In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

In [2]:

```
# import plotly modules
import plotly.offline as py
py.init_notebook_mode(connected=True)
import plotly.graph_objs as go
import plotly.tools as tls

import warnings
warnings.filterwarnings('ignore')


import nltk
nltk.download()
#nltk.download('punkt')
#nltk.download('stopwords')
from nltk import word_tokenize, sent_tokenize
from nltk import pos_tag
from nltk.corpus import stopwords
```

```
showing info https://raw.githubusercontent.com/nltk/nltk_data/gh-pages/index.xm
l (https://raw.githubusercontent.com/nltk/nltk_data/gh-pages/index.xml)
```

In [3]:

```
hotel_review = pd.read_csv('hotelreview.csv', low_memory=False)
```

In [4]:

```
hotel_review.shape
```

Out[4]:

```
(35912, 19)
```

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

Out[5]:

	address	categories	city	country	latitude	longitude	name	postalCode	province	rev
0	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	GA	22T
1	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	GA	03T
2	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	GA	13T
3	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	GA	27T
4	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	GA	05T

In [6]:
```
eighty_count = len(hotel_review)*4 / 5
```

In [7]:
```
hotel_review1 = hotel_review.dropna(thresh=eighty_count,axis=1)
```

In [8]:
```
hotel_review1.shape
```

Out[8]:
```
(35912, 15)
```

In [9]:

```
object_columns_df = hotel_review1.select_dtypes(include=['object'])
print(object_columns_df.iloc[0])

cols = ['country']
for name in cols:
    print(name,':')
    print(object_columns_df[name].value_counts(),'\n')
```

```
address                                          Riviera San Nicol 11/a
categories                                                       Hotels
city                                                           Mableton
country                                                              US
name                                                 Hotel Russo Palace
postalCode                                                        30126
province                                                             GA
reviews.date                                       2013-09-22T00:00:00Z
reviews.dateAdded                                  2016-10-24T00:00:25Z
reviews.text          Pleasant 10 min walk along the sea front to th...
reviews.title                        Good location away from the crouds
reviews.username                                            Russ (kent)
Name: 0, dtype: object
country :
US    35912
Name: country, dtype: int64
```

In [10]:

```
old_names = ['reviews.date', 'reviews.rating', 'reviews.title', 'reviews.text']
new_names = ['date', 'rating', 'title', 'text']
hotel_review2 = hotel_review1.rename(columns=dict(list(zip(old_names, new_names))
```

In [11]:

```
df = hotel_review2[['latitude', 'longitude', 'name', 'address', 'postalCode', 'ca
```

In [12]:

```
df.head()
```

Out[12]:

	latitude	longitude	name	address	postalCode	categories	city	country	da
0	45.421611	12.376187	Hotel Russo Palace	Riviera San Nicol 11/a	30126	Hotels	Mableton	US	2013-(22T00:00:0
1	45.421611	12.376187	Hotel Russo Palace	Riviera San Nicol 11/a	30126	Hotels	Mableton	US	2015-(03T00:00:0
			Hotel	Riviera					

In [13]:

```
df.to_csv("cleaned_hotelreview.csv",index=False)
```

In [14]:

```
df = df[pd.notnull(df['name'])]
df = df[pd.notnull(df['latitude'])]
df = df[pd.notnull(df['longitude'])]
df = df[pd.notnull(df['rating'])]
df = df[pd.notnull(df['date'])]
```

Q1. Which hotel has the highest number of reviews.

In [15]:

```
q1 = df['name'].value_counts().reset_index().iloc[0]['index']
print("Answer: " + q1)
```

```
Answer: The Alexandrian, Autograph Collection
```

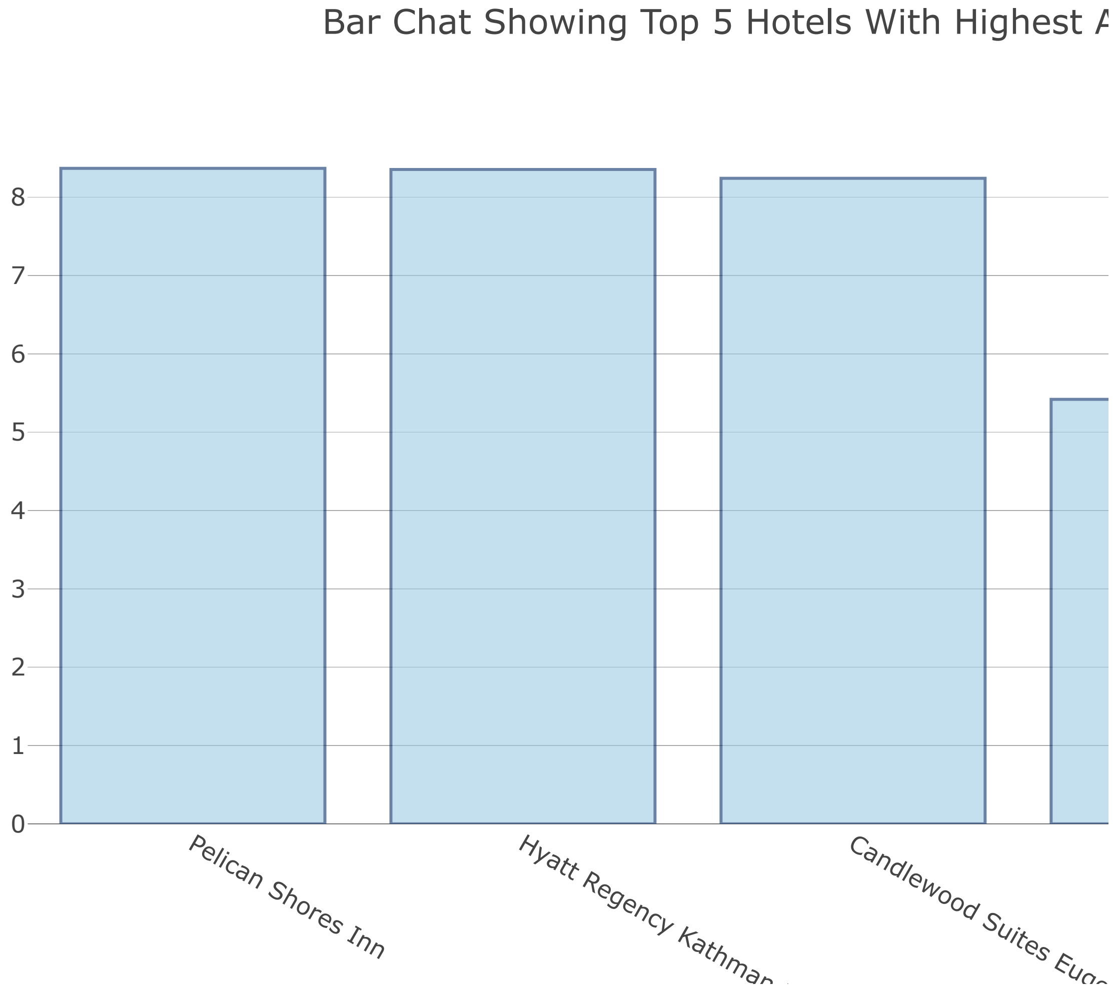
Q2. Which hotel has the highest average rating of reviews.

In [16]:

```
q2 = df.groupby('name')['rating'].mean().reset_index().sort_values(by='rating', a
print("Answer: " + q2)
```

```
Answer: Pelican Shores Inn
```

In [17]:
```
q2 = df.groupby('name')['rating'].mean().reset_index().sort_values(by='rating', a
trace = go.Bar(
    x=q2['name'],
    y=q2['rating'],
    marker=dict(
        color='rgb(158,202,225)',
        line=dict(
            color='rgb(8,48,107)',
            width=1.5,
        )
    ),
    opacity=0.6
)

data = [trace]

layout = go.Layout(
    title='Bar Chat Showing Top 5 Hotels With Highest Average Ratings.',
)

fig = go.Figure(data=data, layout=layout)
py.iplot(fig, filename='hotel-reviews-highest-rating')
```


Bar Chat Showing Top 5 Hotels With Highest A

Q4. Which City has the highest number of hotels.

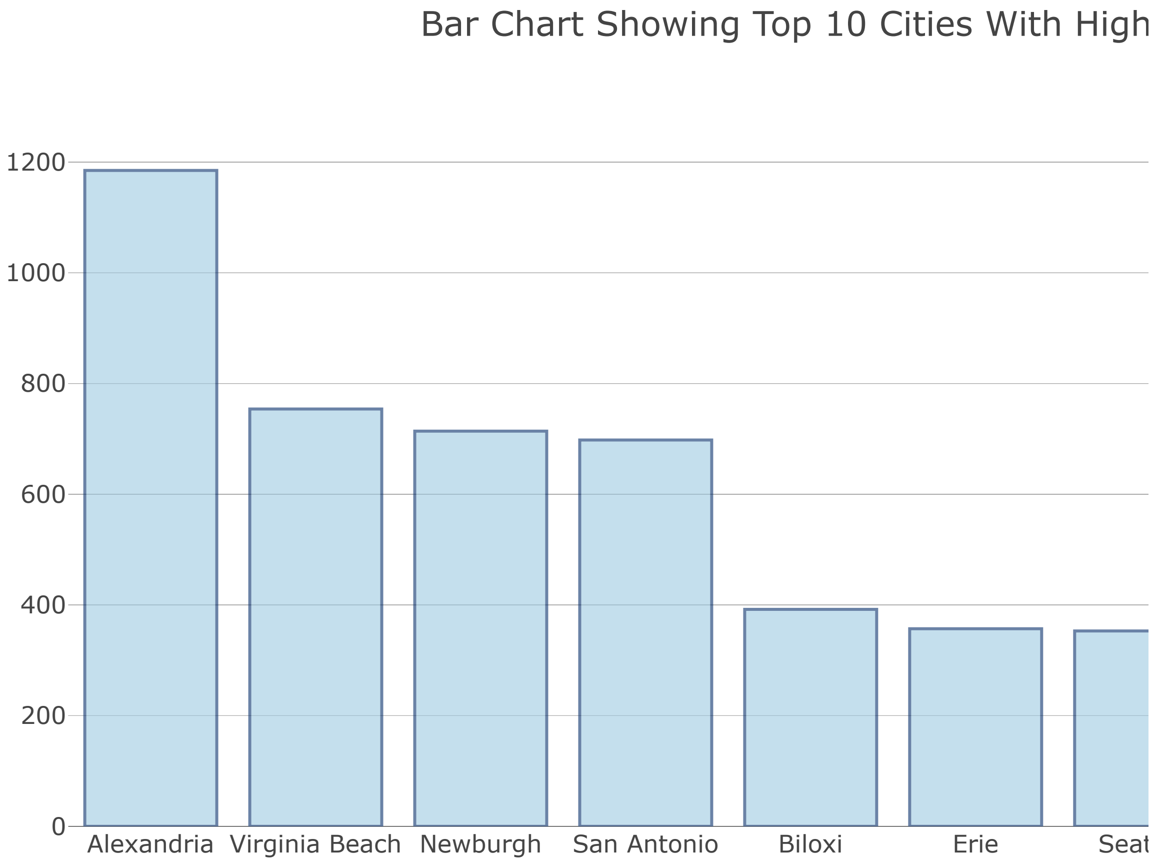
In [18]:

```
q3 = df['city'].value_counts().reset_index().iloc[0]['index']
print("Answer: " + q3)
```

```
Answer: Alexandria
```

In [19]:

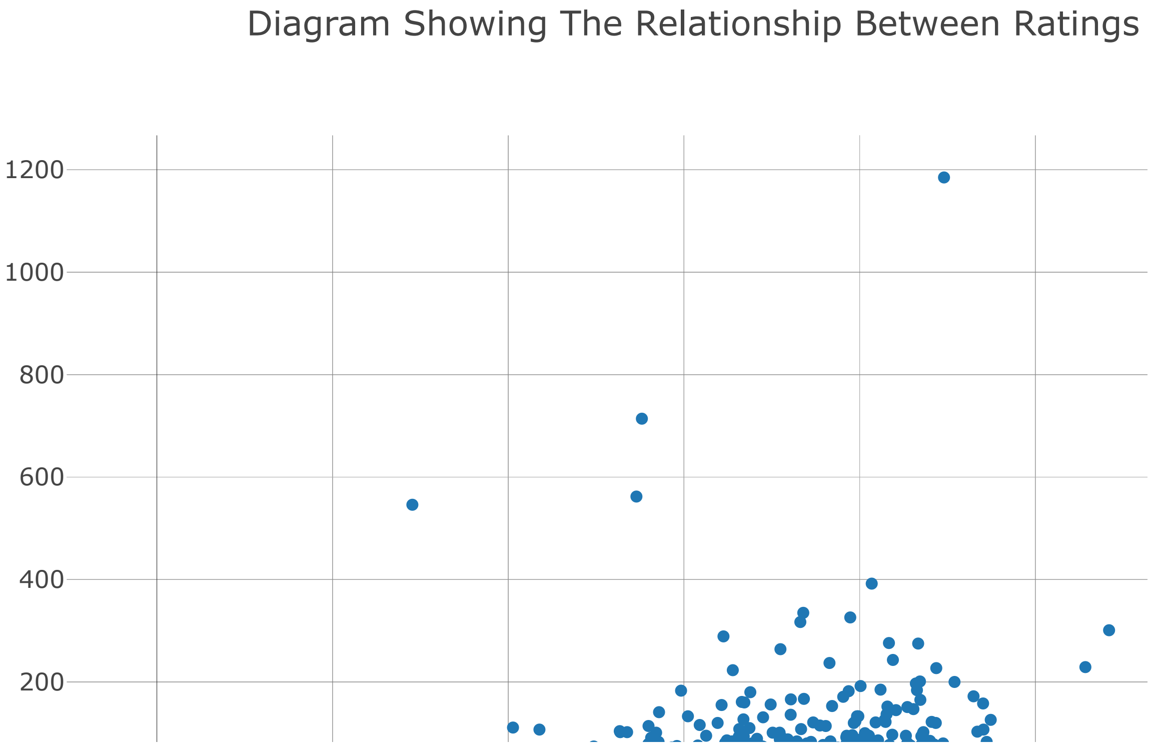
```
q3 = df['city'].value_counts()[:10]
trace = go.Bar(
    x=q3.index,
    y=q3.values,
    marker=dict(
        color='rgb(158,202,225)',
        line=dict(
            color='rgb(8,48,107)',
            width=1.5,
        )
    ),
    opacity=0.6
)

data = [trace]

layout = go.Layout(
    title='Bar Chart Showing Top 10 Cities With Highest Reviews.',
)

fig = go.Figure(data=data, layout=layout)
py.iplot(fig, filename='hotel-reviews-highest-cities')
```

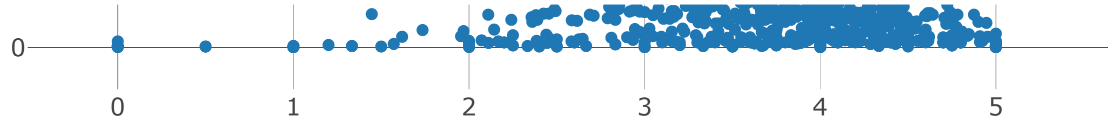


Q3. What is the relationship between total number of reviews per hotel and average rating of the hotel.

In [20]:

```
group_name = df.groupby(['name'])['rating'].mean().reset_index()

group_count = df.groupby('name').count().reset_index()
old_names = ['latitude']
new_names = ['count']
group_count.rename(columns=dict(zip(old_names, new_names)), inplace=True)
group_count = group_count[['name', 'count']]

q4 = pd.merge(group_name, group_count, left_index=True, right_index=True)[['name_

# q4.plot.scatter(x='rating', y='count')

x = (q4['rating']).values
y = (q4['count']).values

data = go.Data([
    go.Scatter(
        x = x,
        y = y,
        mode = 'markers'
    )
])

layout = go.Layout(
    title='Diagram Showing The Relationship Between Ratings & Number Of Reviews.'
)

fig = dict(data=data, layout=layout)

# Plot and embed in ipython notebook!
py.iplot(fig, filename='hotels-reviews-scatter')
```





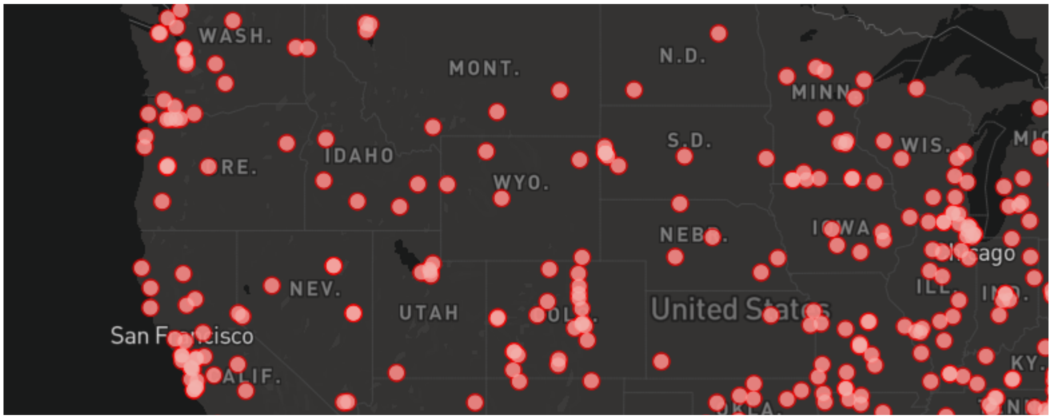
Answer: Based on the above scatter plot diagram, there is no relationship between the average rating of an hotel and the total number of reviews of the hotel.

Q5. Plot an interactive map of the hotels and average review ratings as a label.

In [21]:

```
q5 = df.groupby(['name', 'latitude', 'longitude'])['rating'].mean().reset_index()
lat = q5.latitude
lon = q5.longitude
name = q5.name
rating = round(q5.rating,2)

mapbox_access_token = 'pk.eyJ1Ijoia2FtcGFyaWEiLCJhIjoib0JLTExtSSJ9.6ahf835RV3kBUn
data = go.Data([
    go.Scattermapbox(
        lat=lat,
        lon=lon,
        mode='markers',
        marker=go.Marker(
            size=10,
            color='rgb(255, 0, 0)',
            opacity=0.7
        ),
        text=rating,
        hoverinfo=''
    ),
    go.Scattermapbox(
        lat=lat,
        lon=lon,
        mode='markers',
        marker=go.Marker(
            size=8,
            color='rgb(242, 177, 172)',
            opacity=0.7
        ),
        text=rating,
        hoverinfo=''
    )]
)

layout = go.Layout(
    title='Interactive Map Showing The Location Of Hotels & Average Ratings.',
    autosize=True,
    hovermode='closest',
    showlegend=False,
    mapbox=dict(
        accesstoken=mapbox_access_token,
        bearing=0,
        center=dict(
            lat=38,
            lon=-94
        ),
        pitch=0,
        zoom=3,
        style='dark'
    ),
)

fig = dict(data=data, layout=layout)

py.iplot(fig, filename='hotel-reviews-map')
```

Interactive Map Showing The Location Of Hote



In [22]:
```
# filterout ratings that are zero
hotel_review2.shape
```

Out[22]:
```
(35912, 15)
```

In [23]:
```
hotel_review.columns
```

Out[23]:
```
Index(['address', 'categories', 'city', 'country', 'latitude', 'longitude',
       'name', 'postalCode', 'province', 'reviews.date', 'reviews.dateAdded',
       'reviews.doRecommend', 'reviews.id', 'reviews.rating', 'reviews.text',
       'reviews.title', 'reviews.userCity', 'reviews.username',
       'reviews.userProvince'],
      dtype='object')
```

In [24]:
```
hotel_review = hotel_review[hotel_review['reviews.rating']>0]
```

In [25]:
```
hotel_review_data = hotel_review.rename(index=str, columns={'reviews.date':'revie
       'reviews.doRecommend':'reviewsdoRecommend', 'reviews.id':'reviewsid', 'rev
       'reviews.title':'reviewstitle', 'reviews.userCity':'reviewsuserCity', 'rev
       'reviews.userProvince':'reviewsuserProvince'})
```

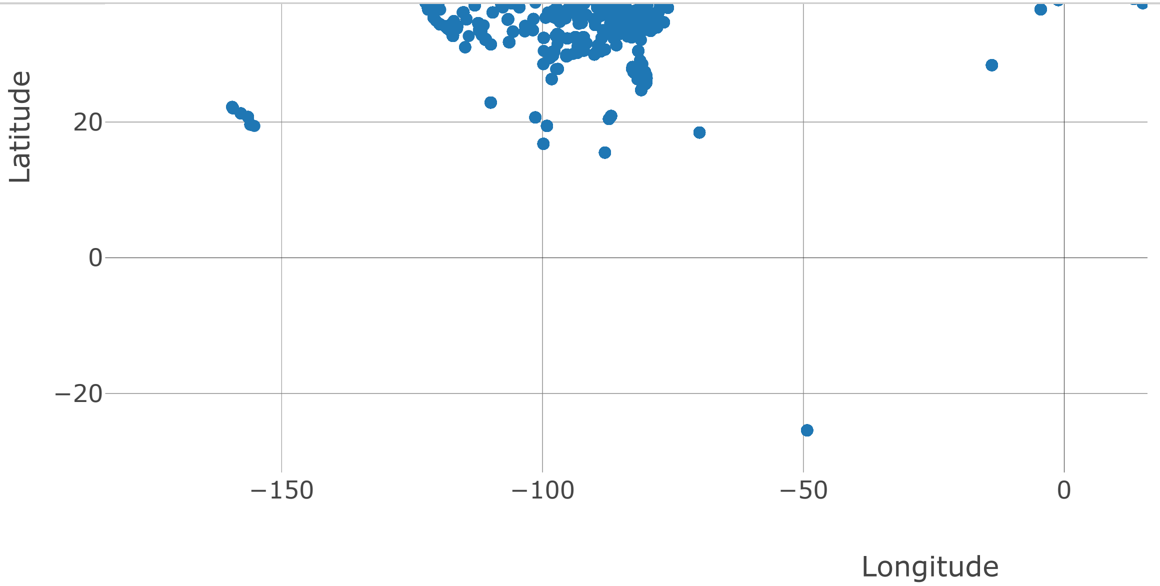
In [26]:
```
hotel_review_data.reviewstext = hotel_review_data.reviewstext.fillna('x')
#A few hundred ratings had a score above 5, filtering these out
hotel_review_data = hotel_review_data[hotel_review_data['reviewsrating']<=5]
#A few hundred ratings had decimals, rounding each of those down to an integer
hotel_review_data.reviewsrating = hotel_review_data.reviewsrating.astype(int)
```

In [27]:
```
#Creating a function that I will use to clean review strings
#Function makes the string 'txt' lowercase, removes stopwords, finds the length, 
#Returns a list of the length, cleaned txt, and only adjective txt
def cleanme(txt):
    sent = txt.lower()
    wrds = word_tokenize(sent)
    clwrds = [w for w in wrds if not w in stopwords.words('english')]
    ln = len(clwrds)
    pos = pd.DataFrame(pos_tag(wrds))
    pos = " ".join(list(pos[pos[1].str.contains("JJ")].iloc[:,0]))
    rt = [ln, " ".join(clwrds), pos]
    return(rt)
```

In [28]:
```
hotel_review_data.country.unique()
```

Out[28]:
```
array(['US'], dtype=object)
```

In [29]:
```
plt_review = go.Scatter(x = hotel_review_data.longitude, y=hotel_review_data.lati
lyt_review = go.Layout(title="Locations of Hotel Reviews", xaxis=dict(title='Long
fig_review = go.Figure(data = [plt_review], layout=lyt_review)
py.iplot(fig_review)
```



In [30]:
```
#Create a field that shows the length of each review
review_length = list()
for i in range(len(hotel_review_data)):
    review_length.append(cleanme(hotel_review_data.iloc[i,:]['reviewstext']))
review_length = pd.DataFrame(review_length)
review_length.columns = ['reviewlen', 'cleanrev', 'adjreview']
```

In [31]:

```
#Add calculated columns back to the dataset
hotel_review_data = hotel_review_data.reset_index()
hotel_review_data = pd.concat([hotel_review_data,review_length], axis=1)
hotel_review_data.head()
```

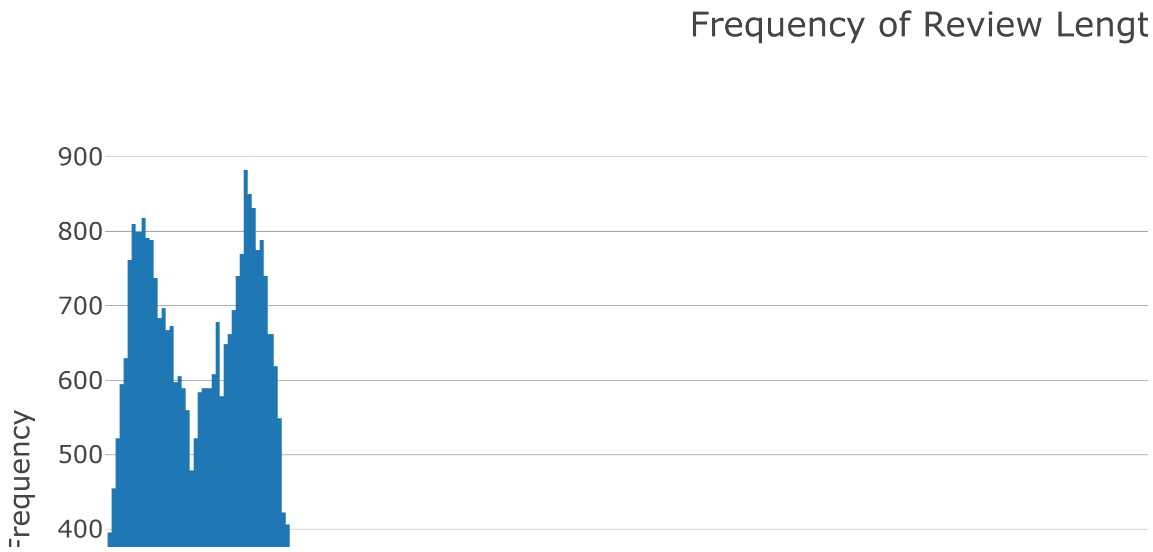
Out[31]:

	index	address	categories	city	country	latitude	longitude	name	postalCode	provin
0	0	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	(
1	1	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	(
2	2	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	(
3	3	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	(
4	4	Riviera San Nicol 11/a	Hotels	Mableton	US	45.421611	12.376187	Hotel Russo Palace	30126	(

5 rows × 23 columns

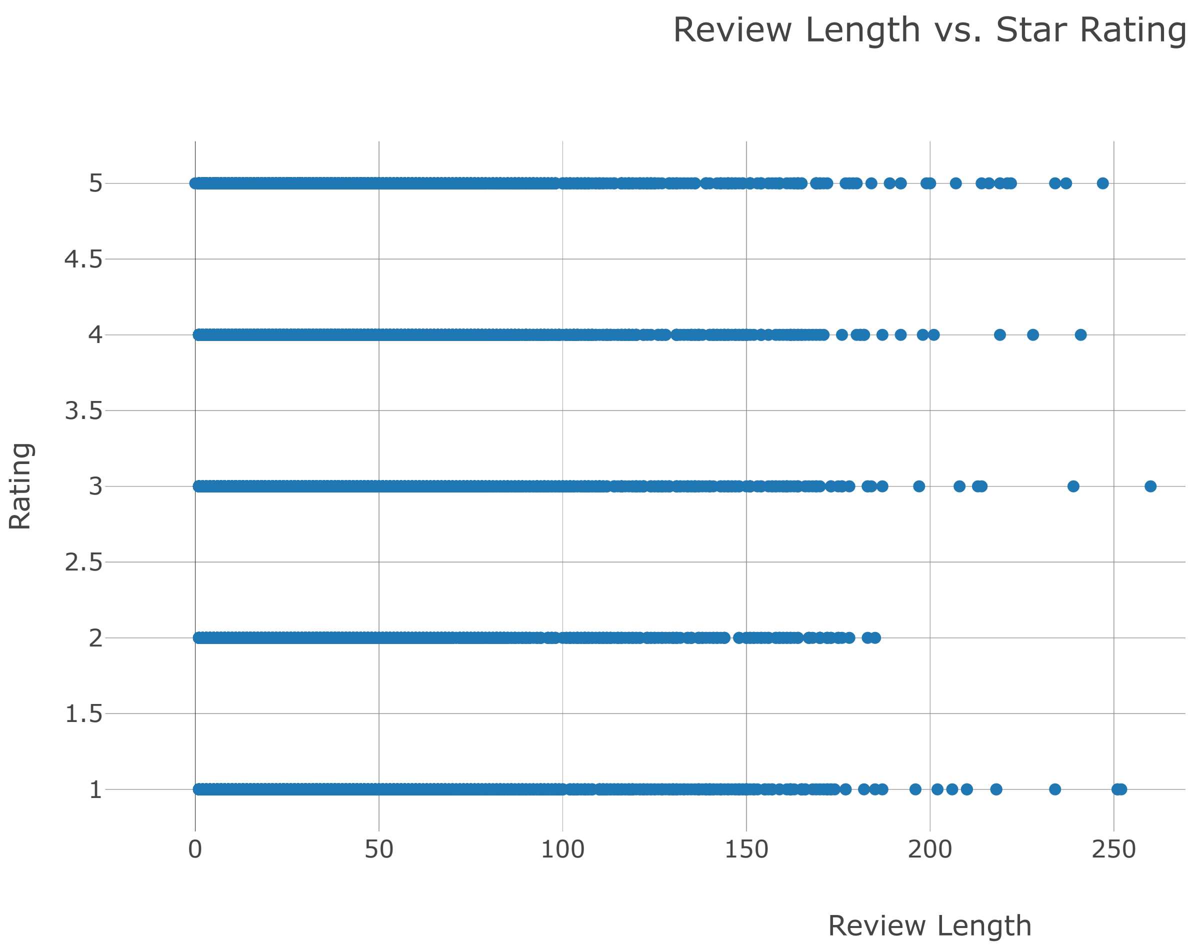
In [32]:

```
plt_hist = go.Histogram(x = hotel_review_data.reviewlen)
lyt_hist = go.Layout(title="Frequency of Review Length", xaxis=dict(title='Review
fig_hist = go.Figure(data=[plt_hist], layout=lyt_hist)
py.iplot(fig_hist)
```



In [33]:

```
hotel_review_data = hotel_review_data.sort_values(by='reviewlen')
plt_scatter = go.Scatter(x = hotel_review_data.reviewlen, y = hotel_review_data.r
lyt_scatter = go.Layout(title="Review Length vs. Star Rating", xaxis=dict(title='
fig_scatter = go.Figure(data=[plt_scatter], layout=lyt_scatter)
py.iplot(fig_scatter)
print("Review Length to Rating Correlation:",hotel_review_data.reviewlen.corr(hot
```



```
Review Length to Rating Correlation: -0.149136176154
```

In [34]:

```
#Setting up the X and Y data, where X is the review text and Y is the rating
#Three different inputs will be used: original review text, cleaned review text, 
x1 = hotel_review_data.reviewstext
x2 = hotel_review_data.cleanrev
x3 = hotel_review_data.adjreview
y = hotel_review_data.reviewsrating
```

In [35]:

```
from sklearn.feature_extraction.text import TfidfVectorizer, CountVectorizer

#Creating a vectorizer to split the text into unigrams and bigrams
vect = TfidfVectorizer(ngram_range = (1,2))
x_vect1 = vect.fit_transform(x1)
x_vect2 = vect.fit_transform(x2)
x_vect3 = vect.fit_transform(x3)
```

In [36]:

```
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, classification_report, confusion_matr

#Making some simple functions for linear svc, knn, and naive bayes
def linsvc(x,y):
    x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.25, ran
    classf = LinearSVC()
    classf.fit(x_train, y_train)
    pred = classf.predict(x_test)
    print("Linear SVC:",accuracy_score(y_test, pred))
    return(y_test, pred)

def revknn(x,y):
    x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.25, ran
    classf = KNeighborsClassifier(n_neighbors=2)
    classf.fit(x_train, y_train)
    pred = classf.predict(x_test)
    print("kNN:",accuracy_score(y_test, pred))
    return(y_test, pred)

def revnb(x,y):
    x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.25, ran
    classf = MultinomialNB()
    classf.fit(x_train, y_train)
    pred = classf.predict(x_test)
    print("Naive Bayes:",accuracy_score(y_test, pred))
    return(y_test, pred)
```

In [37]:

```
from sklearn.svm import LinearSVC
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import MultinomialNB, GaussianNB

svmy1,svmp1 = linsvc(x_vect1,y)
svmy2,svmp2 = linsvc(x_vect2,y)
svmy3,svmp3 = linsvc(x_vect3,y)

knny1,knnp1 = revknn(x_vect1,y)
knny2,knnp2 = revknn(x_vect2,y)
knny3,knnp3 = revknn(x_vect3,y)

nby1,nbp1 = revnb(x_vect1,y)
nby2,nbp2 = revnb(x_vect2,y)
nby3,nbp3 = revnb(x_vect3,y)
```

```
Linear SVC: 0.522295959949
Linear SVC: 0.519734544184
Linear SVC: 0.451042030504
kNN: 0.300034928397
kNN: 0.300500640354
kNN: 0.298987076493
Naive Bayes: 0.403190126907
Naive Bayes: 0.406566538596
Naive Bayes: 0.421236465246
```

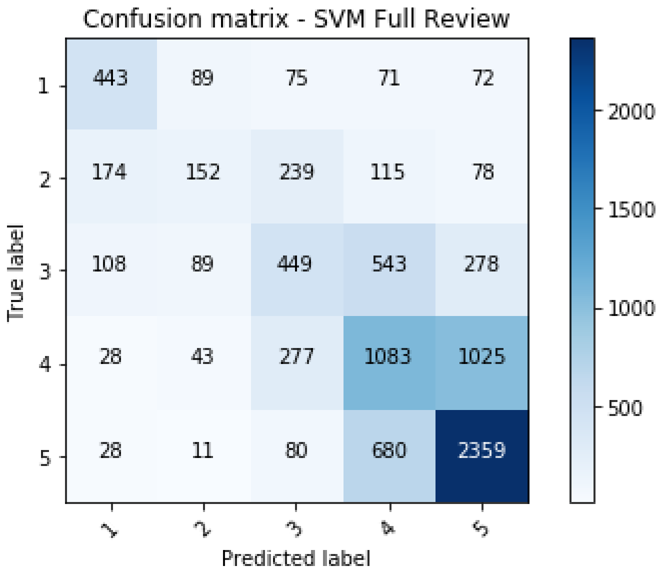
In [38]:

```
#This function will plot a confusion matrix and is taken from the sklearn documen
def plot_confusion_matrix(cm, classes,
                          normalize=False,
                          title='Confusion matrix',
                          cmap=plt.cm.Blues):
    """
    This function prints and plots the confusion matrix.
    Normalization can be applied by setting `normalize=True`.
    """
    plt.imshow(cm, interpolation='nearest', cmap=cmap)
    plt.title(title)
    plt.colorbar()
    tick_marks = np.arange(len(classes))
    plt.xticks(tick_marks, classes, rotation=45)
    plt.yticks(tick_marks, classes)

    if normalize:
        cm = np.around((cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]),decim
        print("Normalized confusion matrix")
    else:
        print('Confusion matrix, without normalization')

    print(cm)

    thresh = cm.max() / 2.
    for i, j in itertools.product(range(cm.shape[0]), range(cm.shape[1])):
        plt.text(j, i, cm[i, j],
                 horizontalalignment="center",
                 color="white" if cm[i, j] > thresh else "black")

    plt.tight_layout()
    plt.ylabel('True label')
    plt.xlabel('Predicted label')
```

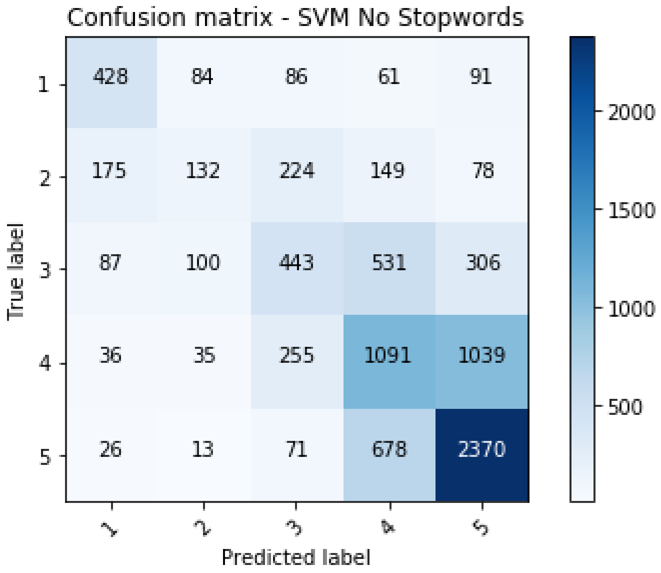
In [39]:

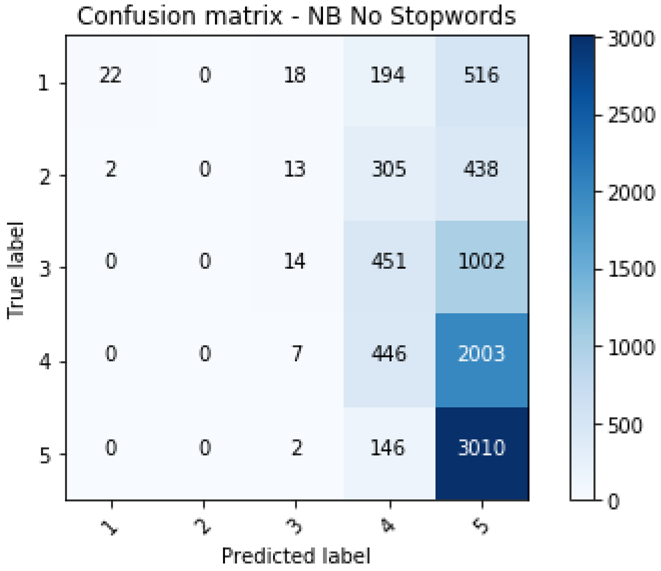
```
import itertools

c1 = confusion_matrix(svmy1,svmp1)
c2 = confusion_matrix(svmy2,svmp2)
c3 = confusion_matrix(nby2,nbp2)
class_names = ['1', '2', '3', '4', '5']
plt.figure()
plot_confusion_matrix(c1, classes=class_names,normalize=False,title='Confusion ma
plt.figure()
plot_confusion_matrix(c2, classes=class_names,normalize=False,title='Confusion ma
plt.figure()
plot_confusion_matrix(c3, classes=class_names,normalize=False,title='Confusion ma
```

```
Confusion matrix, without normalization
[[ 443   89   75   71   72]
 [ 174  152  239  115   78]
 [ 108   89  449  543  278]
 [  28   43  277 1083 1025]
 [  28   11   80  680 2359]]
Confusion matrix, without normalization
[[ 428   84   86   61   91]
 [ 175  132  224  149   78]
 [  87  100  443  531  306]
 [  36   35  255 1091 1039]
 [  26   13   71  678 2370]]
Confusion matrix, without normalization
[[  22    0   18  194  516]
 [   2    0   13  305  438]
 [   0    0   14  451 1002]
 [   0    0    7  446 2003]
 [   0    0    2  146 3010]]
```



Confusion matrix - SVM Full Review





In [40]:

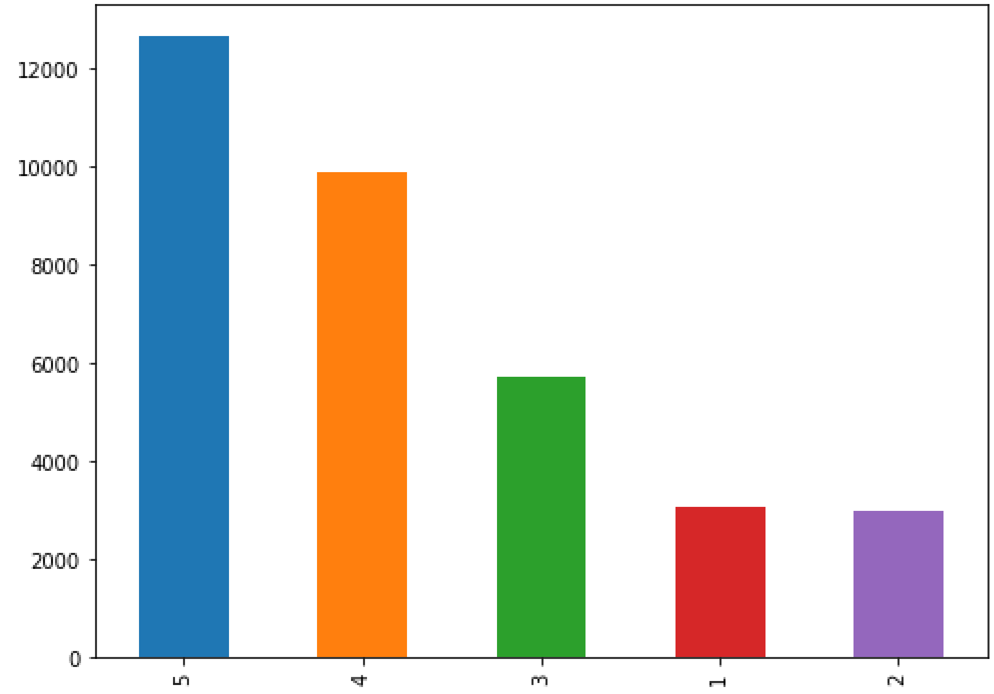
```
from sklearn.feature_extraction.text import TfidfVectorizer, CountVectorizer

hotel_review_data['reviewsrating'] = hotel_review_data['reviewsrating']
hotel_review_data['reviewsrating'].value_counts()
```

Out[40]:

```
5    12671
4     9880
3     5747
1     3070
2     2988
Name: reviewsrating, dtype: int64
```

In [41]:

```
import matplotlib.pyplot as plt
fig = plt.figure(figsize=(8,6))
hotel_review_data['reviewsrating'].value_counts().plot.bar(ylim=0)
plt.show()
```



In [42]:

```
reviewsrating_1 = hotel_review_data[hotel_review_data["reviewsrating"]==1]
reviewsrating_2 = hotel_review_data[hotel_review_data["reviewsrating"]==2]
reviewsrating_3 = hotel_review_data[hotel_review_data["reviewsrating"]==3]
reviewsrating_4 = hotel_review_data[hotel_review_data["reviewsrating"]==4]
reviewsrating_5 = hotel_review_data[hotel_review_data["reviewsrating"]==5]


subset_of_reviewsrating_1 = reviewsrating_1.sample(n=3000)
subset_of_reviewsrating_2 = reviewsrating_2.sample(n=2000)
subset_of_reviewsrating_3 = reviewsrating_3.sample(n=4000)
subset_of_reviewsrating_4 = reviewsrating_4.sample(n=5000)
subset_of_reviewsrating_5 = reviewsrating_5.sample(n=7000)

data_clean1 = pd.concat([subset_of_reviewsrating_1,subset_of_reviewsrating_2,subs
data_clean1 = data_clean1.sample(frac=1).reset_index(drop=True)
print("Current shape of dataset :",data_clean1.shape)
```

```
Current shape of dataset : (21000, 23)
```

In [43]:

```
from sklearn.naive_bayes import MultinomialNB
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.linear_model import SGDClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier

x = data_clean1.reviewstext
y = data_clean1.reviewsrating
count_vect = CountVectorizer()
x_train1, x_test1, y_train1, y_test1 = train_test_split(x, y, test_size=0.20, ran
X_train_counts = count_vect.fit_transform(x_train1)


tfidf_transformer = TfidfTransformer()
tf_transformer = TfidfTransformer(use_idf=False).fit(X_train_counts)
X_train_tf = tf_transformer.transform(X_train_counts)

X_train_tfidf = tfidf_transformer.fit_transform(X_train_counts)
clf = MultinomialNB().fit(X_train_tfidf, y_train1)

X_test_counts = count_vect.transform(x_test1)
tfidf_transformer = TfidfTransformer()
tf_transformer = TfidfTransformer(use_idf=False).fit(X_test_counts)
X_test_tf = tf_transformer.transform(X_test_counts)



pred = clf.predict(X_test_tf)
print("Multinomial Naive Bayes:",accuracy_score(y_test1, pred))


classif = SGDClassifier(loss='hinge', penalty='l2',alpha=1e-3, random_state=42,ma
clf1 = classif.fit(X_train_tfidf, y_train1)

pred = clf1.predict(X_test_tf)
print("SGD:",accuracy_score(y_test1, pred))


clf2 = DecisionTreeClassifier(random_state=0)
clf3 = clf2.fit(X_train_tfidf, y_train1)
pred = clf3.predict(X_test_tf)
print("Decision Tree:",accuracy_score(y_test1, pred))

clf4 = RandomForestClassifier(n_estimators=100, max_depth=5, random_state=0)
clf5 = clf4.fit(X_train_tfidf, y_train1)
pred = clf5.predict(X_test_tf)
print("Random Forest:",accuracy_score(y_test1, pred))

from sklearn.pipeline import Pipeline
text_clf = Pipeline([('vect', CountVectorizer()),
                    ('tfidf', TfidfTransformer()),
                    ('clf-svm', SGDClassifier(loss='hinge', penalty='l2',alpha=1e
text_clf = text_clf.fit(x_train1, y_train1)

predicted = text_clf.predict(x_test1)
np.mean(predicted == y_test1)
```

```
Multinomial Naive Bayes: 0.385476190476
SGD: 0.472142857143
Decision Tree: 0.360714285714
Random Forest: 0.340238095238

C:\Users\vijay\AppData\Local\conda\conda\envs\my_root\lib\site-packages\sklearn
\linear_model\stochastic_gradient.py:117: DeprecationWarning:

n_iter parameter is deprecated in 0.19 and will be removed in 0.21. Use max_ite
r and tol instead.
```

```
Out[43]: 0.49904761904761907
```

In [52]:

```
data_clean_rating15 = pd.concat([subset_of_reviewsrating_1,subset_of_reviewsratin
data_clean_rating15 = data_clean_rating15.sample(frac=1).reset_index(drop=True)
print("Current shape of dataset :",data_clean_rating15.shape)


y = data_clean_rating15.reviewsrating
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, classification_report, confusion_matr

#Setting up the X and Y data, where X is the review text and Y is the rating
#Three different inputs will be used: original review text, cleaned review text, 

x1 = data_clean_rating15.reviewstext
x2 = data_clean_rating15.cleanrev
x3 = data_clean_rating15.adjreview

x3.head()
#Creating a vectorizer to split the text into unigrams and bigrams
vect = TfidfVectorizer(ngram_range = (1,2))
x_vect1 = vect.fit_transform(x1)
x_vect2 = vect.fit_transform(x2)
x_vect3 = vect.fit_transform(x3)

#Making some simple functions for linear svc, knn, and naive bayes
def linsvc(x,y):
    x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.20, ran
    classf = LinearSVC()
    classf.fit(x_train, y_train)
  #  pred1 = classf.predict(x_train)
   # print("Linear SVC: Training Set",accuracy_score(y_train, pred1))
    pred = classf.predict(x_test)
    print("Linear SVC:",accuracy_score(y_test, pred))
    return(y_test, pred)

def revknn(x,y):
    x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.25, ran
    classf = KNeighborsClassifier(n_neighbors=3)
    classf.fit(x_train, y_train)
    pred = classf.predict(x_test)
    print("kNN:",accuracy_score(y_test, pred))
    return(y_test, pred)

def revnb(x,y):
    x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.25, ran
    classf = MultinomialNB()
    classf.fit(x_train, y_train)
    pred = classf.predict(x_test)
    print("Naive Bayes:",accuracy_score(y_test, pred))
    return(y_test, pred)
```

```
Current shape of dataset : (10000, 23)
```

In [53]:
```
from sklearn.svm import LinearSVC
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import MultinomialNB, GaussianNB

svmy1,svmp1 = linsvc(x_vect1,y)
svmy2,svmp2 = linsvc(x_vect2,y)
svmy3,svmp3 = linsvc(x_vect3,y)

knny1,knnp1 = revknn(x_vect1,y)
knny2,knnp2 = revknn(x_vect2,y)
knny3,knnp3 = revknn(x_vect3,y)

nby1,nbp1 = revnb(x_vect1,y)
nby2,nbp2 = revnb(x_vect2,y)
nby3,nbp3 = revnb(x_vect3,y)
```

```
Linear SVC: 0.93
Linear SVC: 0.929
Linear SVC: 0.878
kNN: 0.7176
kNN: 0.718
kNN: 0.7364
Naive Bayes: 0.8228
Naive Bayes: 0.8436
Naive Bayes: 0.8396
```

In [54]:
```
print(clf.predict(count_vect.transform(["A great Hotel and perfect for a traveler
```

```
[5]
```

In [55]:
```
print(clf.predict(count_vect.transform(["2 people checking in a long line Was bad
```

```
[1]
```

In [56]:
```
print(clf.predict(count_vect.transform(["This hotel was nice and a great value fo
```

```
[5]
```

In [57]:
```
print(clf.predict(count_vect.transform(["Bed bugs, will not be back"])))
```

```
[1]
```