In [1]:
```python
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:
```python
import sqlite3
```

In [3]:
```python
connection = sqlite3.connect(r'/Users/haleigh/Desktop/Udemy Courses/Data Analysis Projects/Am
```

In [4]:
```python
type(connection)
```

Out[4]:
```
sqlite3.Connection
```

In [5]:
```python
df = pd.read_sql_query("SELECT * FROM REVIEWS", connection)
```

In [6]:
```python
# raw data
df.shape
```

Out[6]:
```
(568454, 10)
```

In [7]:
```python
# data preparation for analysis
df.columns
```

Out[7]:
```
Index(['Id', 'ProductId', 'UserId', 'ProfileName', 'HelpfulnessNumerator',
       'HelpfulnessDenominator', 'Score', 'Time', 'Summary', 'Text'],
      dtype='object')
```

In [8]:
```
df[df['HelpfulnessNumerator'] > df['HelpfulnessDenominator']]
```

Out[8]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Su
44736	44737	B001EQ55RW	A2V0I904FH7ABY	Ram	3	2	4	1212883200	tas c a
64421	64422	B000MIDROQ	A161DK06JJMCYF	J. E. Stephens "Jeanne"	3	1	5	1224892800	. I at (

In [9]:
```
# valid rows
df_valid = df[df['HelpfulnessNumerator'] <= df['HelpfulnessDenominator']]
```

In [10]:
```
df_valid.shape
```

Out[10]:
```
(568452, 10)
```

In [11]:
```
df_valid.columns
```

Out[11]:
```
Index(['Id', 'ProductId', 'UserId', 'ProfileName', 'HelpfulnessNumerator',
       'HelpfulnessDenominator', 'Score', 'Time', 'Summary', 'Text'],
      dtype='object')
```

In [12]:
```python
# remove duplicate rows for unbiased results
df_valid.duplicated(['UserId', 'ProfileName','Time','Text'])
```

Out[12]:
```
0         False
1         False
2         False
3         False
4         False
          ...
568449    False
568450    False
568451    False
568452    False
568453    False
Length: 568452, dtype: bool
```

In [13]:

```
# shows count of duplicate rows
df_valid[df_valid.duplicated(['UserId', 'ProfileName','Time','Text'])]
```

Out[13]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time
29	30	B0001PB9FY	A3HDKO7OW0QNK4	Canadian Fan	1	1	5	1107820800
574	575	B000G6RYNE	A3PJZ8TU8FDQ1K	Jared Castle	2	2	5	1231718400
1973	1974	B0017165OG	A2EPNS38TTLZYN	tedebear	0	0	3	1312675200
2309	2310	B0001VWE0M	AQM74O8Z4FMS0	Sunshine	0	0	2	1127606400
2323	2324	B0001VWE0C	AQM74O8Z4FMS0	Sunshine	0	0	2	1127606400
...	...	...	...	...	...	...	...	...
568409	568410	B0018CLWM4	A2PE0AGWV6OPL7	Dark Water Mermaid	3	3	5	1309651200

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time
568410	568411	B0018CLWM4	A88HLWDCU57WG	R28	2	2	5	1332979200
568411	568412	B0018CLWM4	AUX1HSY8FX55S	DAW	1	1	5	1319500800
568412	568413	B0018CLWM4	AVZ2OZ479Q9E8	Ai Ling Chow	0	0	5	1336435200
568413	568414	B0018CLWM4	AI3Y26HLPYW4L	kimosabe	1	2	2	1330041600

174521 rows × 10 columns

In [14]:
```
# remove duplicate rows (174521 rows × 10 columns)
data = df_valid.drop_duplicates(subset =['UserId', 'ProfileName','Time','Text'])
```

In [15]:
```
data.shape
```

Out[15]:
```
(393931, 10)
```

In [16]:
```
data.dtypes
```

Out[16]:
```
Id                          int64
ProductId                  object
UserId                     object
ProfileName                object
HelpfulnessNumerator        int64
HelpfulnessDenominator      int64
Score                       int64
Time                        int64
Summary                    object
Text                       object
dtype: object
```

In [17]:
```
import warnings
from warnings import filterwarnings
filterwarnings('ignore')
```

In [18]:
```
data['Time'] = pd.to_datetime(data['Time'], unit= 's')
```

In [19]:
```
# analyse what amazon can recommend more to a user
data['ProfileName']
```

Out[19]:
```
0                              delmartian
1                                  dll pa
2         Natalia Corres "Natalia Corres"
3                                    Karl
4           Michael D. Bigham "M. Wassir"
                       ...
568449                    Lettie D. Carter
568450                           R. Sawyer
568451                      pksd "pk_007"
568452            Kathy A. Welch "katwel"
568453                            srfell17
Name: ProfileName, Length: 393931, dtype: object
```

In [20]:
```python
data['ProfileName'].unique() # get unique names
```

Out[20]:
```
array(['delmartian', 'dll pa', 'Natalia Corres "Natalia Corres"', ...,
       'Lettie D. Carter', 'pksd "pk_007"', 'srfell17'], dtype=object)
```

In [21]:
```python
data['UserId'].nunique() # count of unique users
```

Out[21]:
```
256059
```

In [22]:
```python
recommend_df = data.groupby(['UserId']).agg({'Summary':'count', 'Text':'count', 'Score':'mean
```

In [23]:
```python
recommend_df.columns = ['Number_of_Summaries', 'Num_Text', 'Average_Score', 'Products_Purchas
```

In [24]:
```
recommend_df
```

Out[24]:

	Number_of_Summaries	Num_Text	Average_Score	Products_Purchased
UserId				
AY12DBB0U420B	329	329	4.659574	329
A3OXHLG6DIBRW8	278	278	4.546763	278
A281NPSIMI1C2R	259	259	4.787645	259
A1YUL9PCJR3JTY	214	214	4.621495	214
A1Z54EM24Y40LL	211	211	4.383886	211
...	...	...	...	...
A2E80MDB9TCNGW	1	1	3.000000	1
A2E80RT3HOR35T	1	1	5.000000	1
A2E816C5N51F6X	1	1	5.000000	1
A2E81TVIUZI1IC	1	1	5.000000	1
AZZZOVIBXHGDR	1	1	2.000000	1

256059 rows × 4 columns

In [25]:
```
recommend_df.index[0:10]
```

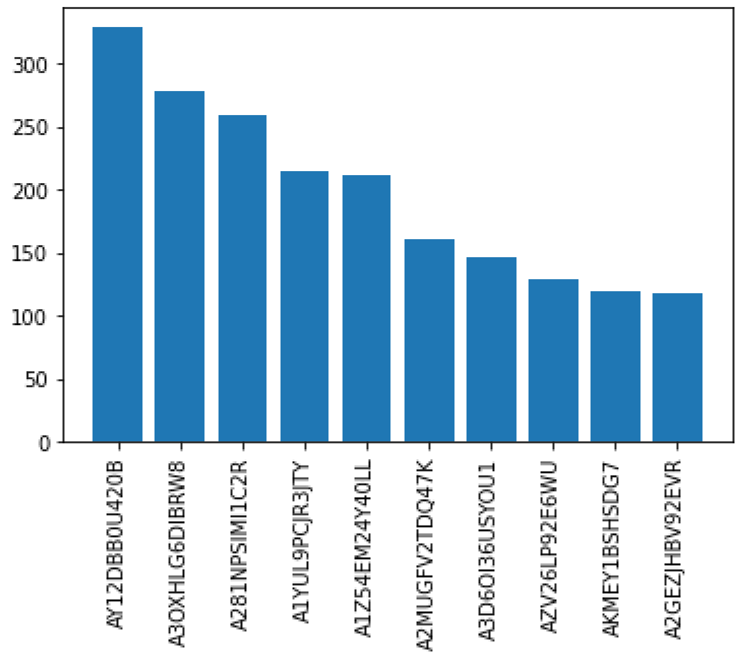
Out[25]:
```
Index(['AY12DBB0U420B', 'A3OXHLG6DIBRW8', 'A281NPSIMI1C2R', 'A1YUL9PCJR3JTY',
       'A1Z54EM24Y40LL', 'A2MUGFV2TDQ47K', 'A3D6OI36USYOU1', 'AZV26LP92E6WU',
       'AKMEY1BSHSDG7', 'A2GEZJHBV92EVR'],
      dtype='object', name='UserId')
```

In [26]:
```
recommend_df['Products_Purchased'][0:10].values
```

Out[26]:
```
array([329, 278, 259, 214, 211, 161, 146, 129, 119, 118])
```

In [27]:
```python
plt.bar(recommend_df.index[0:10], recommend_df['Products_Purchased'][0:10].values)
plt.xticks(rotation='vertical')
```

Out[27]:
```
([0, 1, 2, 3, 4, 5, 6, 7, 8, 9],
 [Text(0, 0, ''),
  Text(0, 0, ''),
  Text(0, 0, ''),
  Text(0, 0, ''),
  Text(0, 0, ''),
  Text(0, 0, ''),
  Text(0, 0, ''),
  Text(0, 0, ''),
  Text(0, 0, ''),
  Text(0, 0, '')])
```



In [28]:
```
# which product has a good amount of reviews
# how many unique products do we have in data?
len(data['ProductId'].unique())
```
Out[28]:
```
67624
```
In [29]:
```
# threshold value for a "good amount" of products should be greater than 500
product_count = data['ProductId'].value_counts().to_frame()
```
In [30]:
```
product_count[product_count['ProductId']>500]
```
Out[30]:

	ProductId
B007JFMH8M	912
B002QWP89S	630
B003B3OOPA	622
B001EO5Q64	566
B0013NUGDE	558
B000KV61FC	556
B000UBD88A	542
B000NMJWZO	542
B005K4Q37A	541
B0090X8IPM	530
B005ZBZLT4	505

In [31]:
```
# most frequent products
frequent_product_ids = product_count[product_count['ProductId']>500].index
```

In [32]:
```
data['ProductId'].isin(frequent_product_ids)
```

Out[32]:
```
0         False
1         False
2         False
3         False
4         False
          ...
568449    False
568450    False
568451    False
568452    False
568453    False
Name: ProductId, Length: 393931, dtype: bool
```

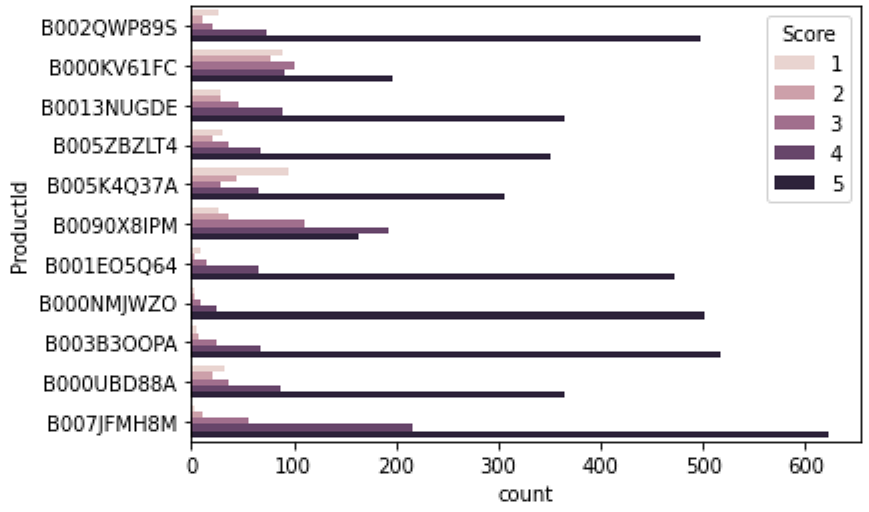
In [33]:
```
frequent_product_df = data[data['ProductId'].isin(frequent_product_ids)]
```

In [34]:
```
frequent_product_df.columns
```

Out[34]:
```
Index(['Id', 'ProductId', 'UserId', 'ProfileName', 'HelpfulnessNumerator',
       'HelpfulnessDenominator', 'Score', 'Time', 'Summary', 'Text'],
      dtype='object')
```

In [35]:
```
sns.countplot(y = 'ProductId', data = frequent_product_df, hue = 'Score')
```

Out[35]:
```
<AxesSubplot:xlabel='count', ylabel='ProductId'>
```



In [36]:
```
# is there a difference between the behabior of the freq. viewers and not freq. viewers regar
# freq. viewer = bought the product 50 times or more
```

In [37]:
```
x = data['UserId'].value_counts()
```

In [38]:
```
x['AY12DBB0U420B']
```

Out[38]:
```
329
```

In [39]:
```python
# if a user has a count of 50 it will be frequent
# consider the user as a pointer to each row of the UserId
data['viewer_type'] = data['UserId'].apply(lambda user : "Frequent" if x[user]>50 else "Not F
```

In [40]:
```python
data.head(3)
```

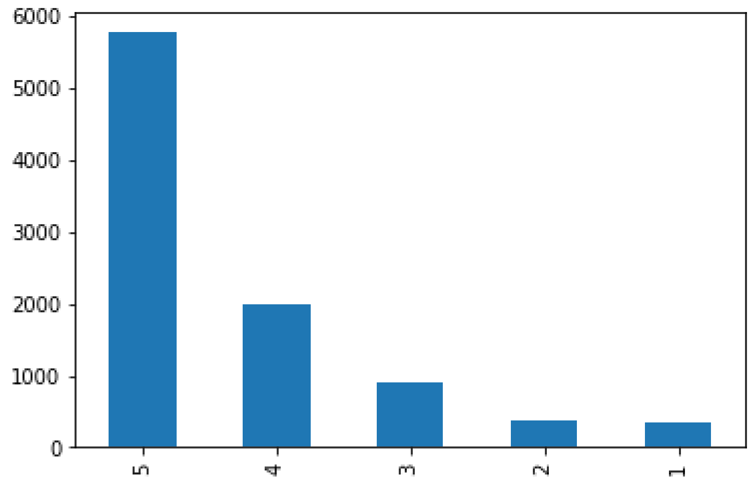
Out[40]:

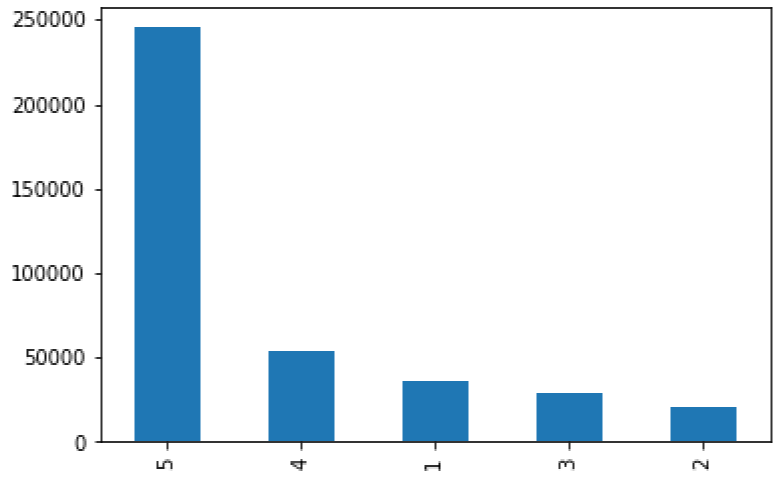
	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	2011-04-27	Good Quality Dog Food	I sev the c
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	2012-09-07	Not as Advertised	F labe . Pe
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	2008-08-18	"Delight" says it all	T con th ar

In [41]:
```python
data['viewer_type'].unique()
```

Out[41]:
```
array(['Not Frequent', 'Frequent'], dtype=object)
```

In [42]:
```python
not_frequent_df = data[data['viewer_type'] == 'Not Frequent']
frequent_df = data[data['viewer_type'] == 'Frequent']
```

In [43]:
```
frequent_df['Score'].value_counts().plot(kind='bar')
```
Out[43]:
```
<AxesSubplot:>
```


In [44]:
```
not_frequent_df['Score'].value_counts().plot(kind='bar')
```
Out[44]:
```
<AxesSubplot:>
```


```
In [45]: # are frequent viewers more likely to leave reviews?
         data[['UserId', 'ProductId', 'Text']]
```

Out[45]:

	UserId	ProductId	Text
0	A3SGXH7AUHU8GW	B001E4KFG0	I have bought several of the Vitality canned d...
1	A1D87F6ZCVE5NK	B00813GRG4	Product arrived labeled as Jumbo Salted Peanut...
2	ABXLMWJIXXAIN	B000LQOCH0	This is a confection that has been around a fe...
3	A395BORC6FGVXV	B000UA0QIQ	If you are looking for the secret ingredient i...
4	A1UQRSCLF8GW1T	B006K2ZZ7K	Great taffy at a great price. There was a wid...
...	...	...	...
568449	A28KG5XORO54AY	B001EO7N10	Great for sesame chicken..this is a good if no...
568450	A3I8AFVPEE8KI5	B003S1WTCU	I'm disappointed with the flavor. The chocolat...
568451	A121AA1GQV751Z	B004I613EE	These stars are small, so you can give 10-15 o...
568452	A3IBEVCTXKNOH	B004I613EE	These are the BEST treats for training and rew...
568453	A3LGQPJCZVL9UC	B001LR2CU2	I am very satisfied ,product is as advertised,...

393931 rows × 3 columns

```
In [46]: def calculate_length(text):
             return len(text.split(' '))
```

```
In [47]: data['Text_length'] = data['Text'].apply(calculate_length)
```

```
In [48]: data['viewer_type'].unique()

Out[48]: array(['Not Frequent', 'Frequent'], dtype=object)
```

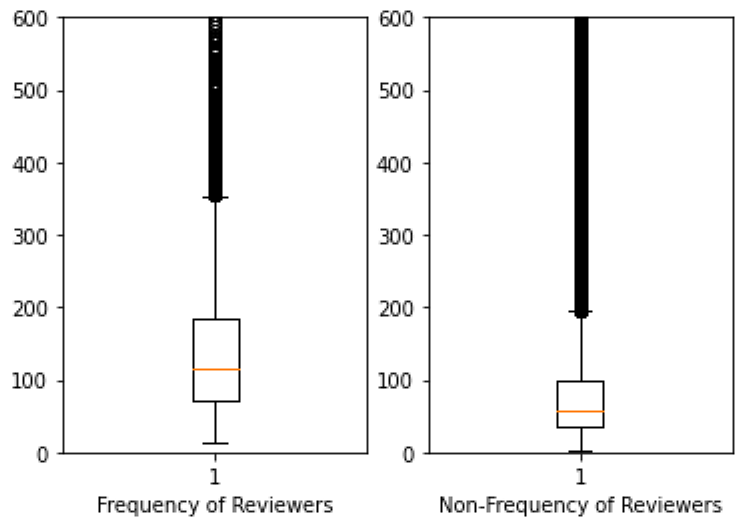
In [49]:
```python
not_frequent_data = data[data['viewer_type'] == 'Not Frequent']
frequent_data = data[data['viewer_type'] == 'Frequent']
```

In [50]:
```python
fig = plt.figure()

ax1 = fig.add_subplot(121)
ax1.boxplot(frequent_data['Text_length'])
ax1.set_xlabel('Frequency of Reviewers')
ax1.set_ylim(0,600)

ax2 = fig.add_subplot(122)
ax2.boxplot(not_frequent_data['Text_length'])
ax2.set_xlabel('Non-Frequency of Reviewers')
ax2.set_ylim(0,600)
```

Out[50]:
```
(0.0, 600.0)
```



```
In [51]:
# perform sentiment analysis on the data
!pip install textblob
from textblob import TextBlob
```

```
Collecting textblob
  Downloading textblob-0.18.0.post0-py3-none-any.whl.metadata (4.5 kB)
Collecting nltk>=3.8 (from textblob)
  Downloading nltk-3.9.1-py3-none-any.whl.metadata (2.9 kB)
Requirement already satisfied: click in /Library/Frameworks/Python.framework/Versions/3.10/lib/p
ython3.10/site-packages (from nltk>=3.8->textblob) (8.0.3)
Requirement already satisfied: joblib in /Library/Frameworks/Python.framework/Versions/3.10/lib/
python3.10/site-packages (from nltk>=3.8->textblob) (1.1.0)
Collecting regex>=2021.8.3 (from nltk>=3.8->textblob)
  Downloading regex-2024.9.11-cp310-cp310-macosx_11_0_arm64.whl.metadata (40 kB)
Requirement already satisfied: tqdm in /Library/Frameworks/Python.framework/Versions/3.10/lib/py
thon3.10/site-packages (from nltk>=3.8->textblob) (4.66.5)
Downloading textblob-0.18.0.post0-py3-none-any.whl (626 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 626.3/626.3 kB 5.7 MB/s eta 0:00:00
Downloading nltk-3.9.1-py3-none-any.whl (1.5 MB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.5/1.5 MB 15.4 MB/s eta 0:00:00
Downloading regex-2024.9.11-cp310-cp310-macosx_11_0_arm64.whl (284 kB)
Installing collected packages: regex, nltk, textblob
Successfully installed nltk-3.9.1 regex-2024.9.11 textblob-0.18.0.post0
```

```
In [53]:
data['Summary'][0]
```

```
Out[53]: 'Good Quality Dog Food'
```

```
In [54]:
TextBlob('Good Quality Dog Food').sentiment.polarity
```

```
Out[54]: 0.7
```

```
In [56]:
sample = data[0:50000]
```

In [57]:
```python
polarity = []

for text in sample['Summary']:
    try:
        polarity.append(TextBlob(text).sentiment.polarity)
    except:
        polarity.append(0)
```

In [58]:
```python
len(polarity)
```

Out[58]:
```
50000
```

In [59]:
```python
sample['polarity'] = polarity
```

In [61]:
```python
# now we have a polarity feature
sample.head()
```

Out[61]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	2011-04-27	Good Quality Dog Food	I sev the c
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	2012-09-07	Not as Advertised	F labe . Pe
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	2008-08-18	"Delight" says it all	T con th ar
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	3	2	2011-06-13	Cough Medicine	If y I ing
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	0	5	2012-10-21	Great taffy	Gre at The a

In [64]:

```
# entire data frame for negative polarity
negative_polarity = sample[sample['polarity'] < 0]
positive_polarity = sample[sample['polarity'] > 0]
```

In [66]:

```
from collections import Counter
```

In [68]:
```
Counter(negative_polarity['Summary']).most_common(50)
```

```
Out[68]: [('Disappointed', 44),
          ('Disappointing', 32),
          ('Bland', 18),
          ('Awful', 17),
          ('Not what I expected', 17),
          ('Terrible', 15),
          ('Horrible', 15),
          ('disappointed', 15),
          ('Disgusting', 12),
          ('not good', 11),
          ("Don't waste your money", 11),
          ('Not good', 10),
          ('Very Disappointed', 10),
          ('disappointing', 9),
          ('Not worth the money', 9),
          ('Not Good', 8),
          ('Not very good', 8),
          ('Not impressed', 8),
          ('Nasty', 8),
          ('Stale', 7),
          ('Bitter', 6),
          ('Waste of money', 6),
          ('Hard to find', 6),
          ('Mediocre', 6),
          ('Weak', 6),
          ('AWFUL', 5),
          ('Addicted', 5),
          ('awful', 5),
          ('Poor Quality', 5),
          ('Not worth it', 5),
          ('Not great', 5),
          ('Bad aftertaste', 5),
          ('Bad', 4),
          ('Disappointed!', 4),
          ('too expensive', 4),
          ('Tasteless', 4),
          ('Terrible!', 4),
          ('Not too bad', 4),
          ('not what I expected', 4),
          ('horrible', 4),
          ('Not what I expected.', 4),
          ('Too expensive', 4),
          ('As expected', 4),
          ('Lipton Loose Tea', 4),
          ('Disappointment', 4),
          ('stale', 4),
          ('Expensive', 4),
          ('Awful!', 4),
          ('Horrible!', 3),
          ('NASTY', 3)]
```

In [69]:
```
Counter(positive_polarity['Summary']).most_common(50)
```

```
Out[69]: [('Delicious!', 208),
          ('Delicious', 204),
          ('Great product', 100),
          ('Excellent', 85),
          ('Love it!', 81),
          ('Great', 81),
          ('Great Product', 77),
          ('Great!', 70),
          ('Good stuff', 51),
          ('Awesome', 50),
          ('Excellent!', 44),
          ('Good Stuff', 44),
          ('The Best', 43),
          ('great product', 43),
          ('Great Coffee', 43),
          ('Awesome!', 43),
          ('Love it', 37),
          ('Wonderful', 35),
          ('Good', 34),
          ('Fantastic!', 34),
          ('Amazing', 34),
          ('Great product!', 34),
          ('Great taste', 34),
          ('Good product', 33),
          ('Perfect', 32),
          ('delicious', 31),
          ('Great Tea', 31),
          ('Great coffee', 31),
          ('Excellent product', 31),
          ('Very good', 29),
          ('Wonderful!', 28),
          ('Fantastic', 28),
          ('Amazing!', 27),
          ('Excellent Product', 27),
          ('Love these!', 25),
          ('great', 25),
          ('Perfect!', 25),
          ('great coffee', 24),
          ('very good', 24),
          ('Great flavor', 24),
          ('Great Product!', 23),
          ('Good stuff!', 22),
          ('Pretty Good', 22),
          ('good stuff', 22),
          ('Pretty good', 22),
          ('Great Taste', 22),
          ('Great stuff', 21),
          ('Great Stuff', 21),
          ('Good coffee', 20),
          ('Great tea', 20)]
```

```
In [ ]:
```