- ***Import libraries***

Importing libraries

In [ ]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
import nltk
```

- ***Import Data***

Importing Data

In [114]:
```
data = pd.read_csv('D:/Distance Learning Courses/Predictive Analytics and Machine Learning/yelp.csv')
print(data.shape)
```

```
(10000, 10)
```

- ***Import Data***

Basic Data Exploration

In [115]:
```
data.head()
```

Out[115]:

	business_id	date	review_id	stars	text	type	user_id	cool	useful	funny
0	9yKzy9PApeiPPOUJEtnvkg	2011-01-26	fWKvX83p0-ka4JS3dc6E5A	5	My wife took me here on my birthday for breakf...	review	rLtl8ZkDX5vH5nAx9C3q5Q	2	5	0
1	ZRJwVLyzEJq1VAihDhYiow	2011-07-27	IjZ33sJrzXqU-0X6U8NwyA	5	I have no idea why some people give bad review...	review	0a2KyEL0d3Yb1V6aivbluQ	0	0	0
2	6oRAC4uyJCsJl1X0WZpVSA	2012-06-14	IESLBzqUCLdSzSqm0eCSxQ	4	love the gyro plate. Rice is so good and I als...	review	0hT2KtfLiobPvh6cDC8JQg	0	1	0
3	_1QQZuf4zZOyFCvXc0o6Vg	2010-05-27	G-WvGaISbqqaMHlNnByodA	5	Rosie, Dakota, and I LOVE Chaparral Dog Park!!...	review	uZetl9T0NcROGOyFfughhg	1	2	0
4	6ozycU1RpktNG2-1BroVtw	2012-01-05	1uJFq2r5QfJG_6ExMRCaGw	5	General Manager Scott Petello is a good egg!!!...	review	vYmM4KTsC8ZfQBg-j5MWkw	0	0	0

In [116]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 10 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
 0   business_id  10000 non-null  object
 1   date         10000 non-null  object
 2   review_id    10000 non-null  object
 3   stars        10000 non-null  int64 
 4   text         10000 non-null  object
 5   type         10000 non-null  object
 6   user_id      10000 non-null  object
 7   cool         10000 non-null  int64 
 8   useful       10000 non-null  int64 
 9   funny        10000 non-null  int64 
dtypes: int64(4), object(6)
memory usage: 781.4+ KB
```

In [117]:
```
for col in data.columns:
    print(col.ljust(30),': ',len(data[col].unique()),'labels'.ljust(10),' : ',data[col].dtype)
```

```
business_id                    :  4174 labels      :  object
date                           :  1995 labels      :  object
review_id                      :  10000 labels      :  object
stars                          :  5 labels      :  int64
text                           :  9998 labels      :  object
type                           :  1 labels      :  object
user_id                        :  6403 labels      :  object
cool                           :  29 labels      :  int64
useful                         :  28 labels      :  int64
funny                          :  29 labels      :  int64
```

- ***Dropping Unnecessary Columns***

Dropping Unnecessary Columns

In [118]:
```
data = data.drop(['review_id'],axis = 1)
data = data.drop(['type'],axis = 1)
```

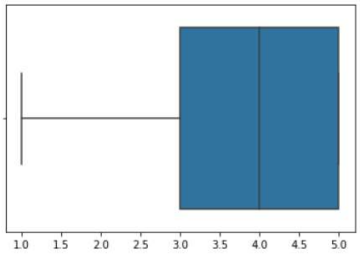
- ***Visualizing the voting columns***

Plotting to get a sense of data

Box Plot and Count Plot

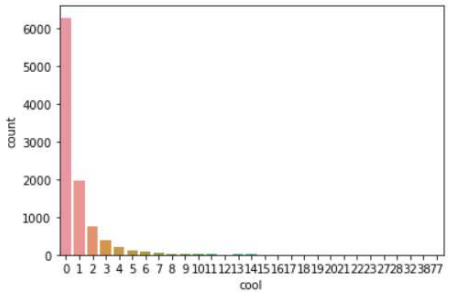
In [119]:
```
sns.boxplot(data=data,x=data['stars'])
```

Out[119]: <AxesSubplot:xlabel='stars'>



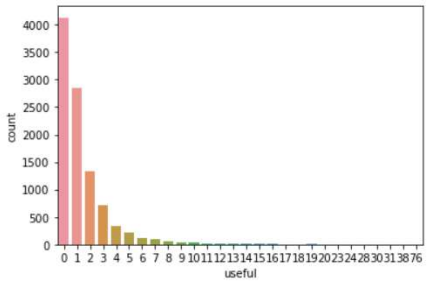
In [120]:
```
sns.countplot(data=data,x=data['cool'])
```

Out[120]: <AxesSubplot:xlabel='cool', ylabel='count'>



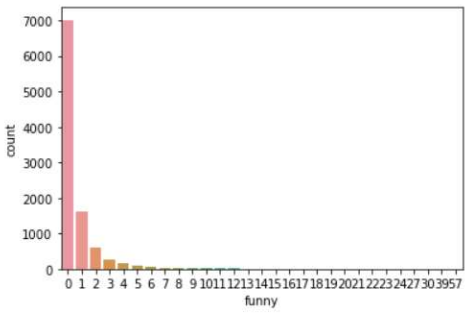
In [121]:
```
sns.countplot(data=data,x=data['useful'])
```

Out[121]: <AxesSubplot:xlabel='useful', ylabel='count'>



```
In [122]: sns.countplot(data=data,x=data['funny'])
```

```
Out[122]: <AxesSubplot:xlabel='funny', ylabel='count'>
```



- ***Checking the reviews if any has less than zero stars***

Count of values for each star

```
In [145]: data['stars'].value_counts()
```

```
Out[145]: 4    3526
          5    3337
          3    1461
          2     927
          1     749
          Name: stars, dtype: int64
```

- ***Checking NULL values if any***

Checking NULL values

```
In [146]: count=data.isna().sum()
          count
```

```
Out[146]: business_id            0
          date                   0
          stars                  0
          text                   0
          user_id                0
          cool                   0
          useful                 0
          funny                  0
          body_text_clean        0
          body_text_tokenized    0
          body_text_nostop       0
          body_text_lemmatized   0
          text1                  0
          dtype: int64
```

- ***Constructing a New DataFrame out of the previous one***

Making a new dataframe with feature and label

In [147]:
```
data1 = pd.DataFrame(data,columns = ['text','stars'])
data1.head()
```

Out[147]:

	text	stars
0	My wife took me here on my birthday for breakf...	5
1	I have no idea why some people give bad review...	5
2	love the gyro plate. Rice is so good and I als...	4
3	Rosie, Dakota, and I LOVE Chaparral Dog Park!!...	5
4	General Manager Scott Petello is a good egg!!!...	5

- ***Removing Punctuations***

Removing Punctuations

In [148]:
```
import string
string.punctuation

def remove_punct (text):
    text_nopunct = "".join([char for char in text if char not in string.punctuation ])
    return text_nopunct

data1['body_text_clean'] = data1['text'].apply(lambda x:remove_punct(x))
```

- ***Tokenizing***

Tokenizing

In [154]:
```
import re
def tokenize(text):
    tokens = re.split('\W+',text)
    return tokens

data1['body_text_tokenized'] = data1['body_text_clean'].apply(lambda x:tokenize(x.lower()))
data1['body_text_tokenized'].head()
```

Out[154]:
```
0    [my, wife, took, me, here, on, my, birthday, f...
1    [i, have, no, idea, why, some, people, give, b...
2    [love, the, gyro, plate, rice, is, so, good, a...
3    [rosie, dakota, and, i, love, chaparral, dog, ...
4    [general, manager, scott, petello, is, a, good...
Name: body_text_tokenized, dtype: object
```

- ***Removing Stopwords***

Removing Stopwords

In [155]:
```
stop_words = nltk.corpus.stopwords.words('english')

def remove_stopwords(tokenized_list):
    text = [word for word in tokenized_list if word not in stop_words]
    return text

data1['body_text_nostop'] = data1['body_text_tokenized'].apply(lambda x: remove_stopwords(x))
data1['body_text_nostop'].head()
```

Out[155]:
```
0    [wife, took, birthday, breakfast, excellent, w...
1    [idea, people, give, bad, reviews, place, goes...
2    [love, gyro, plate, rice, good, also, dig, can...
3    [rosie, dakota, love, chaparral, dog, park, co...
4    [general, manager, scott, petello, good, egg, ...
Name: body_text_nostop, dtype: object
```

- ***Lemmatizing***

Lemmatizing

In [158]:
```
wn = nltk.WordNetLemmatizer()

def lemmatizing(tokenized_text):
    text = [wn.lemmatize(word) for word in tokenized_text]
    return text

data1['body_text_lemmatized'] = data1['body_text_nostop'].apply(lambda x:lemmatizing(x))
data1['body_text_lemmatized'].head()
```

Out[158]:
```
0    [wife, took, birthday, breakfast, excellent, w...
1    [idea, people, give, bad, review, place, go, s...
2    [love, gyro, plate, rice, good, also, dig, can...
3    [rosie, dakota, love, chaparral, dog, park, co...
4    [general, manager, scott, petello, good, egg, ...
Name: body_text_lemmatized, dtype: object
```

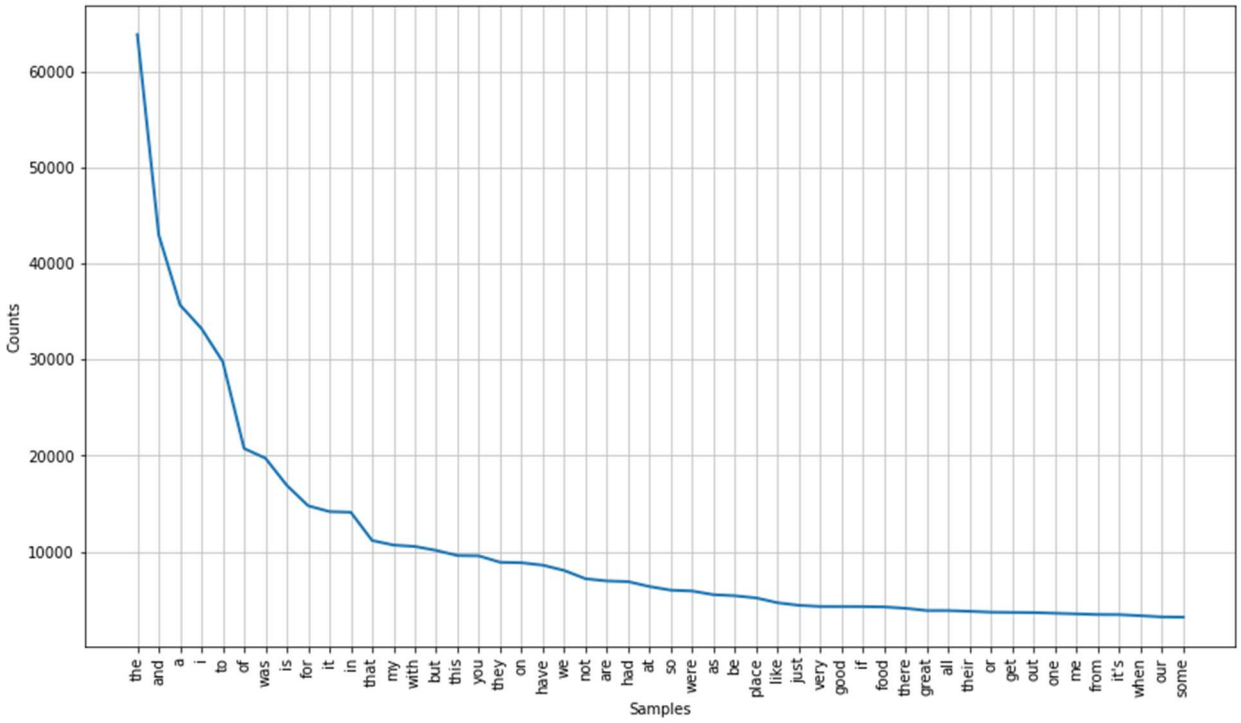
- ***Word Vectorization***

Vectorization

In [159]:
```
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.metrics import mean_squared_error



def clean_text (text):
    text = "".join([word.lower() for word in text if word not in string.punctuation])
    tokens = re.split('\W+',text)
    text = [ps.stem(word) for word in tokens if word not in stop_words]
    return text


count_vect = CountVectorizer(analyzer=clean_text)
X_counts = count_vect.fit_transform(data1['body_text_clean'])
```

- ***Visualizing most common words***

```
In [161]: import string
          plt.figure(figsize = (14,8))
          txt = " ".join(data['text'])
          words = txt.translate(string.punctuation).lower().split()
          fd = nltk.FreqDist(words)
          fd.plot(50,cumulative = False)

          fd.most_common(10)
```




```
Out[161]: [('the', 63808),
           ('and', 42959),
           ('a', 35667),
           ('i', 33228),
           ('to', 29781),
           ('of', 20737),
           ('was', 19727),
           ('is', 16905),
           ('for', 14778),
           ('it', 14170)]
```

- ***Finding most common words***

Finding most common words

In [132]:
```
from nltk.corpus import stopwords
import re
word_list = []
i=0

for txt in data['text']:
    w_list = re.sub(r'[^a-z]',' ',txt.lower()).split()
    data.loc[i, 'text1'] = ' '.join(w_list)
    w_list = [w for w in w_list if w not in stopwords.words('english')]
    word_list += w_list
    i+=1


all_words_fd = nltk.FreqDist(word_list)
word_common = all_words_fd.most_common(3000)
word_features = [w[0] for w in word_common]
print(word_common[0:5])
print(word_features[0:10])
```

```
[('w', 122222), ('u', 88280), ('v', 64336), ('st', 36200), ('ut', 24888)]
['w', 'u', 'v', 'st', 'ut', 'us', 'ss', 'x', 'tt', 'ts']
```

- ***Feature Identification***

Finding features

In [138]:
```
def find_feature(document):
    features = {}
    words = document.split()
    for w in word_common:
        features[w[0]]=(w[0] in words)
    return features

Feature_set = []
for i, row in enumerate(data.values):
    q,label,text,text_len,text1,q,q,q,q,q,q,q,q= row
    Feature_set.append((find_feature(text1),label))


print (Feature_set[0][1])
print(len(Feature_set[0][0]))
Feature_set[0][0]
```

```
212
```

Out[138]:
```
{'w': False,
 'u': False,
 'v': False,
 'st': False,
 'ut': False,
 'us': False,
 'ss': False,
 'x': False,
 'tt': False,
 'ts': False,
 'su': False,
```

In [170]:
```
print (Feature_set[0][1])
```

```
2011-01-26
```

- ***Train Test Split***

Defining Train Set and Test Set

```
In [171]: train_set = Feature_set[:3000]
          test_set  = Feature_set[3000:]
```

- ***Training a Classifier***

Fitting a Classifier

```
In [172]: classifier = nltk.NaiveBayesClassifier.train(train_set)
```

- ***Finding the accuracy of the model***

Finding the accuracy of the data.

```
In [ ]: print(nltk.classify.accuracy(classifier,test_set)*100)
```