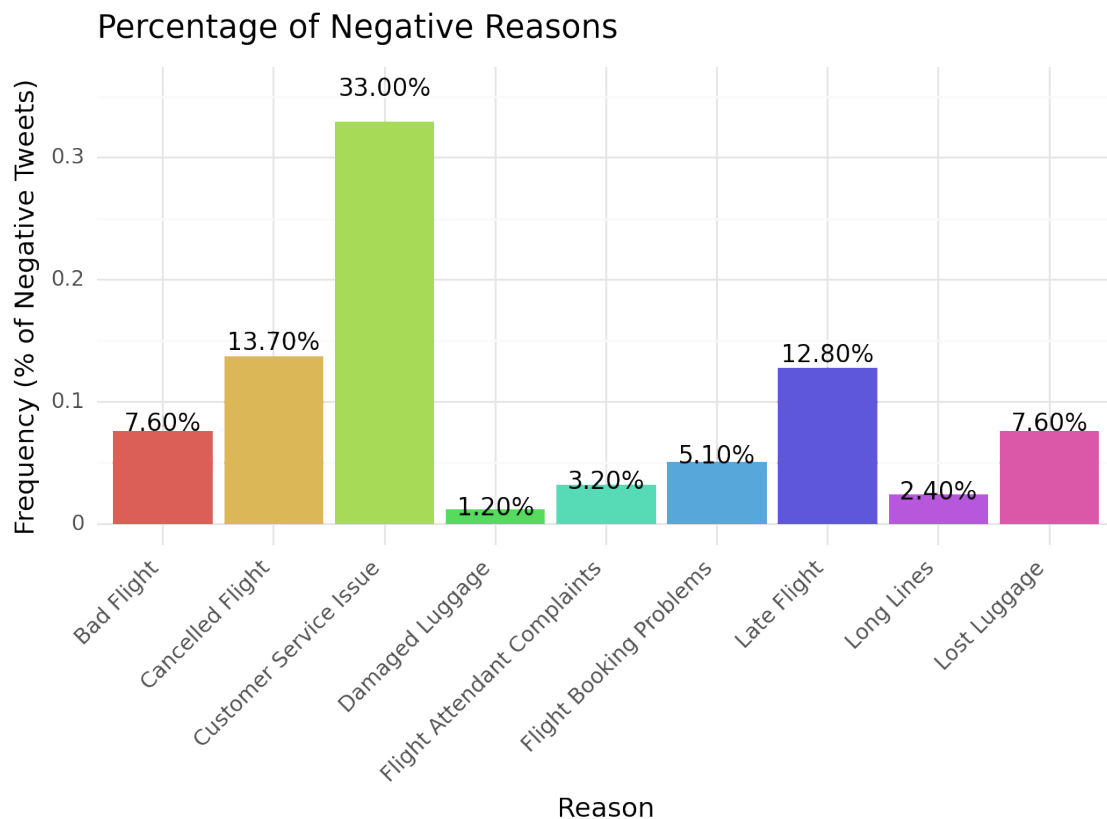
	Percentage Value of Total Negative Sentiments	\
0	0.330	
1	0.128	
2	0.076	
3	0.076	
4	0.137	
5	0.032	
6	0.051	
7	0.024	
8	0.012	

	Percentage of Total Negative Sentiments
0	33.00%
1	12.80%
2	7.60%
3	7.60%
4	13.70%
5	3.20%
6	5.10%
7	2.40%
8	1.20%

[27]:



```
print(ggplot(Southwest_Negative_Sentiment_Frequency_DF, aes(x = "Negative_Reason", y = "Percentage Value of Total Negative Sentiments", fill = "Negative Reason" )) +
  geom_bar(stat = "identity") +
  geom_text(aes(label = "Percentage of Total Negative Sentiments"),
    position = position_stack(vjust = 1.08), size = 10) +
  theme_minimal() +
  labs(title = "Percentage of Negative Reasons",
    x = "Reason",
    y = "Frequency (% of Negative Tweets)" ) +
  theme(axis_text_x = element_text(angle = 45, ha = "right"),
    legend_position = "none"))
```



Of the 2420 tweets centered around Southwest Airlines → 1186 of the tweets had a negative sentiment

## 1.5 Delta Airlines Data

```
[28]: Delta_DF.head()
```

```
[28]:
```

	tweet_id	airline_sentiment	airline_sentiment_confidence	\
6746	570309345281486848	positive	0.6469	
6747	570309308937842688	neutral	0.6869	
6748	570308513181904901	neutral	1.0000	
6749	570307820962373632	negative	1.0000	
6750	570305363859406848	negative	1.0000	

	negativereason	negativereason_confidence	airline	\
6746	NaN	NaN	Delta	
6747	NaN	NaN	Delta	
6748	NaN	NaN	Delta	
6749	Flight Attendant Complaints	0.6522	Delta	
6750	Bad Flight	1.0000	Delta	

	name	retweet_count	\
6746	jaxbra	0	
6747	Oneladyyouadore	0	
6748	Oneladyyouadore	0	
6749	Oneladyyouadore	0	
6750	Oneladyyouadore	0	

	text	\
6746	@JetBlue Yesterday on my way from EWR to FLL j...	
6747	@JetBlue I hope so because I fly very often an...	
6748	@JetBlue flight 1041 to Savannah, GA	
6749	@JetBlue They weren't on any flight, they just...	
6750	@JetBlue everyone is here but our pilots are n...	

	tweet_created	tweet_location	user_timezone
6746	2015-02-24 11:48:38 -0800	east brunswick, nj	Atlantic Time (Canada)
6747	2015-02-24 11:48:29 -0800	Georgia	Quito
6748	2015-02-24 11:45:20 -0800	Georgia	Quito
6749	2015-02-24 11:42:34 -0800	Georgia	Quito
6750	2015-02-24 11:32:49 -0800	Georgia	Quito

```
[29]: (Delta_DF["retweet_count"]).describe()
```

```
[29]:
```

count	2222.000000
mean	0.113411
std	1.074325
min	0.000000
25%	0.000000
50%	0.000000
75%	0.000000

```
max          31.000000
Name: retweet_count, dtype: float64
```

```
[30]: print(Delta_DF["airline_sentiment"].value_counts())

Delta_Sentiment_Frequency = {'Sentiment': ['Negative', 'Neutral', 'Positive'],
                              'Counts': [955, 723, 544]}

Delta_Sentimnts_DF = pd.DataFrame(Delta_Sentiment_Frequency)

wedges, texts, autotexts = plt.pie(Delta_Sentimnts_DF['Counts'],
                                   labels = Delta_Sentimnts_DF['Sentiment'],
                                   startangle = 45,
                                   autopct='%1.0f%%',
                                   wedgeprops = {"edgecolor": "black",
                                                'linewidth': 2,
                                                'antialiased': True})

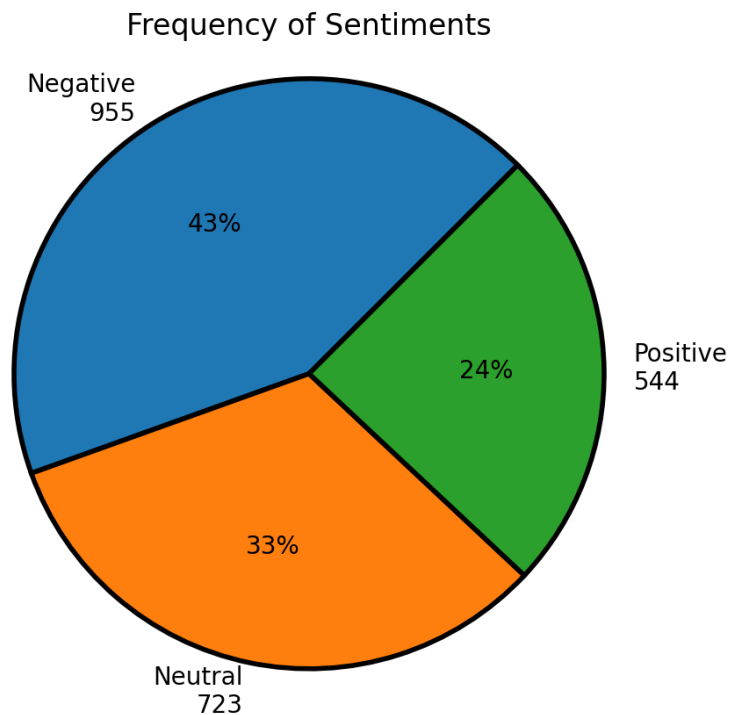
plt.title('Frequency of Sentiments')

for i, count in enumerate(Delta_Sentimnts_DF['Counts']):
    texts[i].set_text(f'{Delta_Sentimnts_DF["Sentiment"][i]}\n{count}')

plt.axis('equal')

plt.show()
```

```
negative      955
neutral       723
positive      544
Name: airline_sentiment, dtype: int64
```



```
[31]: print(Delta_DF["negativereason"].value_counts())

Delta_Negative_Sentiment_Frequency = {'Negative Reason': ['Customer Service_
↳Issue', 'Late Flight', 'Lost Luggage', 'Bad Flight', 'Cancelled Flight',_
↳'Flight Attendant Complaints',
                                                    'Flight Booking_
↳Problems', 'Long Lines', 'Damaged Luggage'],
                                     'Counts': [199, 269, 57, 64, 51, 60, 44,_
↳14, 11]}
Delta_Negative_Sentiment_Frequency_DF = pd.
↳DataFrame(Delta_Negative_Sentiment_Frequency)
Delta_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_
↳Sentiments"] = Delta_Negative_Sentiment_Frequency_DF["Counts"] / 955
Delta_Negative_Sentiment_Frequency_DF["Percentage Value of Total Negative_
↳Sentiments"] = Delta_Negative_Sentiment_Frequency_DF["Percentage Value of_
↳Total Negative Sentiments"].round(3)
Delta_Negative_Sentiment_Frequency_DF["Percentage of Total Negative_
↳Sentiments"] = Delta_Negative_Sentiment_Frequency_DF["Percentage Value of_
↳Total Negative Sentiments"].map('{:.2%}'.format)
Delta_Negative_Sentiment_Frequency_DF
```

Late Flight	269
Customer Service Issue	199
Can't Tell	186
Bad Flight	64
Flight Attendant Complaints	60
Lost Luggage	57
Cancelled Flight	51
Flight Booking Problems	44
longlines	14
Damaged Luggage	11

Name: negativereason, dtype: int64

```
[31]:
```

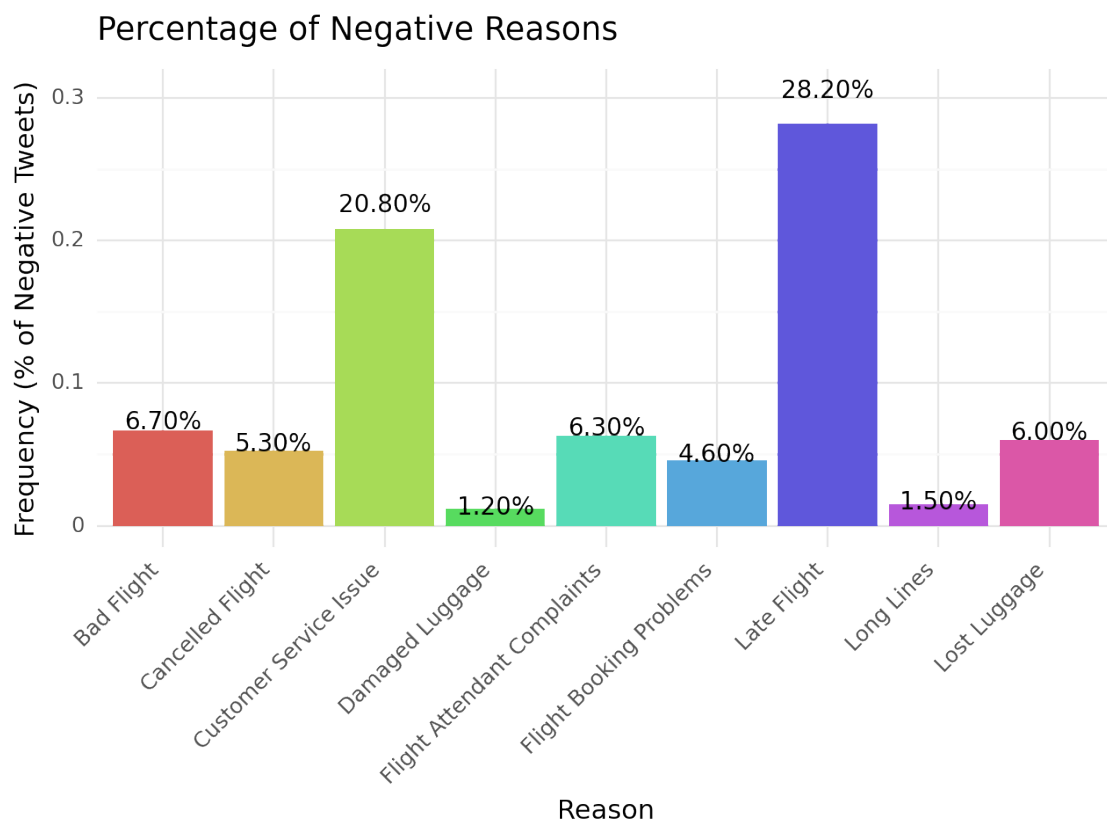
	Negative Reason	Counts \
0	Customer Service Issue	199
1	Late Flight	269
2	Lost Luggage	57
3	Bad Flight	64
4	Cancelled Flight	51
5	Flight Attendant Complaints	60
6	Flight Booking Problems	44
7	Long Lines	14
8	Damaged Luggage	11

	Percentage Value of Total Negative Sentiments \
0	0.208
1	0.282
2	0.060
3	0.067
4	0.053
5	0.063
6	0.046
7	0.015
8	0.012

	Percentage of Total Negative Sentiments
0	20.80%
1	28.20%
2	6.00%
3	6.70%
4	5.30%
5	6.30%
6	4.60%
7	1.50%
8	1.20%

```
[32]:
```

```
print(ggplot(Delta_Negative_Sentiment_Frequency_DF, aes(x = "Negative Reason",  
  y = "Percentage Value of Total Negative Sentiments", fill = "Negative Reason" )) +  
  geom_bar(stat = "identity") +  
  geom_text(aes(label = "Percentage of Total Negative Sentiments"),  
  position = position_stack(vjust = 1.08), size = 10) +  
  theme_minimal() +  
  labs(title = "Percentage of Negative Reasons",  
    x = "Reason",  
    y = "Frequency (% of Negative Tweets)") +  
  theme(axis_text_x = element_text(angle = 45, ha = "right"),  
    legend_position = "none"))
```



Of the 2222 tweets centered around Delta Airlines → 955 of the tweets had a negative sentiment

## 1.6 Virgin America Data

```
[33]: Virgin_America_DF.head()
```

```
[33]:      tweet_id  airline_sentiment  airline_sentiment_confidence  \
0   570306133677760513             neutral                1.0000
1   570301130888122368             positive                0.3486
2   570301083672813571             neutral                0.6837
3   570301031407624196             negative                1.0000
4   570300817074462722             negative                1.0000

      negativereason  negativereason_confidence  airline  name  \
0              NaN                NaN  Virgin America  cairdin
1              NaN                0.0000  Virgin America  jnardino
2              NaN                NaN  Virgin America  yvonnalynn
3      Bad Flight                0.7033  Virgin America  jnardino
4      Can't Tell                1.0000  Virgin America  jnardino

      retweet_count  text  \
0              0      @VirginAmerica What @dhepburn said.
1              0      @VirginAmerica plus you've added commercials t...
2              0      @VirginAmerica I didn't today... Must mean I n...
3              0      @VirginAmerica it's really aggressive to blast...
4              0      @VirginAmerica and it's a really big bad thing..

      tweet_created  tweet_location  user_timezone
0  2015-02-24 11:35:52 -0800        NaN  Eastern Time (US & Canada)
1  2015-02-24 11:15:59 -0800        NaN  Pacific Time (US & Canada)
2  2015-02-24 11:15:48 -0800  Lets Play  Central Time (US & Canada)
3  2015-02-24 11:15:36 -0800        NaN  Pacific Time (US & Canada)
4  2015-02-24 11:14:45 -0800        NaN  Pacific Time (US & Canada)
```

```
[34]: (Virgin_America_DF["retweet_count"]).describe()
```

```
[34]: count      504.000000
mean         0.051587
std          0.347266
min          0.000000
25%          0.000000
50%          0.000000
75%          0.000000
max          4.000000
Name: retweet_count, dtype: float64
```

```
[35]: print(Virgin_America_DF["airline_sentiment"].value_counts())

Virgin_America_Sentiment_Frequency = {'Sentiment': ['Negative', 'Neutral', 'Positive'],
                                       'Counts': [181, 171, 152]}

Virgin_America_Sentimnts_DF = pd.DataFrame(Virgin_America_Sentiment_Frequency)
```

```
wedges, texts, autotexts = plt.pie(Virgin_America_Sentimnts_DF['Counts'],
                                   labels = Virgin_America_Sentimnts_DF['Sentiment'],
                                   autopct='%1.0f%%',
                                   wedgeprops = {"edgecolor": "black",
                                                'linewidth': 2,
                                                'antialiased': True})

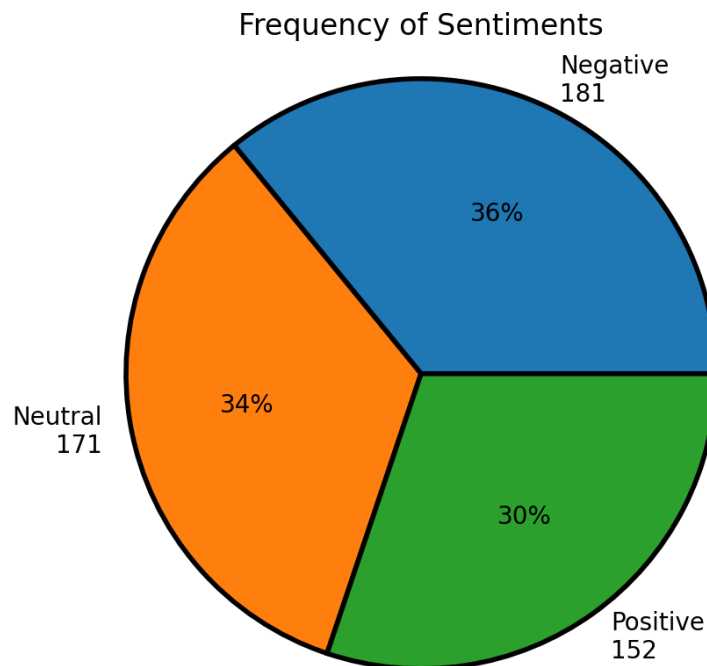
plt.title('Frequency of Sentiments')

for i, count in enumerate(Virgin_America_Sentimnts_DF['Counts']):
    texts[i].set_text(f'{Virgin_America_Sentimnts_DF["Sentiment"][i]}\n{count}')

plt.axis('equal')

plt.show()
```

```
negative    181
neutral     171
positive    152
Name: airline_sentiment, dtype: int64
```





```
[36]: print(Virgin_America_DF["negativereason"].value_counts())

Virgin_America_Negative_Sentiment_Frequency = {'Negative Reason': ['Customer_
↳Service Issue', 'Late Flight', 'Lost Luggage', 'Bad Flight', 'Cancelled_
↳Flight', 'Flight Attendant Complaints',
                                                    'Flight_
↳Booking Problems', 'Long Lines', 'Damaged Luggage'],
                                                'Counts': [60, 17, 5, 19, 18, 5, 28, 3,
↳4]}

Virgin_America_Negative_Sentiment_Frequency_DF = pd.
↳DataFrame(Virgin_America_Negative_Sentiment_Frequency)
Virgin_America_Negative_Sentiment_Frequency_DF["Percentage Value of Total_
↳Negative Sentiments"] =_
↳Virgin_America_Negative_Sentiment_Frequency_DF["Counts"] / 181
Virgin_America_Negative_Sentiment_Frequency_DF["Percentage Value of Total_
↳Negative Sentiments"] =_
↳Virgin_America_Negative_Sentiment_Frequency_DF["Percentage Value of Total_
↳Negative Sentiments"].round(3)
Virgin_America_Negative_Sentiment_Frequency_DF["Percentage of Total Negative_
↳Sentiments"] = Virgin_America_Negative_Sentiment_Frequency_DF["Percentage_
↳Value of Total Negative Sentiments"].map('{:.2%}'.format)
Virgin_America_Negative_Sentiment_Frequency_DF
```

```
Customer Service Issue      60
Flight Booking Problems     28
Can't Tell                  22
Bad Flight                  19
Cancelled Flight            18
Late Flight                 17
Lost Luggage                5
Flight Attendant Complaints  5
Damaged Luggage             4
longlines                   3
Name: negativereason, dtype: int64
```

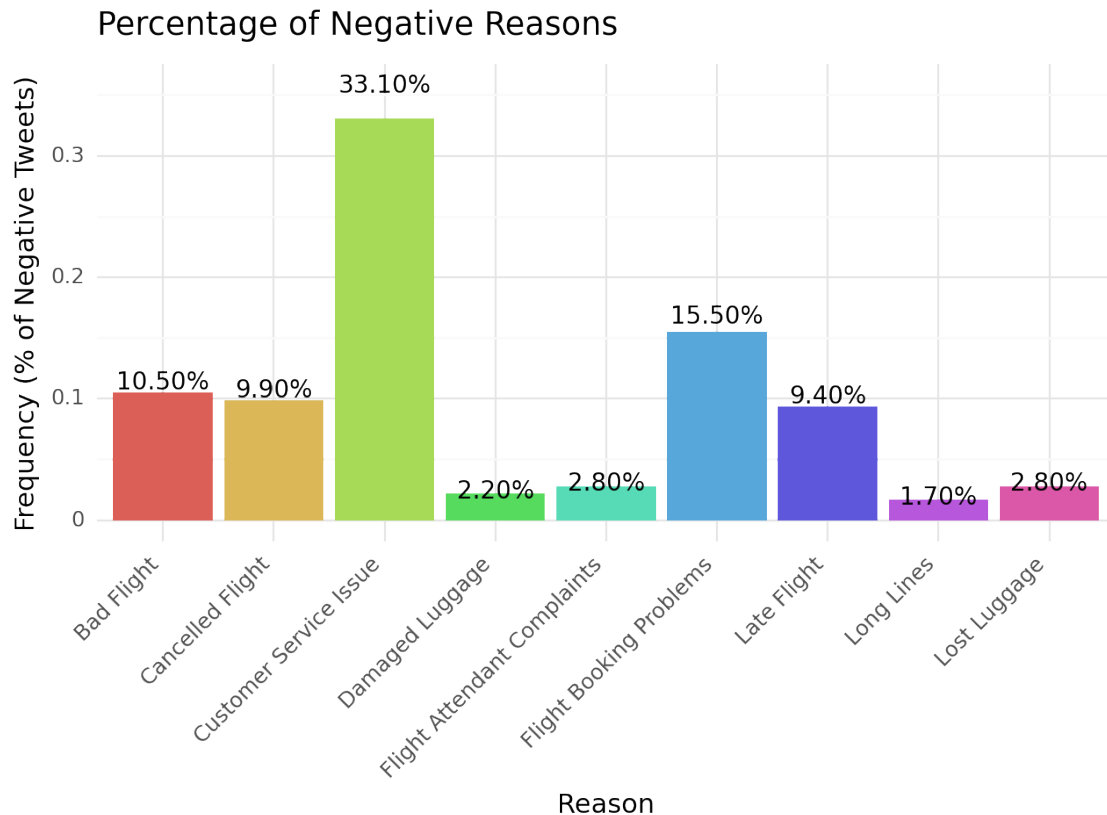
```
[36]:
```

	Negative Reason	Counts \
0	Customer Service Issue	60
1	Late Flight	17
2	Lost Luggage	5
3	Bad Flight	19
4	Cancelled Flight	18
5	Flight Attendant Complaints	5
6	Flight Booking Problems	28
7	Long Lines	3
8	Damaged Luggage	4

	Percentage Value of Total Negative Sentiments \
0	0.331
1	0.094
2	0.028
3	0.105
4	0.099
5	0.028
6	0.155
7	0.017
8	0.022

	Percentage of Total Negative Sentiments
0	33.10%
1	9.40%
2	2.80%
3	10.50%
4	9.90%
5	2.80%
6	15.50%
7	1.70%
8	2.20%

```
[37]: print(ggplot(Virgin_America_Negative_Sentiment_Frequency_DF, aes(x = "Negative_Reason", y = "Percentage Value of Total Negative Sentiments", fill = "Negative Reason" )) +
  geom_bar(stat = "identity") +
  geom_text(aes(label = "Percentage of Total Negative Sentiments"),
  position = position_stack(vjust = 1.08), size = 10) +
  theme_minimal() +
  labs(title = "Percentage of Negative Reasons",
    x = "Reason",
    y = "Frequency (% of Negative Tweets)") +
  theme(axis_text_x = element_text(angle = 45, ha = "right"),
    legend_position = "none"))
```



Of the 504 tweets centered around Virgin America → 181 of the tweets had a negative sentiment  
 ##Comparing Trends

```
[ ]: Negative_Sentiments_Percentage_By_Airline = pd.DataFrame().
    ↳ assign(Negative_Reason = United_Negative_Sentiment_Frequency_DF['Negative_Reason'],

    ↳ United_Negative_Sentiment_Frequency_Percentages =
    ↳ United_Negative_Sentiment_Frequency_DF['Percentage of Total Negative Sentiments'],

    ↳ US_Airays_Negative_Sentiment_Frequency_Percentages =
    ↳ US_Airways_Negative_Sentiment_Frequency_DF['Percentage of Total Negative Sentiments'],

    ↳ American_Negative_Sentiment_Frequency_Percentages =
    ↳ American_Negative_Sentiment_Frequency_DF['Percentage of Total Negative Sentiments'],
```

```

↪Southwest_Negative_Sentiment_Frequency_Percentages =
↪Southwest_Negative_Sentiment_Frequency_DF['Percentage of Total Negative
↪Sentiments'],

↪Delta_Negative_Sentiment_Frequency_Percentages =
↪Delta_Negative_Sentiment_Frequency_DF['Percentage of Total Negative
↪Sentiments'],

↪Virgin_America_Negative_Sentiment_Frequency_Percentages =
↪Virgin_America_Negative_Sentiment_Frequency_DF['Percentage of Total Negative
↪Sentiments'])

```

Negative\_Sentiments\_Percentage\_By\_Airline

```

[ ]:      Negative_Reason \
0      Customer Service Issue
1      Late Flight
2      Lost Luggage
3      Bad Flight
4      Cancelled Flight
5      Flight Attendant Complaints
6      Flight Booking Problems
7      Long Lines
8      Damaged Luggage

United_Negative_Sentiment_Frequency_Percentages \
0      25.90%
1      19.90%
2      10.20%
3      8.20%
4      6.90%
5      6.40%
6      5.50%
7      1.80%
8      0.80%

US_Airways_Negative_Sentiment_Frequency_Percentages \
0      35.80%
1      20.00%
2      6.80%
3      4.60%
4      8.40%
5      5.40%
6      5.40%
7      2.20%
8      0.50%

```

	American_Negative_Sentiment_Frequency_Percentages \
0	39.20%
1	12.70%
2	7.60%
3	4.40%
4	12.60%
5	4.40%
6	6.60%
7	1.70%
8	0.60%

	Southwest_Negative_Sentiment_Frequency_Percentages \
0	33.00%
1	12.80%
2	7.60%
3	7.60%
4	13.70%
5	3.20%
6	5.10%
7	2.40%
8	1.20%

	Delta_Negative_Sentiment_Frequency_Percentages \
0	20.80%
1	28.20%
2	6.00%
3	6.70%
4	5.30%
5	6.30%
6	4.60%
7	1.50%
8	1.20%

	Virgin_America_Negative_Sentiment_Frequency_Percentages
0	33.10%
1	9.40%
2	2.80%
3	10.50%
4	9.90%
5	2.80%
6	15.50%
7	1.70%
8	2.20%

```
[ ]: Negative_Reason_Percentage_Frequency_Data = {"Negative_Reason": ["Customer_
↪Service Issue", "Late Flight", "Lost Luggage",
```

```

                                "Bad Flight",
    ↪ "Cancelled Flight", "Flight Attendant Complaints",
                                "Flight
    ↪ Booking Problems", "Long Lines", "Damaged Luggage"],
                                "United_Airlines_%": [25.86, 19.
    ↪ 94, 10.22, 8.20, 6.87, 6.38, 5.47, 1.82, 0.84],
                                "US_Airays_%": [35.84, 20.02, 6.
    ↪ 81, 4.60, 8.35, 5.44, 5.39, 2.21, 0.49],
                                "American_Airlines_%": [39.18, 12.
    ↪ 70, 7.60, 4.44, 12.55, 4.44, 6.63, 1.73, 0.61],
                                "Southwest_Airlines_%": [32.97, 12.
    ↪ 82, 7.59, 7.59, 13.66, 3.20, 5.14, 2.45, 1.18],
                                "Delta_Airlines_%": [20.84, 28.17,
    ↪ 5.97, 6.70, 5.34, 6.28, 4.61, 1.47, 1.15],
                                "Virgin_America_%": [33.15, 9.39,
    ↪ 2.76, 10.50, 9.94, 2.76, 15.47, 1.66, 2.21]]}

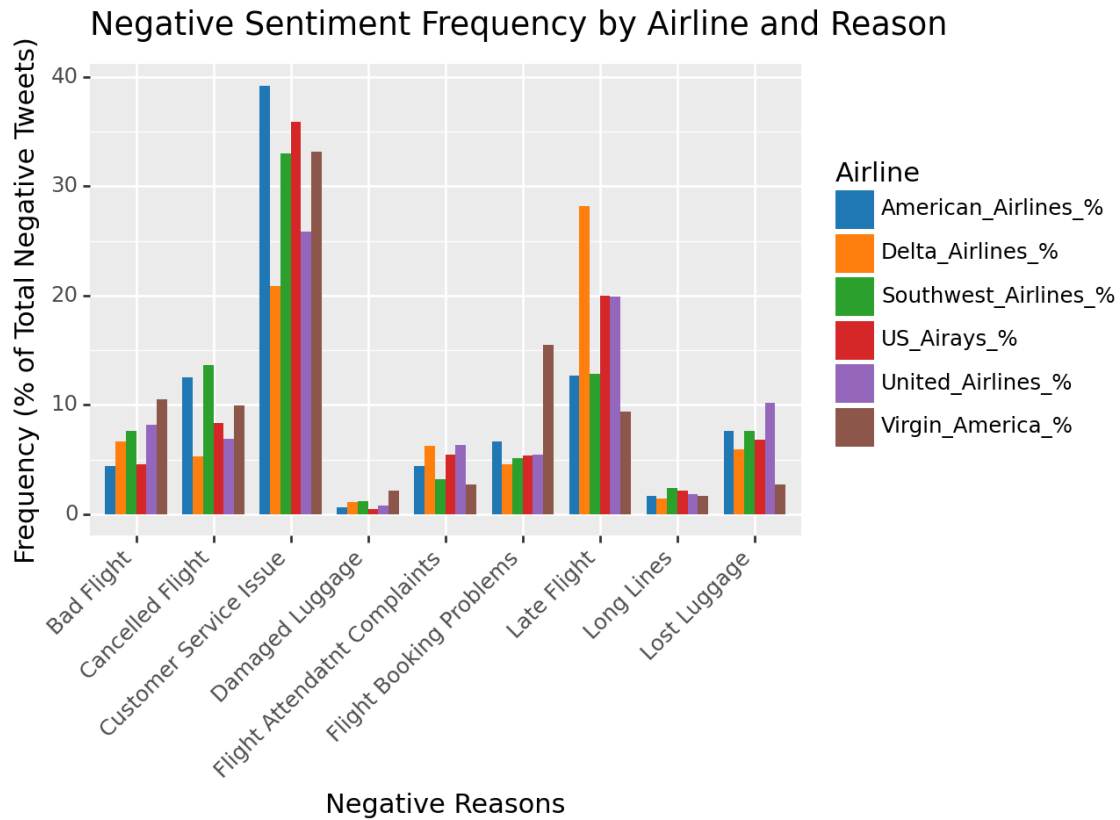
Negative_Reason_Percentage_Freq_Data = pd.
    ↪ DataFrame(Negative_Reason_Percentage_Frequency_Data)

melted_data = pd.melt(Negative_Reason_Percentage_Freq_Data,
                        id_vars=["Negative_Reason"],
                        var_name="Airline",
                        value_name="Frequency"
)

custom_colors = ["#1f77b4", "#ff7f0e", "#2ca02c", "#d62728", "#9467bd",
    ↪ "#8c564b", "#e377c2", "#7f7f7f", "#bcbd22"]

(ggplot(melted_data, aes(x = "Negative_Reason", y = "Frequency", fill =
    ↪ "Airline"))) +
geom_bar(stat = "identity", position = "dodge", width = 0.8) +
labs(
    title = "Negative Sentiment Frequency by Airline and Reason",
    x = "Negative Reasons",
    y = "Frequency (% of Total Negative Tweets)") +
theme(axis_text_x = element_text(rotation = 45, ha = "right"),
      legend_position="right") +
scale_fill_manual(values = custom_colors)
)

```



[ ]: <Figure Size: (640 x 480)>

```
[40]: Negative_Reason_Data = {"Customer Service Issue" : [25.90,      35.
↪80,      39.20,      33.00,      20.80,      33.10],
    "Late Flight" :      [19.90,      20.00,      12.
↪70,      12.80,      28.20,      9.40],
    "Lost Luggage" :      [10.20,      6.80,      7.
↪60,      7.60,      6.00,      2.80],
    "Bad Flight" :      [8.20,      4.60,      4.
↪40,      7.60,      6.70,      10.50],
    "Cancelled Flight" :      [6.90,      8.
↪40,      12.60,      13.70,      5.30,      9.90],
    "Flight Attendant Complaints" : [6.40,      5.
↪40,      4.40,      3.20,      6.30,      2.80],
    "Flight Booking Problems"      : [5.50,      5.
↪40,      6.60,      5.10,      4.60,      15.50],
    "Long Lines" :      [1.80,      2.20,      1.
↪70,      2.40,      1.50,      1.70],
    "Damaged Luggage" :      [0.80,      0.50,      0.
↪60,      1.20,      1.20,      2.20]}
```

```
Negative_Reason_Total_Data = pd.DataFrame(Negative_Reason_Data)
Negative_Reason_Total_Data
```

```
[40]:
```

	Customer Service Issue	Late Flight	Lost Luggage	Bad Flight	\
0	25.9	19.9	10.2	8.2	
1	35.8	20.0	6.8	4.6	
2	39.2	12.7	7.6	4.4	
3	33.0	12.8	7.6	7.6	
4	20.8	28.2	6.0	6.7	
5	33.1	9.4	2.8	10.5	

	Cancelled Flight	Flight Attendant Complaints	Flight Booking Problems	\
0	6.9	6.4	5.5	
1	8.4	5.4	5.4	
2	12.6	4.4	6.6	
3	13.7	3.2	5.1	
4	5.3	6.3	4.6	
5	9.9	2.8	15.5	

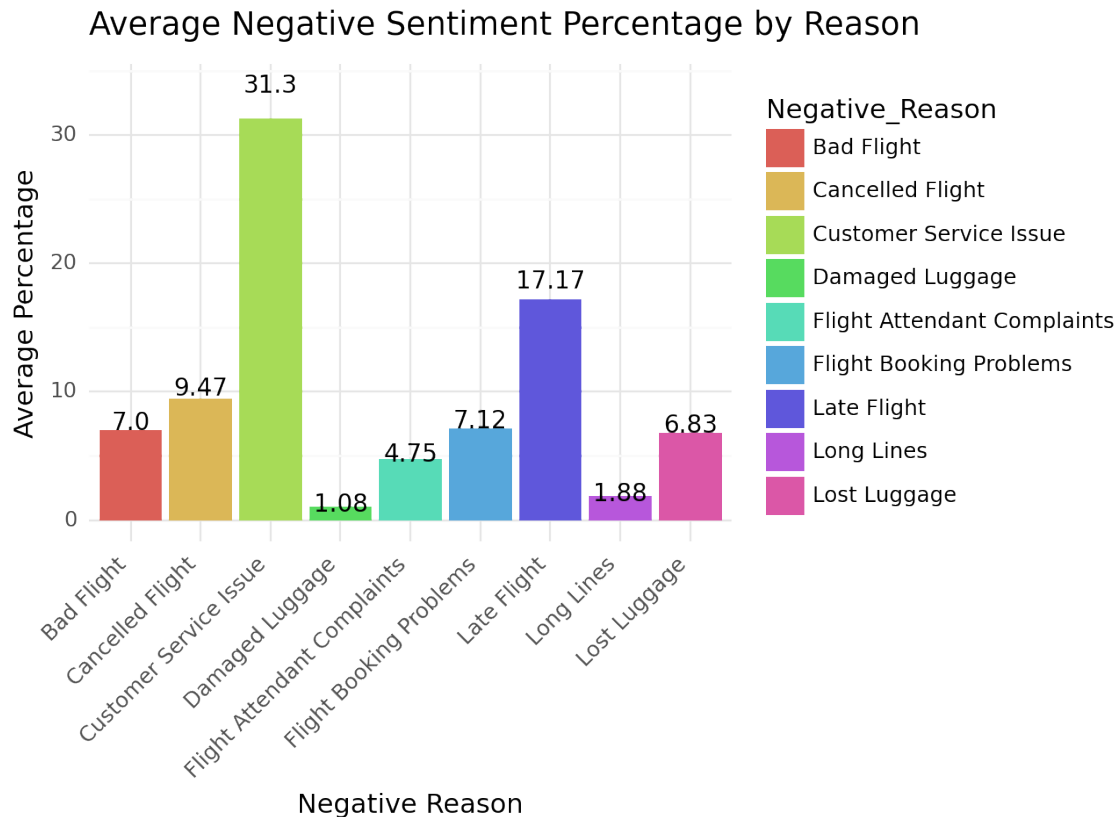
	Long Lines	Damaged Luggage
0	1.8	0.8
1	2.2	0.5
2	1.7	0.6
3	2.4	1.2
4	1.5	1.2
5	1.7	2.2

```
[45]: melted_reason_data = pd.melt(Negative_Reason_Total_Data, var_name = "Negative_Reason", value_name = "Percentage")

average_data = melted_reason_data.groupby("Negative_Reason")["Percentage"].mean().reset_index()
average_data["Percentage"] = average_data["Percentage"].round(2)

(ggplot(average_data, aes(x = 'Negative_Reason', y = 'Percentage', fill = "Negative_Reason")) +
  geom_bar(stat = "identity", position = "dodge") +
  geom_text(aes(label = "Percentage"), position = position_stack(vjust = 1.08), size = 10) +
  theme_minimal() +
  theme(axis_text_x = element_text(angle = 45, hjust = 1)) +
  labs(title = "Average Negative Sentiment Percentage by Reason",
        x = "Negative Reason",
        y = "Average Percentage"))
```





[45]: <Figure Size: (640 x 480)>

```
[ ]: # doesn't show this cells output when downloading PDF
!pip install gwpv &> /dev/null

# installing necessary files
!apt-get install texlive texlive-xetex texlive-latex-extra pandoc
!sudo apt-get update
!sudo apt-get install texlive-xetex texlive-fonts-recommended

# installing pypandoc
!pip install pypandoc

# connecting your google drive
from google.colab import drive
drive.mount('/content/drive')

# copying your file over. Change "Class6-Completed.ipynb" to whatever your file_
!cp "drive/My Drive/Colab Notebooks/MGSC_410_HW_1.ipynb" ./

# Again, replace "Class6-Completed.ipynb" to whatever your file is called (see_
```

```
!jupyter nbconvert --to PDF "MGSC_410_HW_1.ipynb"
```

Reading package lists... Done

Building dependency tree... Done

Reading state information... Done

pandoc is already the newest version (2.9.2.1-3ubuntu2).

pandoc set to manually installed.

The following additional packages will be installed:

dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono  
fonts-texgyre fonts-urw-base35 libapache-pom-java libcommons-logging-java  
libcommons-parent-java libfontbox-java libfontenc1 libgs9 libgs9-common  
libidn12 libijs-0.35 libjbig2dec0 libkpathsea6 libpdfbox-java libptexenc1  
libruby3.0 libsynchronet2 libteckit0 libtexlua53 libtexlua53 libwoff1  
libzip-0-13 lmodern poppler-data preview-latex-style rake ruby  
ruby-net-telnet ruby-rubygems ruby-webrick ruby-xmlrpc ruby3.0  
rubygems-integration tclutils teckit tex-common tex-gyre texlive-base  
texlive-binaries texlive-fonts-recommended texlive-latex-base  
texlive-latex-recommended texlive-pictures texlive-plain-generic tipa  
xfonts-encodings xfonts-utils

Suggested packages:

fonts-noto fonts-freefont-otf | fonts-freefont-ttf libavalon-framework-java  
libcommons-logging-java-doc libexcalibur-logkit-java liblog4j1.2-java  
poppler-utils ghostscript fonts-japanese-mincho | fonts-ipafont-mincho  
fonts-japanese-gothic | fonts-ipafont-gothic fonts-arphic-ukai  
fonts-arphic-uming fonts-nanum ri ruby-dev bundler debhelper gv  
| postscript-viewer perl-tk xpdf | pdf-viewer xzdec  
texlive-fonts-recommended-doc texlive-latex-base-doc python3-pygments  
icc-profiles libfile-which-perl libspreadsheet-parseexcel-perl  
texlive-latex-extra-doc texlive-latex-recommended-doc texlive-luatex  
texlive-pstricks dot2tex prerex texlive-pictures-doc vprerex  
default-jre-headless tipa-doc

The following NEW packages will be installed:

dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono  
fonts-texgyre fonts-urw-base35 libapache-pom-java libcommons-logging-java  
libcommons-parent-java libfontbox-java libfontenc1 libgs9 libgs9-common  
libidn12 libijs-0.35 libjbig2dec0 libkpathsea6 libpdfbox-java libptexenc1  
libruby3.0 libsynchronet2 libteckit0 libtexlua53 libtexlua53 libwoff1  
libzip-0-13 lmodern poppler-data preview-latex-style rake ruby  
ruby-net-telnet ruby-rubygems ruby-webrick ruby-xmlrpc ruby3.0  
rubygems-integration tclutils teckit tex-common tex-gyre texlive texlive-base  
texlive-binaries texlive-fonts-recommended texlive-latex-base  
texlive-latex-extra texlive-latex-recommended texlive-pictures  
texlive-plain-generic texlive-xetex tipa xfonts-encodings xfonts-utils

0 upgraded, 55 newly installed, 0 to remove and 18 not upgraded.

Need to get 182 MB of archives.

After this operation, 572 MB of additional disk space will be used.

Get:1 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-droid-fallback all

1:6.0.1r16-1.1build1 [1,805 kB]  
Get:2 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-lato all 2.0-2.1 [2,696 kB]  
Get:3 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 poppler-data all 0.4.11-1 [2,171 kB]  
Get:4 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 tex-common all 6.17 [33.7 kB]  
Get:5 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-urw-base35 all 20200910-1 [6,367 kB]  
Get:6 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libgs9-common all 9.55.0~dfsg1-0ubuntu5.4 [752 kB]  
Get:7 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libidn12 amd64 1.38-4ubuntu1 [60.0 kB]  
Get:8 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libijs-0.35 amd64 0.35-15build2 [16.5 kB]  
Get:9 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libjbig2dec0 amd64 0.19-3build2 [64.7 kB]  
Get:10 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libgs9 amd64 9.55.0~dfsg1-0ubuntu5.4 [5,032 kB]  
Get:11 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libkpathsea6 amd64 2021.20210626.59705-1ubuntu0.1 [60.3 kB]  
Get:12 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libwoff1 amd64 1.0.2-1build4 [45.2 kB]  
Get:13 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 dvisvgm amd64 2.13.1-1 [1,221 kB]  
Get:14 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 fonts-lmodern all 2.004.5-6.1 [4,532 kB]  
Get:15 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-noto-mono all 20201225-1build1 [397 kB]  
Get:16 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 fonts-texgyre all 20180621-3.1 [10.2 MB]  
Get:17 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libapache-pom-java all 18-1 [4,720 B]  
Get:18 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libcommons-parent-java all 43-1 [10.8 kB]  
Get:19 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libcommons-logging-java all 1.2-2 [60.3 kB]  
Get:20 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 libfontenc1 amd64 1:1.1.4-1build3 [14.7 kB]  
Get:21 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libptexenc1 amd64 2021.20210626.59705-1ubuntu0.1 [39.1 kB]  
Get:22 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 rubygems-integration all 1.18 [5,336 B]  
Get:23 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 ruby3.0 amd64 3.0.2-7ubuntu2.4 [50.1 kB]  
Get:24 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 ruby-rubygems all 3.3.5-2 [228 kB]  
Get:25 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 ruby amd64 1:3.0~exp1

[5,100 B]

Get:26 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 rake all 13.0.6-2 [61.7 kB]

Get:27 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 ruby-net-telnet all 0.1.1-2 [12.6 kB]

Get:28 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 ruby-webrick all 1.7.0-3 [51.8 kB]

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Get:30 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libruby3.0 amd64 3.0.2-7ubuntu2.4 [5,113 kB]

Get:31 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libsynchronet2 amd64 2021.20210626.59705-1ubuntu0.1 [55.5 kB]

Get:32 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libteckit0 amd64 2.5.11+ds1-1 [421 kB]

Get:33 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libtexlua53 amd64 2021.20210626.59705-1ubuntu0.1 [120 kB]

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Get:35 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libzip-0-13 amd64 0.13.72+dfsg.1-1.1 [27.0 kB]

Get:36 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 xfonts-encodings all 1:1.0.5-0ubuntu2 [578 kB]

Get:37 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 xfonts-utils amd64 1:7.7+6build2 [94.6 kB]

Get:38 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 lmodern all 2.004.5-6.1 [9,471 kB]

Get:39 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 preview-latex-style all 12.2-1ubuntu1 [185 kB]

Get:40 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 t1utils amd64 1.41-4build2 [61.3 kB]

Get:41 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 teckit amd64 2.5.11+ds1-1 [699 kB]

Get:42 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 tex-gyre all 20180621-3.1 [6,209 kB]

Get:43 <http://archive.ubuntu.com/ubuntu> jammy-updates/universe amd64 texlive-binaries amd64 2021.20210626.59705-1ubuntu0.1 [9,848 kB]

Get:44 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 texlive-base all 2021.20220204-1 [21.0 MB]

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Get:49 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libfontbox-java all

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1:1.8.16-2 [207 kB]
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1:1.8.16-2 [5,199 kB]
Get:51 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-pictures
all 2021.20220204-1 [8,720 kB]
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all 2021.20220204-1 [13.9 MB]
Get:53 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-plain-
generic all 2021.20220204-1 [27.5 MB]
Get:54 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tipa all 2:1.3-21
[2,967 kB]
Get:55 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-xetex all
2021.20220204-1 [12.4 MB]
Fetched 182 MB in 7s (24.7 MB/s)
Extracting templates from packages: 100%
Preconfiguring packages ...
Selecting previously unselected package fonts-droid-fallback.
(Reading database ... 120895 files and directories currently installed.)
Preparing to unpack .../00-fonts-droid-fallback_1%3a6.0.1r16-1.1build1_all.deb
...
Unpacking fonts-droid-fallback (1:6.0.1r16-1.1build1) ...
Selecting previously unselected package fonts-lato.
Preparing to unpack .../01-fonts-lato_2.0-2.1_all.deb ...
Unpacking fonts-lato (2.0-2.1) ...
Selecting previously unselected package poppler-data.
Preparing to unpack .../02-poppler-data_0.4.11-1_all.deb ...
Unpacking poppler-data (0.4.11-1) ...
Selecting previously unselected package tex-common.
Preparing to unpack .../03-tex-common_6.17_all.deb ...
Unpacking tex-common (6.17) ...
Selecting previously unselected package fonts-urw-base35.
Preparing to unpack .../04-fonts-urw-base35_20200910-1_all.deb ...
Unpacking fonts-urw-base35 (20200910-1) ...
Selecting previously unselected package libgs9-common.
Preparing to unpack .../05-libgs9-common_9.55.0~dfsg1-0ubuntu5.4_all.deb ...
Unpacking libgs9-common (9.55.0~dfsg1-0ubuntu5.4) ...
Selecting previously unselected package libidn12:amd64.
Preparing to unpack .../06-libidn12_1.38-4ubuntu1_amd64.deb ...
Unpacking libidn12:amd64 (1.38-4ubuntu1) ...
Selecting previously unselected package libijs-0.35:amd64.
Preparing to unpack .../07-libijs-0.35_0.35-15build2_amd64.deb ...
Unpacking libijs-0.35:amd64 (0.35-15build2) ...
Selecting previously unselected package libjbig2dec0:amd64.
Preparing to unpack .../08-libjbig2dec0_0.19-3build2_amd64.deb ...
Unpacking libjbig2dec0:amd64 (0.19-3build2) ...
Selecting previously unselected package libgs9:amd64.
Preparing to unpack .../09-libgs9_9.55.0~dfsg1-0ubuntu5.4_amd64.deb ...
Unpacking libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.4) ...

```

```

Selecting previously unselected package libkpathsea6:amd64.
Preparing to unpack .../10-libkpathsea6_2021.20210626.59705-1ubuntu0.1_amd64.deb
...
Unpacking libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Selecting previously unselected package libwoff1:amd64.
Preparing to unpack .../11-libwoff1_1.0.2-1build4_amd64.deb ...
Unpacking libwoff1:amd64 (1.0.2-1build4) ...
Selecting previously unselected package dvisvgm.
Preparing to unpack .../12-dvisvgm_2.13.1-1_amd64.deb ...
Unpacking dvisvgm (2.13.1-1) ...
Selecting previously unselected package fonts-lmodern.
Preparing to unpack .../13-fonts-lmodern_2.004.5-6.1_all.deb ...
Unpacking fonts-lmodern (2.004.5-6.1) ...
Selecting previously unselected package fonts-noto-mono.
Preparing to unpack .../14-fonts-noto-mono_20201225-1build1_all.deb ...
Unpacking fonts-noto-mono (20201225-1build1) ...
Selecting previously unselected package fonts-texgyre.
Preparing to unpack .../15-fonts-texgyre_20180621-3.1_all.deb ...
Unpacking fonts-texgyre (20180621-3.1) ...
Selecting previously unselected package libapache-pom-java.
Preparing to unpack .../16-libapache-pom-java_18-1_all.deb ...
Unpacking libapache-pom-java (18-1) ...
Selecting previously unselected package libcommons-parent-java.
Preparing to unpack .../17-libcommons-parent-java_43-1_all.deb ...
Unpacking libcommons-parent-java (43-1) ...
Selecting previously unselected package libcommons-logging-java.
Preparing to unpack .../18-libcommons-logging-java_1.2-2_all.deb ...
Unpacking libcommons-logging-java (1.2-2) ...
Selecting previously unselected package libfontenc1:amd64.
Preparing to unpack .../19-libfontenc1_1%3a1.1.4-1build3_amd64.deb ...
Unpacking libfontenc1:amd64 (1:1.1.4-1build3) ...
Selecting previously unselected package libptexenc1:amd64.
Preparing to unpack .../20-libptexenc1_2021.20210626.59705-1ubuntu0.1_amd64.deb
...
Unpacking libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Selecting previously unselected package rubygems-integration.
Preparing to unpack .../21-rubygems-integration_1.18_all.deb ...
Unpacking rubygems-integration (1.18) ...
Selecting previously unselected package ruby3.0.
Preparing to unpack .../22-ruby3.0_3.0.2-7ubuntu2.4_amd64.deb ...
Unpacking ruby3.0 (3.0.2-7ubuntu2.4) ...
Selecting previously unselected package ruby-rubygems.
Preparing to unpack .../23-ruby-rubygems_3.3.5-2_all.deb ...
Unpacking ruby-rubygems (3.3.5-2) ...
Selecting previously unselected package ruby.
Preparing to unpack .../24-ruby_1%3a3.0~exp1_amd64.deb ...
Unpacking ruby (1:3.0~exp1) ...
Selecting previously unselected package rake.

```

```

Preparing to unpack .../25-rake_13.0.6-2_all.deb ...
Unpacking rake (13.0.6-2) ...
Selecting previously unselected package ruby-net-telnet.
Preparing to unpack .../26-ruby-net-telnet_0.1.1-2_all.deb ...
Unpacking ruby-net-telnet (0.1.1-2) ...
Selecting previously unselected package ruby-webrick.
Preparing to unpack .../27-ruby-webrick_1.7.0-3_all.deb ...
Unpacking ruby-webrick (1.7.0-3) ...
Selecting previously unselected package ruby-xmlrpc.
Preparing to unpack .../28-ruby-xmlrpc_0.3.2-1ubuntu0.1_all.deb ...
Unpacking ruby-xmlrpc (0.3.2-1ubuntu0.1) ...
Selecting previously unselected package libruby3.0:amd64.
Preparing to unpack .../29-libruby3.0_3.0.2-7ubuntu2.4_amd64.deb ...
Unpacking libruby3.0:amd64 (3.0.2-7ubuntu2.4) ...
Selecting previously unselected package libsyntax2:amd64.
Preparing to unpack .../30-libsyntax2_2021.20210626.59705-1ubuntu0.1_amd64.deb
...
Unpacking libsyntax2:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Selecting previously unselected package libteckit0:amd64.
Preparing to unpack .../31-libteckit0_2.5.11+ds1-1_amd64.deb ...
Unpacking libteckit0:amd64 (2.5.11+ds1-1) ...
Selecting previously unselected package libtexlua53:amd64.
Preparing to unpack .../32-libtexlua53_2021.20210626.59705-1ubuntu0.1_amd64.deb
...
Unpacking libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Selecting previously unselected package libtexluajit2:amd64.
Preparing to unpack
.../33-libtexluajit2_2021.20210626.59705-1ubuntu0.1_amd64.deb ...
Unpacking libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Selecting previously unselected package libzzip-0-13:amd64.
Preparing to unpack .../34-libzzip-0-13_0.13.72+dfsg.1-1.1_amd64.deb ...
Unpacking libzzip-0-13:amd64 (0.13.72+dfsg.1-1.1) ...
Selecting previously unselected package xfonts-encodings.
Preparing to unpack .../35-xfonts-encodings_1%3a1.0.5-0ubuntu2_all.deb ...
Unpacking xfonts-encodings (1:1.0.5-0ubuntu2) ...
Selecting previously unselected package xfonts-utils.
Preparing to unpack .../36-xfonts-utils_1%3a7.7+6build2_amd64.deb ...
Unpacking xfonts-utils (1:7.7+6build2) ...
Selecting previously unselected package lmodern.
Preparing to unpack .../37-lmodern_2.004.5-6.1_all.deb ...
Unpacking lmodern (2.004.5-6.1) ...
Selecting previously unselected package preview-latex-style.
Preparing to unpack .../38-preview-latex-style_12.2-1ubuntu1_all.deb ...
Unpacking preview-latex-style (12.2-1ubuntu1) ...
Selecting previously unselected package t1utils.
Preparing to unpack .../39-t1utils_1.41-4build2_amd64.deb ...
Unpacking t1utils (1.41-4build2) ...
Selecting previously unselected package teckit.

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Preparing to unpack .../40-teckit_2.5.11+ds1-1_amd64.deb ...
Unpacking teckit (2.5.11+ds1-1) ...
Selecting previously unselected package tex-gyre.
Preparing to unpack .../41-tex-gyre_20180621-3.1_all.deb ...
Unpacking tex-gyre (20180621-3.1) ...
Selecting previously unselected package texlive-binaries.
Preparing to unpack .../42-texlive-
binaries_2021.20210626.59705-1ubuntu0.1_amd64.deb ...
Unpacking texlive-binaries (2021.20210626.59705-1ubuntu0.1) ...
Selecting previously unselected package texlive-base.
Preparing to unpack .../43-texlive-base_2021.20220204-1_all.deb ...
Unpacking texlive-base (2021.20220204-1) ...
Selecting previously unselected package texlive-fonts-recommended.
Preparing to unpack .../44-texlive-fonts-recommended_2021.20220204-1_all.deb ...
Unpacking texlive-fonts-recommended (2021.20220204-1) ...
Selecting previously unselected package texlive-latex-base.
Preparing to unpack .../45-texlive-latex-base_2021.20220204-1_all.deb ...
Unpacking texlive-latex-base (2021.20220204-1) ...
Selecting previously unselected package texlive-latex-recommended.
Preparing to unpack .../46-texlive-latex-recommended_2021.20220204-1_all.deb ...
Unpacking texlive-latex-recommended (2021.20220204-1) ...
Selecting previously unselected package texlive.
Preparing to unpack .../47-texlive_2021.20220204-1_all.deb ...
Unpacking texlive (2021.20220204-1) ...
Selecting previously unselected package libfontbox-java.
Preparing to unpack .../48-libfontbox-java_1%3a1.8.16-2_all.deb ...
Unpacking libfontbox-java (1:1.8.16-2) ...
Selecting previously unselected package libpdfbox-java.
Preparing to unpack .../49-libpdfbox-java_1%3a1.8.16-2_all.deb ...
Unpacking libpdfbox-java (1:1.8.16-2) ...
Selecting previously unselected package texlive-pictures.
Preparing to unpack .../50-texlive-pictures_2021.20220204-1_all.deb ...
Unpacking texlive-pictures (2021.20220204-1) ...
Selecting previously unselected package texlive-latex-extra.
Preparing to unpack .../51-texlive-latex-extra_2021.20220204-1_all.deb ...
Unpacking texlive-latex-extra (2021.20220204-1) ...
Selecting previously unselected package texlive-plain-generic.
Preparing to unpack .../52-texlive-plain-generic_2021.20220204-1_all.deb ...
Unpacking texlive-plain-generic (2021.20220204-1) ...
Selecting previously unselected package tipa.
Preparing to unpack .../53-tipa_2%3a1.3-21_all.deb ...
Unpacking tipa (2:1.3-21) ...
Selecting previously unselected package texlive-xetex.
Preparing to unpack .../54-texlive-xetex_2021.20220204-1_all.deb ...
Unpacking texlive-xetex (2021.20220204-1) ...
Setting up fonts-lato (2.0-2.1) ...
Setting up fonts-noto-mono (20201225-1build1) ...
Setting up libwoff1:amd64 (1.0.2-1build4) ...

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Setting up libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Setting up libijs-0.35:amd64 (0.35-15build2) ...
Setting up libtexluaajit2:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Setting up libfontbox-java (1:1.8.16-2) ...
Setting up rubygems-integration (1.18) ...
Setting up libzip-0-13:amd64 (0.13.72+dfsg.1-1.1) ...
Setting up fonts-urw-base35 (20200910-1) ...
Setting up poppler-data (0.4.11-1) ...
Setting up tex-common (6.17) ...
update-language: texlive-base not installed and configured, doing nothing!
Setting up libfontenc1:amd64 (1:1.1.4-1build3) ...
Setting up libjbig2dec0:amd64 (0.19-3build2) ...
Setting up libteckit0:amd64 (2.5.11+ds1-1) ...
Setting up libapache-pom-java (18-1) ...
Setting up ruby-net-telnet (0.1.1-2) ...
Setting up xfonts-encodings (1:1.0.5-0ubuntu2) ...
Setting up t1utils (1.41-4build2) ...
Setting up libidn12:amd64 (1.38-4ubuntu1) ...
Setting up fonts-texgyre (20180621-3.1) ...
Setting up libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Setting up ruby-webrick (1.7.0-3) ...
Setting up fonts-lmodern (2.004.5-6.1) ...
Setting up fonts-droid-fallback (1:6.0.1r16-1.1build1) ...
Setting up ruby-xmlrpc (0.3.2-1ubuntu0.1) ...
Setting up libsynchronet2:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Setting up libgs9-common (9.55.0~dfsg1-0ubuntu5.4) ...
Setting up teckit (2.5.11+ds1-1) ...
Setting up libpdfbox-java (1:1.8.16-2) ...
Setting up libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.4) ...
Setting up preview-latex-style (12.2-1ubuntu1) ...
Setting up libcommons-parent-java (43-1) ...
Setting up dvisvgm (2.13.1-1) ...
Setting up libcommons-logging-java (1.2-2) ...
Setting up xfonts-utils (1:7.7+6build2) ...
Setting up libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.1) ...
Setting up texlive-binaries (2021.20210626.59705-1ubuntu0.1) ...
update-alternatives: using /usr/bin/xdvi-xaw to provide /usr/bin/xdvi.bin
(xdvi.bin) in auto mode
update-alternatives: using /usr/bin/bibtex.original to provide /usr/bin/bibtex
(bibtex) in auto mode
Setting up lmodern (2.004.5-6.1) ...
Setting up texlive-base (2021.20220204-1) ...
/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
mktexlsr: Updating /var/lib/texmf/ls-R-TEXLIVEDIST...
mktexlsr: Updating /var/lib/texmf/ls-R-TEXMFMAIN...

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mktexlsr: Updating /var/lib/texmf/ls-R...
mktexlsr: Done.
tl-paper: setting paper size for dvips to a4:
/var/lib/texmf/dvips/config/config-paper.ps
tl-paper: setting paper size for dvipdfmx to a4:
/var/lib/texmf/dvipdfmx/dvipdfmx-paper.cfg
tl-paper: setting paper size for xdvi to a4: /var/lib/texmf/xdvi/XDvi-paper
tl-paper: setting paper size for pdftex to a4: /var/lib/texmf/tex/generic/tex-
ini-files/pdftexconfig.tex
Setting up tex-gyre (20180621-3.1) ...
Setting up texlive-plain-generic (2021.20220204-1) ...
Setting up texlive-latex-base (2021.20220204-1) ...
Setting up texlive-latex-recommended (2021.20220204-1) ...
Setting up texlive-pictures (2021.20220204-1) ...
Setting up texlive-fonts-recommended (2021.20220204-1) ...
Setting up tipa (2:1.3-21) ...
Setting up texlive (2021.20220204-1) ...
Setting up texlive-latex-extra (2021.20220204-1) ...
Setting up texlive-xetex (2021.20220204-1) ...
Setting up rake (13.0.6-2) ...
Setting up libruby3.0:amd64 (3.0.2-7ubuntu2.4) ...
Setting up ruby3.0 (3.0.2-7ubuntu2.4) ...
Setting up ruby (1:3.0~exp1) ...
Setting up ruby-rubygems (3.3.5-2) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for fontconfig (2.13.1-4.2ubuntu5) ...
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link

Processing triggers for tex-common (6.17) ...
Running updmap-sys. This may take some time... done.
Running mktexlsr /var/lib/texmf ... done.
Building format(s) --all.
    This may take some time... done.
Get:1 https://cloud.r-project.org/bin/linux/ubuntu jammy-cran40/ InRelease
[3,626 B]
Get:2 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64

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InRelease [1,581 B]
Get:3 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:4 https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/x86_64
Packages [518 kB]
Hit:5 http://archive.ubuntu.com/ubuntu jammy InRelease
Get:6 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Get:7 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages
[1,002 kB]
Get:8 https://ppa.launchpadcontent.net/c2d4u.team/c2d4u4.0+/ubuntu jammy
InRelease [18.1 kB]
Get:9 http://security.ubuntu.com/ubuntu jammy-security/restricted amd64 Packages
[1,226 kB]
Get:10 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [109 kB]
Get:11 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages
[1,081 kB]
Get:12 http://archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [1,342
kB]
Hit:13 https://ppa.launchpadcontent.net/deadsnakes/ppa/ubuntu jammy InRelease
Get:14 http://archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 Packages
[1,252 kB]
Get:15 http://archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages
[1,266 kB]
Hit:16 https://ppa.launchpadcontent.net/graphics-drivers/ppa/ubuntu jammy
InRelease
Hit:17 https://ppa.launchpadcontent.net/ubuntugis/ppa/ubuntu jammy InRelease
Get:18 https://ppa.launchpadcontent.net/c2d4u.team/c2d4u4.0+/ubuntu jammy/main
Sources [2,197 kB]
Get:19 https://ppa.launchpadcontent.net/c2d4u.team/c2d4u4.0+/ubuntu jammy/main
amd64 Packages [1,128 kB]
Fetched 11.4 MB in 6s (2,032 kB/s)
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package texlive-fonts-recommended_
Collecting py pandoc
  Downloading py pandoc-1.11-py3-none-any.whl (20 kB)
Installing collected packages: py pandoc
Successfully installed py pandoc-1.11

```