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

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

In [3]:
```
con = sqlite3.connect('/home/inshad/Downloads/Project 5-- Amazon Customers Data Analysis-20221214T080727Z-001/Project 5--_ Amazon Customers
```

In [4]:
```
df = pd.read_sql_query('SELECT * FROM Reviews',con)
```

In [5]:
```
df.head()
```

Out[5]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	1303862400	Good Quality Dog Food	I have bought several of the Vitality canned d...
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	1346976000	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	1219017600	"Delight" says it all	This is a confection that has been around a fe...
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	3	2	1307923200	Cough Medicine	If you are looking for the secret ingredient i...
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	0	5	1350777600	Great taffy	Great taffy at a great price. There was a wid...

In [6]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 568454 entries, 0 to 568453
Data columns (total 10 columns):
 #   Column                  Non-Null Count   Dtype 
---  ------                  --------------   ----- 
 0   Id                      568454 non-null  int64 
 1   ProductId               568454 non-null  object
 2   UserId                  568454 non-null  object
 3   ProfileName             568454 non-null  object
 4   HelpfulnessNumerator    568454 non-null  int64 
 5   HelpfulnessDenominator  568454 non-null  int64 
 6   Score                   568454 non-null  int64 
 7   Time                    568454 non-null  int64 
 8   Summary                 568454 non-null  object
 9   Text                    568454 non-null  object
dtypes: int64(5), object(5)
memory usage: 43.4+ MB
```

In [7]:
```
df.isna().sum()
```

Out[7]:
```
Id                      0
ProductId               0
UserId                  0
ProfileName             0
HelpfulnessNumerator    0
HelpfulnessDenominator  0
Score                   0
Time                    0
Summary                 0
Text                    0
dtype: int64
```

In [8]:
```
df.duplicated().sum()
```

Out[8]: 0

Sentiment Analysis using Textblob

In [9]:
```
from textblob import TextBlob
```

In [10]:
```
df['Summary'][0]
```

Out[10]: 'Good Quality Dog Food'

In [11]:
```
df['Summary'][540]
```

Out[11]: 'Not the Best'

In [12]:
```
TextBlob(df['Summary'][0]).sentiment.polarity
```

Out[12]: 0.7

We will perform polarity on Summary column

In [13]:
```
Polarity = []
for item in df['Summary']:
    try:
        Polarity.append(TextBlob(item).sentiment.polarity)
    except:
        Polarity.append(0)
```

In [14]:
```
df['Polarity'] = Polarity
```

In [15]:
```
df.head()
```

Out[15]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text	Polarity
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	1303862400	Good Quality Dog Food	I have bought several of the Vitality canned d...	0.7
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	1346976000	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...	0.0
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	1219017600	"Delight" says it all	This is a confection that has been around a fe...	0.0
3	4	B000UA0QIQ	A395BORC6FGVXV	Karl	3	3	2	1307923200	Cough Medicine	If you are looking for the secret ingredient i...	0.0
4	5	B006K2ZZ7K	A1UQRSCLF8GW1T	Michael D. Bigham "M. Wassir"	0	0	5	1350777600	Great taffy	Great taffy at a great price. There was a wid...	0.8

Now we will distinguish positive and negative reviews based on the polarity. Higher the polarity, postive the review is and lower the polarity negative the review is.

In [16]:
```
data_positive = df[df['Polarity']>0]
data_negative = df[df['Polarity']<0]
```

EDA for positive reviews

In [17]:
```
total_positive_text = (" ".join(data_positive['Summary']))
total_positive_text[0:300]
```

Out[17]:
```
'Good Quality Dog Food Great taffy Nice Taffy Great!  Just as good as the expensive brands! Wonderful, tasty taffy Healthy Dog Food The Best Hot Sauce in the World My cats LOVE this "diet" food better than their regular food My Cats Are Not Fans of the New Food fresh and greasy! Love it! GREAT SWEET '
```

Inorder to make wordcloud image, we will remove all non-alphabets from the total postive text

In [18]:
```
from wordcloud import WordCloud,STOPWORDS
```

In [19]:
```
import re
```

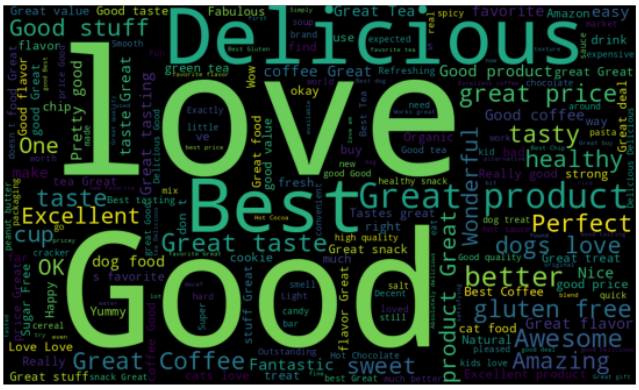
In [20]:
```
total_positive_text = re.sub(r'[^a-zA-z0-9]',' ',total_positive_text)
total_positive_text[0:300]
```

Out[20]:
```
'Good Quality Dog Food Great taffy Nice Taffy Great   Just as good as the expensive brands  Wonderful  tasty taffy Healthy Dog Food The Best Hot Sauce in the World My cats LOVE this  diet  food better than their regular food My Cats Are Not Fans of the New Food fresh and greasy Love it  GREAT SWEET '
```

In [21]:
```
total_positive_text = re.sub(' +',' ',total_positive_text)
```

In [22]:
```
wordcloud_positive = WordCloud(width=1000,height=600,stopwords=STOPWORDS).generate(total_positive_text)
plt.figure(figsize=(10,6))
plt.imshow(wordcloud_positive)
plt.axis('off')
```

Out[22]:
```
(-0.5, 999.5, 599.5, -0.5)
```



EDA for negative reviews

In [23]:
```
total_negative_text = (" ".join(data_negative['Summary']))
total_negative_text[0:300]
```

Out[23]:
```
"poor taste Nasty No flavor How can you go wrong! pretty expensive stale product. Bigger then other brands Order only in cold weather Bad disappointing My every day green tea BROKEN BOTTLE BOTTOMS! Tasteless but low calorie Marley's Mellow Mood Lite - Half Tea Half Lemonade Nearly killed the cats CHA"
```

In [24]:
```
total_negative_text = re.sub(r'[^a-zA-Z0-9]',' ',total_negative_text)
```

In [25]:
```
total_negative_text = re.sub(' +',' ',total_negative_text)
total_negative_text[0:300]
```

Out[25]:
```
'poor taste Nasty No flavor How can you go wrong pretty expensive stale product Bigger then other brands Order only in cold weather Bad dis
appointing My every day green tea BROKEN BOTTLE BOTTOMS Tasteless but low calorie Marley s Mellow Mood Lite Half Tea Half Lemonade Nearly k
illed the cats CHANGED '
```

In [26]:
```
total_negative_text = re.sub('good',' ',total_negative_text)
total_negative_text = re.sub('Tasty',' ',total_negative_text)
total_negative_text = re.sub(' +',' ',total_negative_text)
```

In [27]:
```
wordcloud_negative = WordCloud(width=1000,height=600,stopwords=STOPWORDS).generate(total_negative_text)
plt.figure(figsize=(10,6))
plt.imshow(wordcloud_negative)
plt.axis('off')
```

Out[27]:
```
(-0.5, 999.5, 599.5, -0.5)
```

EDA for Business analytics

In [28]:
```
df.head(3)
```

Out[28]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text	Polarity
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1	5	1303862400	Good Quality Dog Food	I have bought several of the Vitality canned d...	0.7
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	1346976000	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...	0.0
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1	4	1219017600	"Delight" says it all	This is a confection that has been around a fe...	0.0

We will extract the top users and we can recommend more products to the users who are frequent buyers

In [29]:
```
# we have this much unique users
df['UserId'].nunique()
```

Out[29]:
```
256059
```

In [30]:
```
top_customers = df.groupby('UserId').agg({'ProductId':'count','Score':'mean','Summary':'count','Text':'count'}).sort_values(by='ProductId',
top_customers.columns=['no_of_products','Avg_rating','no_of_summary','no_of_reviews']
top_customers
```

Out[30]:

UserId	no_of_products	Avg_rating	no_of_summary	no_of_reviews
A3OXHLG6DIBRW8	448	4.535714	448	448
A1YUL9PCJR3JTY	421	4.494062	421	421
AY12DBB0U420B	389	4.647815	389	389
A281NPSIMI1C2R	365	4.841096	365	365
A1Z54EM24Y40LL	256	4.453125	256	256
...	...	...	...	...
A2HROKQO0GA5AF	1	3.000000	1	1
A2HROR28DMJV2W	1	5.000000	1	1
A2HRR8CO2Y20G8	1	5.000000	1	1
A2HRSML93IK9TR	1	5.000000	1	1
AZZZOVIBXHGDR	1	2.000000	1	1

256059 rows × 4 columns

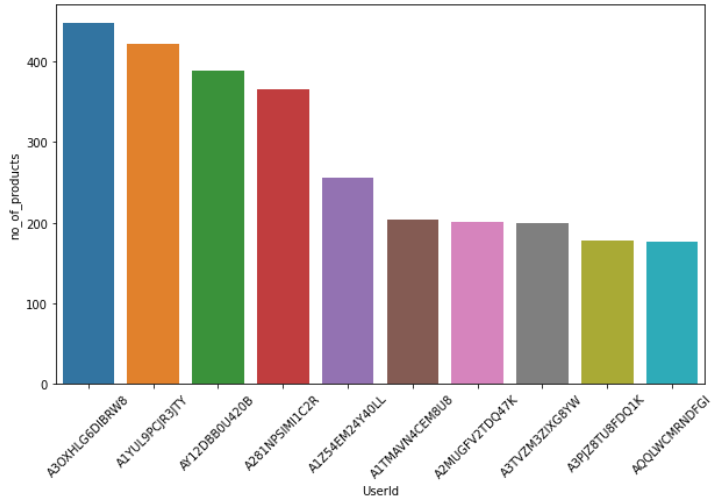
In [31]:
```
# top 10 users and their no:of products purchased
```

In [32]:
```
top_10_customers = top_customers[0:10].index
```

In [33]:
```
prod_top_10 = top_customers['no_of_products'][0:10]
```

In [34]:
```
plt.figure(figsize=(10,6))
plt.xticks(rotation=45)
sns.barplot(x=top_10_customers,y=prod_top_10)
```

Out[34]: <AxesSubplot:xlabel='UserId', ylabel='no_of_products'>



There is a high probability for these customer ids to purchase again and therefore recommend more products to these customers

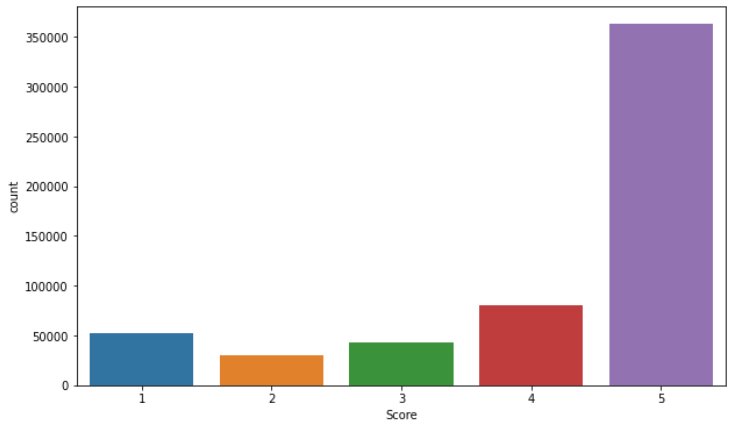
In [ ]:

In [ ]:

Visualization of overall rating of the product purchased

In [35]:
```
plt.figure(figsize=(10,6))
sns.countplot(x=df['Score'])
```

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



Visualization of the length of the reviews posted by customers

In [36]:
```
lowest_score = df[df['Score']==1]
highest_score = df[df['Score']==5]
```

In [37]:
```
lowest_score.reset_index(inplace=True)
highest_score.reset_index(inplace=True)
```

In [38]:
```
lowest_score.head(2)
```

Out[38]:

	index	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text	Polarity
0	1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0	1	1346976000	Not as Advertised	Product arrived labeled as Jumbo Salted Peanut...	0.000000
1	12	13	B0009XLVG0	A327PCT23YH90	LT	1	1	1	1339545600	My Cats Are Not Fans of the New Food	My cats have been happily eating Felidae Plati...	0.136364

In [39]:
```
len(lowest_score['Text'][0].split(' '))
```

Out[39]: 31

In [40]:
```
def calc_length(col):
    return len(col.split(' '))
```

In [41]:
```
lowest_score['text_length'] = lowest_score['Text'].apply(calc_length)
```

```
/home/inshad/.local/lib/python3.6/site-packages/ipykernel_launcher.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  """Entry point for launching an IPython kernel.
```

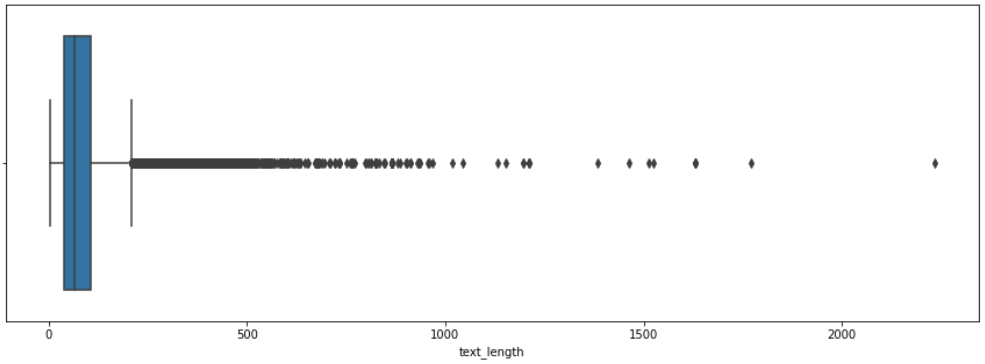
In [42]:
```
highest_score['text_length_positive'] = highest_score['Text'].apply(calc_length)
```

```
/home/inshad/.local/lib/python3.6/site-packages/ipykernel_launcher.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  """Entry point for launching an IPython kernel.
```

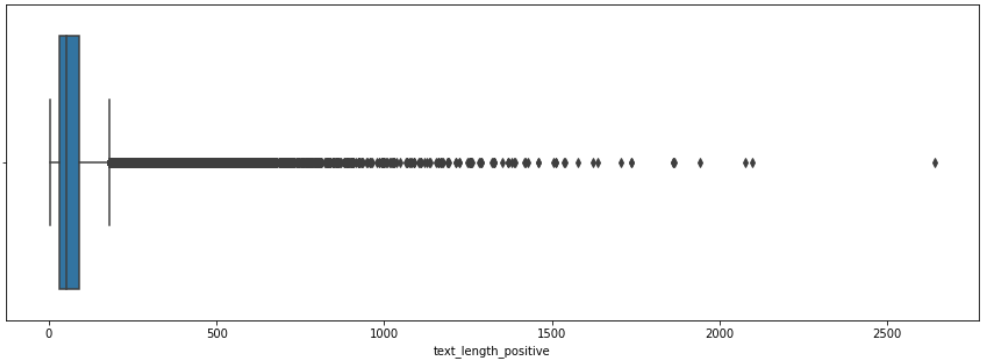
In [43]:
```
plt.figure(figsize=(15,5))
sns.boxplot(x=lowest_score['text_length'],data=lowest_score)
```

Out[43]: <AxesSubplot:xlabel='text_length'>



In [44]:
```
plt.figure(figsize=(15,5))
sns.boxplot(x=highest_score['text_length_positive'],data=highest_score)
```

Out[44]: <AxesSubplot:xlabel='text_length_positive'>



Word Cloud Visualization for random sample data

In [45]:
```
random_data = df.sample(n=1000)
random_data.head(2)
```

Out[45]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	HelpfulnessDenominator	Score	Time	Summary	Text	Polarity
284671	284672	B001P3NU4E	ANX9YYM0EY3AD	Craig Witkowski	0	3	5	1337990400	CET Chews are great, Amazon, not so great	The CET chews are fantastic in keeping my cat'...	0.8
365726	365727	B00032ANFC	A2FRFAQCWZJT3Q	B. Davis "The Happy Hermit"	0	0	5	1283299200	Best Soy Milk	I use two cartons a week and love it. It's cr...	1.0

In [46]:
```
random_data.reset_index(inplace=True)
```

In [47]:
```
random_data.Text.iloc[0]
```

Out[47]:
```
'The CET chews are fantastic in keeping my cat\'s teeth clean.  However Amazon has buckled under to a group called "Color of Change" with i
s a race-centered extreme leftist group that is extorting companies to drop affiliation with a business group called ALEC (American Legisla
tive Exchange Council).  Color of Change was founded by Van Jones, an avowed radical with a race-based agenda that has been exposed by his
own words caught on tape.  Caving in to such race-based political groups that oppose the free market system is a losing proposition and is
a sure way to lose customers such as myself.  My latest purchase of these CET chews tonight was not made at Amazon but at another company.
Amazon needs to disassociate itself from race-based hate groups and re-join with ALEC to support the free market.'
```

In [48]:
```
import string
punctuations_ = string.punctuation
```

In [49]:
```
random_data['Text'] = random_data['Text'].str.lower()
```

In [50]:
```
def remove_punctuations(txt):
    no_punc = ' '
    for i in txt:
        if i not in punctuations_:
            no_punc = no_punc + i
    return no_punc
```

In [51]:
```
random_data['Text'] = random_data['Text'].apply(remove_punctuations)
```

In [52]:
```
random_data.Text.iloc[0]
```

Out[52]:
```
' the cet chews are fantastic in keeping my cats teeth clean  however amazon has buckled under to a group called color of change with is a racecentered extreme leftist group that is extorting companies to drop affiliation with a business group called alec american legislative exchange council  color of change was founded by van jones an avowed radical with a racebased agenda that has been exposed by his own words caught on tape  caving in to such racebased political groups that oppose the free market system is a losing proposition and is a sure way to lose customers such as myself  my latest purchase of these cet chews tonight was not made at amazon but at another company amazon needs to disassociate itself from racebased hate groups and rejoin with alec to support the free market'
```

In [53]:
```
import nltk
from nltk.corpus import stopwords
```

In [54]:
```
[word for word in random_data['Text'][0].split(" ") if word not in set(stopwords.words('english'))]
```

Out[54]:
```
['',
 'cet',
 'chews',
 'fantastic',
 'keeping',
 'cats',
 'teeth',
 'clean',
 '',
 'however',
 'amazon',
 'buckled',
 'group',
 'called',
 'color',
 'change',
 'racecentered',
 'extreme',
 'leftist',
 'group',
 'extorting',
 'companies',
 'drop',
 'affiliation',
 'business',
 'group',
 'called',
 'alec',
 'american',
 'legislative',
 'exchange',
 'council',
 '',
 'color',
 'change',
 'founded',
 'van',
 'jones',
 'avowed',
 'radical',
 'racebased',
 'agenda',
 'exposed',
 'words',
 'caught',
 'tape',
 '',
 'caving',
 'racebased',
 'political',
 'groups',
 'oppose',
 'free',
 'market',
 'system',
 'losing',
 'proposition',
 'sure',
 'way',
 'lose',
 'customers',
 '',
 'latest',
 'purchase',
 'cet',
 'chews',
 'tonight',
 'made',
 'amazon',
 'another',
 'company',
 'amazon',
 'needs',
```

```
'disassociate',
'racebased',
'hate',
'groups',
'rejoin',
'alec',
'support',
'free',
'market']
```

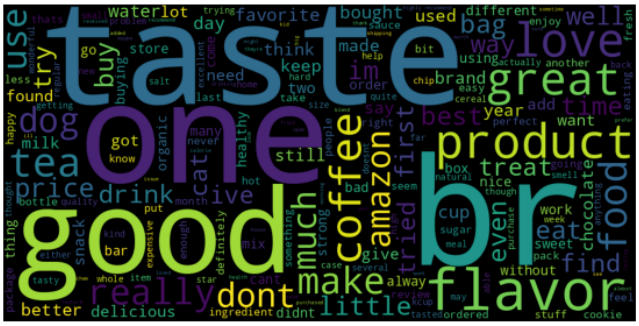
In [55]:
```
def remov_stopwords(review):
    return " ".join([word for word in review.split(" ") if word not in set(stopwords.words('english'))])
```

In [56]:
```
random_data['Text'] = random_data['Text'].apply(remov_stopwords)
```

In [57]:
```
comment_words = ' '.join(random_data['Text'])
```

In [59]:
```
word_cloud = WordCloud(width=1000,height=500,stopwords=STOPWORDS).generate(comment_words)
plt.figure(figsize=(10,5))
plt.imshow(word_cloud)
plt.axis('off')
```

Out[59]: (-0.5, 999.5, 499.5, -0.5)



In [ ]: