In [0]:
```
'''Here we are studying customer review dateset.
we are using Zip file which is being taken from amazon website
and the name of the dateset is amazon reviews us Gift Card v1 00.The review da
teset comprises of many customers'''
```

In [0]:
```
from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity = "all"
import csv
import gzip
import matplotlib.pyplot as plt
from matplotlib import colors
from collections import defaultdict
f=gzip.open('amazon_reviews_us_Gift_Card_v1_00.tsv.gz','rt')
reader=csv.reader(f,delimiter='\t');header=next(reader)
dataset=[]
for line in reader:
  d=dict(zip(header,line))
  for field in['helpful_votes','star_rating','total_votes']:
    d[field]=int(d[field])
  for field in['verified_purchase','vine']:
    if d[field]=='Y':
      d[field]=True
    else:
      d[field]=False
  dataset.append(d)
```

In [0]:
```
'''each customer having his own review id
customer credentials details present such as which country
marketplace customer belongs to then various product details present
such as product id, product_category, product_parent, product_title
then details on customer reviews present such as review_body,
review_date,review_headline,review_id,customer star ratings,his total votes,
his votes whether he found the store peoples helpful or not.
then details on whether purchase verified or not verified also given.
we now need to do some cleaning on the data so that our data becomes more mean
ingful
we should remove unnecessary and trivial data which
would only create more confusions and won't be helpful in
building significant data models and projecting accurate predictions'''
```

In [2]:
```
dataset[0]
len(dataset)
```

Out[2]:
```
{'customer_id': '24371595',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'B004LLIL5A',
 'product_parent': '346014806',
 'product_title': 'Amazon eGift Card - Celebrate',
 'review_body': 'Great birthday gift for a young adult.',
 'review_date': '2015-08-31',
 'review_headline': 'Five Stars',
 'review_id': 'R27ZP1F1CD0C3Y',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False}
```

Out[2]:
```
148310
```

In [0]:
```
'''HERE WE TRY TO FILTER REVIEWS BY DATE.FOR THE MOMENT WE WILL FILTER BASED O
N REVIEW'S YEAR
WE GOT ERROR.SO FIRST WE HAVE TO PREPROCESS OUR DATESET TO EXTRACT ONLY THOSE
ENTRIES CONTAINING A REVIEW DATE FIELD'''
```

In [3]:
```
for d in dataset:
  d['yearint']=int(d['review_date'][:4])
```

```
---------------------------------------------------------------------------
KeyError                                  Traceback (most recent call last)
<ipython-input-3-e9bbad8b7105> in <module>()
      1 for d in dataset:
----> 2   d['yearint']=int(d['review_date'][:4])

KeyError: 'review_date'
```

In [4]:
```
dataset=[d for d in dataset if 'review_date' in d ]
print('\n')
len(dataset)
```

Out[4]:
```
148309
```

In [0]:
```
#now let us filter old reviews i.e. those before 2010
```

In [5]:
```
for d in dataset:
  d['yearint']=int(d['review_date'][:4])
dataset=[d for d in dataset if d['yearint'] >2010]
dataset[0]
len(dataset)
```

Out[5]:
```
{'customer_id': '24371595',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'B004LLIL5A',
 'product_parent': '346014806',
 'product_title': 'Amazon eGift Card - Celebrate',
 'review_body': 'Great birthday gift for a young adult.',
 'review_date': '2015-08-31',
 'review_headline': 'Five Stars',
 'review_id': 'R27ZP1F1CD0C3Y',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False,
 'yearint': 2015}
```

Out[5]:
```
146727
```

In [0]:
```
#let us write other list comprehension to exclude reviews with low helpful rat
es
```

In [6]:
```
dataset=[d for d in dataset if d['total_votes']<3
         or d['helpful_votes']/d['total_votes']>=0.5]
dataset[0]
len(dataset)
```

Out[6]:
```
{'customer_id': '24371595',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'B004LLIL5A',
 'product_parent': '346014806',
 'product_title': 'Amazon eGift Card - Celebrate',
 'review_body': 'Great birthday gift for a young adult.',
 'review_date': '2015-08-31',
 'review_headline': 'Five Stars',
 'review_id': 'R27ZP1F1CD0C3Y',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False,
 'yearint': 2015}
```

Out[6]:
```
146461
```

In [0]:
```
'''let us filter our dataset to discard inactive users i.e.
users who have written only a single review in this directory.
then we can filter to keep users with 2 or more reviews'''
```

In [7]:
```
nReviewperuser=defaultdict(int)
for d in dataset:
  nReviewperuser[d['customer_id']]+=1
dataset[0]
dataset=[d for d in dataset if nReviewperuser[d['customer_id']]>=2 ]
dataset[0]
len(dataset)
```

Out[7]:
```
{'customer_id': '24371595',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'B004LLIL5A',
 'product_parent': '346014806',
 'product_title': 'Amazon eGift Card - Celebrate',
 'review_body': 'Great birthday gift for a young adult.',
 'review_date': '2015-08-31',
 'review_headline': 'Five Stars',
 'review_id': 'R27ZP1F1CD0C3Y',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False,
 'yearint': 2015}
```

Out[7]:
```
{'customer_id': '48872127',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'BT00CTOYC0',
 'product_parent': '506740729',
 'product_title': 'Amazon.com $15 Gift Card in a Greeting Card (Amazon Surpri
se Box Design)',
 'review_body': 'I love that I have instant, helpful options when I forget a
birthday! Thanks for saving the day Amazon!',
 'review_date': '2015-08-31',
 'review_headline': 'Quick Solution for Forgotten Occasion',
 'review_id': 'RVN4P3RU4F8IE',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False,
 'yearint': 2015}
```

Out[7]:
```
11048
```

In [0]:
```
#let us remove short reviews which may be uninformative
```

In [8]:
```
dataset=[d for d in dataset if len(d['review_body'].split())>=10]
dataset[0]
len(dataset)
```

Out[8]:
```
{'customer_id': '48872127',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'BT00CTOYC0',
 'product_parent': '506740729',
 'product_title': 'Amazon.com $15 Gift Card in a Greeting Card (Amazon Surpri
se Box Design)',
 'review_body': 'I love that I have instant, helpful options when I forget a
birthday! Thanks for saving the day Amazon!',
 'review_date': '2015-08-31',
 'review_headline': 'Quick Solution for Forgotten Occasion',
 'review_id': 'RVN4P3RU4F8IE',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False,
 'yearint': 2015}
```

Out[8]:
```
6915
```

In [0]:
```
#average star rating for the entire dataset comes out as 4.806
```

In [9]:
```
ratings=[d['star_rating'] for d in dataset]
sum(ratings)/len(ratings)
```

Out[9]:
```
4.806073752711497
```

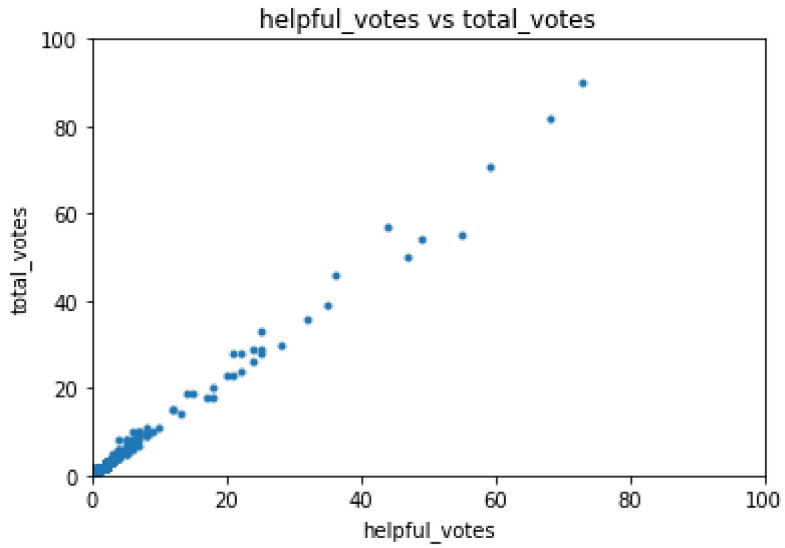
In [0]:
```
'''from the scatter plot we understand that helpful_votes
is positively correlated with total_votes i.e.
with increase in helpful votes total votes increase accordingly.'''
```

In [10]:
```
helpful_votes=[d['helpful_votes'] for d in dataset]
total_votes=[d['total_votes'] for d in dataset]
plt.gca().set(xlabel='helpful_votes',ylabel='total_votes',title='helpful_votes vs total_votes')
plt.axis([0, 100, 0, 100])
size = 500
plt.scatter(helpful_votes,total_votes,marker=".")
```

Out[10]:
```
[Text(0, 0.5, 'total_votes'),
 Text(0.5, 0, 'helpful_votes'),
 Text(0.5, 1.0, 'helpful_votes vs total_votes')]
```

Out[10]:
```
(0.0, 100.0, 0.0, 100.0)
```

Out[10]:
```
<matplotlib.collections.PathCollection at 0x7f77250eccf8>
```



In [0]:
```
'''defaultdict"structure from the "collections"library allows us to automate initializing a dictionary with all zero counts'''
```

In [11]:
```
#ratingcounts={1:0,2:0,3:0,4:0,5:0}
ratingcounts=defaultdict(int)
print('\n')
for d in dataset:
  ratingcounts[d['star_rating']]+=1
ratingcounts
```

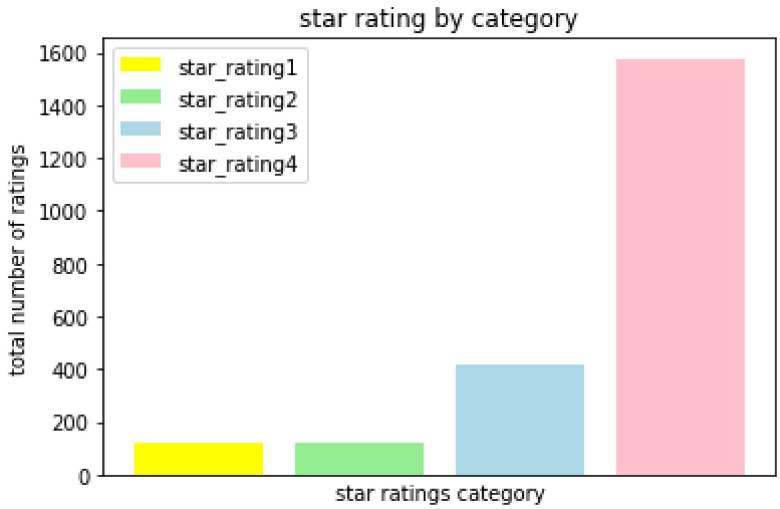
Out[11]:
```
defaultdict(int, {1: 121, 2: 61, 3: 140, 4: 394, 5: 6199})
```

In [12]:
```
star1=sum([d['star_rating']for d in dataset if d['star_rating'] is 1 ])
star2=sum([d['star_rating']for d in dataset if d['star_rating'] is 2 ])
star3=sum([d['star_rating']for d in dataset if d['star_rating'] is 3 ])
star4=sum([d['star_rating']for d in dataset if d['star_rating'] is 4 ])
star5=sum([d['star_rating']for d in dataset if d['star_rating'] is 5 ])
index=[1]
p1=plt.bar(index,star1,color='yellow')
index=[2]
p2=plt.bar(index,star2,color='lightgreen')
index=[3]
p3=plt.bar(index,star3,color='lightblue')
index=[4]
p4=plt.bar(index,star4,color='pink')
plt.gca().set(title='star rating by category',ylabel='total number of ratings'
,xlabel='star ratings category')
plt.xticks([])
plt.legend((p1[0],p2[0],p3[0],p4[0]),('star_rating1','star_rating2','star_rati
ng3','star_rating4'))
plt.show()
index=[1]
p5=plt.bar(index,star5,color='lightgreen')
index=[2]
p4=plt.bar(index,star4,color='pink')
plt.gca().set(title='star rating by category',ylabel='total number of ratings'
,xlabel='star ratings category')
plt.xticks([])
plt.legend((p5[0],p4[0]),('star_rating5','star_rating4'))
plt.show()
```

Out[12]:
```
[Text(0, 0.5, 'total number of ratings'),
 Text(0.5, 0, 'star ratings category'),
 Text(0.5, 1.0, 'star rating by category')]
```

Out[12]:
```
([], <a list of 0 Text major ticklabel objects>)
```

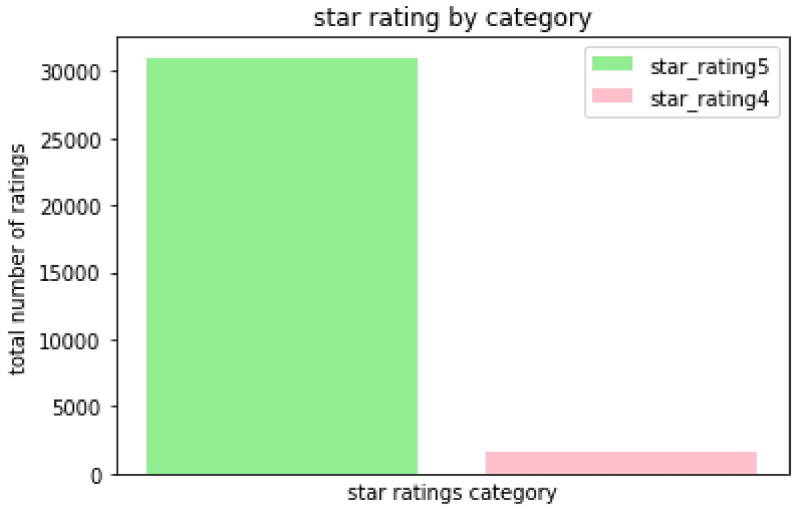
Out[12]:
```
<matplotlib.legend.Legend at 0x7f77250286a0>
```



Out[12]:
```
[Text(0, 0.5, 'total number of ratings'),
 Text(0.5, 0, 'star ratings category'),
 Text(0.5, 1.0, 'star rating by category')]
```

Out[12]:
```
([], <a list of 0 Text major ticklabel objects>)
```

Out[12]:
```
<matplotlib.legend.Legend at 0x7f7724fa6438>
```



In [0]:
```
'''from Bar plot we can clearly find that star_rating5 count is signifiantly
high comapared to other star_ratings'''
```

In [13]:
```
ratingsperproduct=defaultdict(list)
for d in dataset:
  ratingsperproduct[d['product_id']].append(d['star_rating'])
ratingsperproduct['B004LLIL5A'][-15:]
```

Out[13]:
```
[5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5]
```

In [0]:
```
#Average ratings per product stands out to be 4.8787
```

In [14]:
```
averageratingperproduct={}
for p in ratingsperproduct:
  averageratingperproduct[p]=sum(ratingsperproduct[p])/len(ratingsperproduct[p
])
averageratingperproduct['B004LLIL5A']
```

Out[14]:
```
4.878787878787879
```

In [15]:
```
toprated=[(averageratingperproduct[p],p) for p in averageratingperproduct
          if len(ratingsperproduct)>50]
toprated.sort()
toprated[201:211]
```

Out[15]:
```
[(4.785714285714286, 'B00CHQ7ESQ'),
 (4.78743961352657, 'B00IX1I3G6'),
 (4.791666666666667, 'B00A4EK4CQ'),
 (4.795454545454546, 'B00G4IV2VI'),
 (4.8, 'B004KNWWP4'),
 (4.8, 'B004KNWWWM'),
 (4.8, 'B004KNWX1M'),
 (4.8, 'B004WKPW0W'),
 (4.8, 'B005EISPLE'),
 (4.8, 'B005EISPOG')]
```

In [0]:
```
#verified_purchase is 6395. unverified purchase is 520.
```

In [16]:
```
verifiedcounts=defaultdict(int)
verifiedcounts
for d in dataset:
  verifiedcounts[d['verified_purchase']]+=1
verifiedcounts
```

Out[16]:
```
defaultdict(int, {})
```

Out[16]:
```
defaultdict(int, {False: 520, True: 6395})
```

In [17]:
```
dataset[0]
len(dataset)
```

Out[17]:
```
{'customer_id': '48872127',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'BT00CTOYC0',
 'product_parent': '506740729',
 'product_title': 'Amazon.com $15 Gift Card in a Greeting Card (Amazon Surpri
se Box Design)',
 'review_body': 'I love that I have instant, helpful options when I forget a
birthday! Thanks for saving the day Amazon!',
 'review_date': '2015-08-31',
 'review_headline': 'Quick Solution for Forgotten Occasion',
 'review_id': 'RVN4P3RU4F8IE',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False,
 'yearint': 2015}
```

Out[17]:
```
6915
```

In [0]:
```
'''plotted a Bar chart between verified purchase and
unverified purchase.verified purchase is 6395. unverified purchase is 520'''
```

In [18]:
```
unverified_purchase=sum([d['verified_purchase']==False  for d in dataset ])
unverified_purchase
print('\n')
verified_purchase=sum([d['verified_purchase']== True for d in dataset])
verified_purchase
index=[1]
p1=plt.bar(index,verified_purchase,color='green')
index=[2]
p2=plt.bar(index,unverified_purchase,color='red')
plt.gca().set(title='verified vs unverified purchase',ylabel='total number of
 purchase',xlabel='purchase category')
plt.xticks([])
plt.legend((p1[0],p2[0]),('verified_purchase','unverified_purchase'))
plt.show()
```

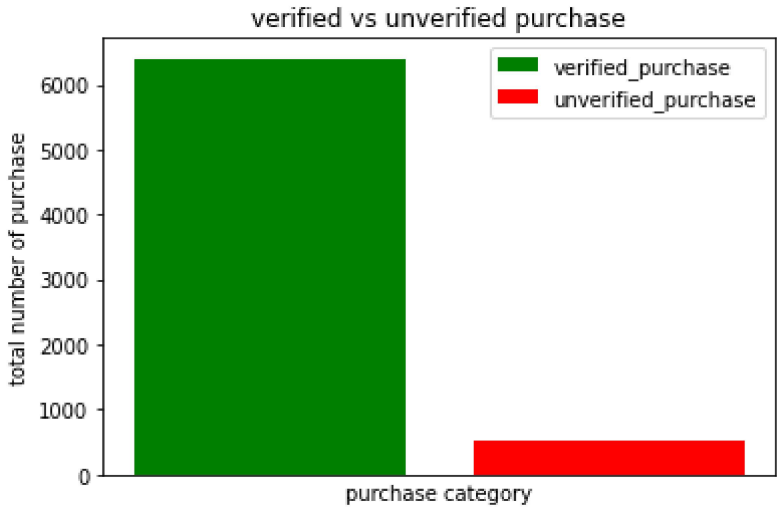
Out[18]: 520

Out[18]: 6395

Out[18]:
```
[Text(0, 0.5, 'total number of purchase'),
 Text(0.5, 0, 'purchase category'),
 Text(0.5, 1.0, 'verified vs unverified purchase')]
```

Out[18]: ([], <a list of 0 Text major ticklabel objects>)

Out[18]: <matplotlib.legend.Legend at 0x7f77250b9898>



In [0]:
```
productcounts=defaultdict(int)
for d in dataset:
  productcounts[d['product_id']]+=1
```

In [20]:
```
counts=[(productcounts[p],p) for p in productcounts]
counts.sort()
counts[-10:]
```

Out[20]:
```
[(118, 'B004LLIKY2'),
 (134, 'BT00CTOUNS'),
 (148, 'B007V6EVY2'),
 (152, 'B00A48G0D4'),
 (152, 'BT00DDC7CE'),
 (154, 'B0091JKU5Q'),
 (167, 'B004KNWWO0'),
 (207, 'B00IX1I3G6'),
 (236, 'BT00DDVMVQ'),
 (508, 'B004LLIKVU')]
```

In [21]:
```
nRatings=len(dataset)
nRatings
```

Out[21]:
```
6915
```

In [22]:
```
average=0
for d in dataset:
  average+=d['star_rating']
average/=nRatings
average
```

Out[22]:
```
4.806073752711497
```

In [0]:
```
#total customer headcount is 3801 and products count is 848.
```

In [23]:
```
users=set()
items=set()
for d in dataset:
  users.add(d['customer_id'])
  items.add(d['product_id'])
len(users),len(items)
```

Out[23]:
```
(3801, 848)
```

In [24]:
```
dataset[0]
```

Out[24]:
```
{'customer_id': '48872127',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'BT00CTOYC0',
 'product_parent': '506740729',
 'product_title': 'Amazon.com $15 Gift Card in a Greeting Card (Amazon Surpri
se Box Design)',
 'review_body': 'I love that I have instant, helpful options when I forget a
birthday! Thanks for saving the day Amazon!',
 'review_date': '2015-08-31',
 'review_headline': 'Quick Solution for Forgotten Occasion',
 'review_id': 'RVN4P3RU4F8IE',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False,
 'yearint': 2015}
```

In [25]:
```
avverified=0
avunverified=0
nverified=0
nunverified=0
for d in dataset:
  if d['verified_purchase']==True:
    avverified+=d['star_rating']
    nverified+=1
  else:
    avunverified+=d['star_rating']
    nunverified+=1
avverified/=nverified
avunverified/=nunverified
avverified,avunverified
```

Out[25]:
```
(4.8151681000781865, 4.694230769230769)
```

In [0]:
```
'''Average for Verified rating is 4.8151.
Average for unverified rating also is somewhere nearby i.e. 4.694'''
```

In [27]:
```
verifiedRatings=[d['star_rating'] for d in dataset
                 if d['verified_purchase']==True ]
unverifiedRatings=[d['star_rating'] for d in dataset
                 if d['verified_purchase']==False ]
sum(verifiedRatings)/len(verifiedRatings)
print('\n')
sum(unverifiedRatings)/len(unverifiedRatings)
dataset[0]
```

Out[27]:
```
4.8151681000781865
```

Out[27]:
```
4.694230769230769
```

Out[27]:
```
{'customer_id': '48872127',
 'helpful_votes': 0,
 'marketplace': 'US',
 'product_category': 'Gift Card',
 'product_id': 'BT00CTOYC0',
 'product_parent': '506740729',
 'product_title': 'Amazon.com $15 Gift Card in a Greeting Card (Amazon Surpri
se Box Design)',
 'review_body': 'I love that I have instant, helpful options when I forget a
birthday! Thanks for saving the day Amazon!',
 'review_date': '2015-08-31',
 'review_headline': 'Quick Solution for Forgotten Occasion',
 'review_id': 'RVN4P3RU4F8IE',
 'star_rating': 5,
 'total_votes': 0,
 'verified_purchase': True,
 'vine': False,
 'yearint': 2015}
```

In [28]:
```
import pandas as pd
df=pd.DataFrame(dataset)
df.head(5)
```

Out[28]:

	marketplace	customer_id	review_id	product_id	product_parent	product_title	pr
0	US	48872127	RVN4P3RU4F8IE	BT00CTOYC0	506740729	Amazon.com $15 Gift Card in a Greeting Card (A...	
1	US	25208893	R13UP4ELOFYDB5	B00PG40PAK	750842252	Amazon eGift Card - Truth in Gift Cards	
2	US	13376158	R3KLV1HD0EFCSV	B005Z3D5OU	379368939	Amazon.com Gift Cards, Pack of 3 (Various Desi...	
3	US	47184195	R3SILVKZXUV8TT	B00A4EK4YO	16766865	Amazon eGift Card - Thank You (Global)	
4	US	1094807	R3U229HF6OOJXQ	B004LLIKVU	473048287	Amazon.com eGift Cards	

In [29]:
```
df.columns
```

Out[29]:
```
Index(['marketplace', 'customer_id', 'review_id', 'product_id',
       'product_parent', 'product_title', 'product_category', 'star_rating',
       'helpful_votes', 'total_votes', 'vine', 'verified_purchase',
       'review_headline', 'review_body', 'review_date', 'yearint'],
      dtype='object')
```

In [30]:
```
df.shape
```

Out[30]:
```
(6915, 16)
```

In [0]:
```
'''star_rating,helpful_votes,total_votes,
yearint are scale variables,rest all are categorical variables'''
```

In [31]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6915 entries, 0 to 6914
Data columns (total 16 columns):
 #   Column             Non-Null Count  Dtype 
---  ------             --------------  ----- 
 0   marketplace        6915 non-null   object
 1   customer_id        6915 non-null   object
 2   review_id          6915 non-null   object
 3   product_id         6915 non-null   object
 4   product_parent     6915 non-null   object
 5   product_title      6915 non-null   object
 6   product_category   6915 non-null   object
 7   star_rating        6915 non-null   int64 
 8   helpful_votes      6915 non-null   int64 
 9   total_votes        6915 non-null   int64 
 10  vine               6915 non-null   bool  
 11  verified_purchase  6915 non-null   bool  
 12  review_headline    6915 non-null   object
 13  review_body        6915 non-null   object
 14  review_date        6915 non-null   object
 15  yearint            6915 non-null   int64 
dtypes: bool(2), int64(4), object(10)
memory usage: 770.0+ KB
```

In [0]:
```
'''here we got more descriptions of the input variable
and those descriptions are like getting mean,std deviation,min,max,and data in
25%,50% and 75% quartile for all the listed input features'''
```

In [32]:
```
df.describe()
```

Out[32]:

	star_rating	helpful_votes	total_votes	yearint
count	6915.000000	6915.000000	6915.000000	6915.000000
mean	4.806074	0.735358	0.861316	2013.421547
std	0.678074	29.120181	33.726331	1.055599
min	1.000000	0.000000	0.000000	2011.000000
25%	5.000000	0.000000	0.000000	2013.000000
50%	5.000000	0.000000	0.000000	2013.000000
75%	5.000000	0.000000	0.000000	2014.000000
max	5.000000	2383.000000	2763.000000	2015.000000

In [33]:
```
df.isnull().sum()
```

Out[33]:
```
marketplace          0
customer_id          0
review_id            0
product_id           0
product_parent       0
product_title        0
product_category     0
star_rating          0
helpful_votes        0
total_votes          0
vine                 0
verified_purchase    0
review_headline      0
review_body          0
review_date          0
yearint              0
dtype: int64
```

In [0]:
```
#here for all categorical variables we convert bool values to equivalent 1 and
0.
```

In [34]:
```
#DUMMY CODING USING THE LOOP STRUCTURE
for col in df.columns:
  if df[col].dtype=='object':
    df[col]=pd.Categorical(df[col]).codes
df.head(5)
```

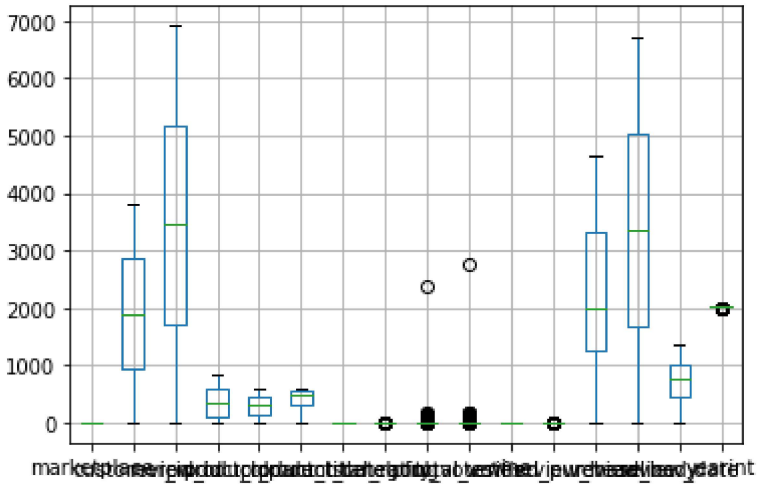
Out[34]:

	marketplace	customer_id	review_id	product_id	product_parent	product_title	product_categ
0	0	3213	6722	775	258	521	
1	0	1443	196	735	415	505	
2	0	390	4678	250	172	578	
3	0	3061	5090	401	44	494	
4	0	105	5189	71	236	580	

In [0]:
```
#Here Box plot is plotted
```

In [35]:
```
df.boxplot()
```

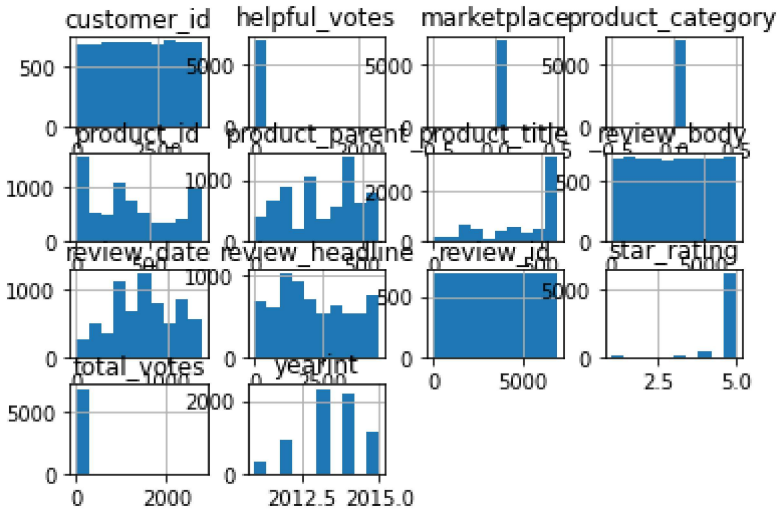
Out[35]: <matplotlib.axes._subplots.AxesSubplot at 0x7f7724edf7b8>



In [0]:
```
#here histogram is being plotted to draw comparisons between variables
```

In [36]:
```
x=df.drop(['vine','verified_purchase'],axis=1)
x.hist(grid='off')
```

Out[36]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7f7724c6f160>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f7724bd9e10>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f7724ba8b70>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f7724b76710>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f7724b3dfd0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f7724a8acc0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f7724a5b278>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f7724a21a20>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f7724a21a90>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f77249bd390>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f7724906a58>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f77248d3240>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x7f7724898c50>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f772486a7b8>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f772483c470>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x7f7724783898>]],
      dtype=object)
```



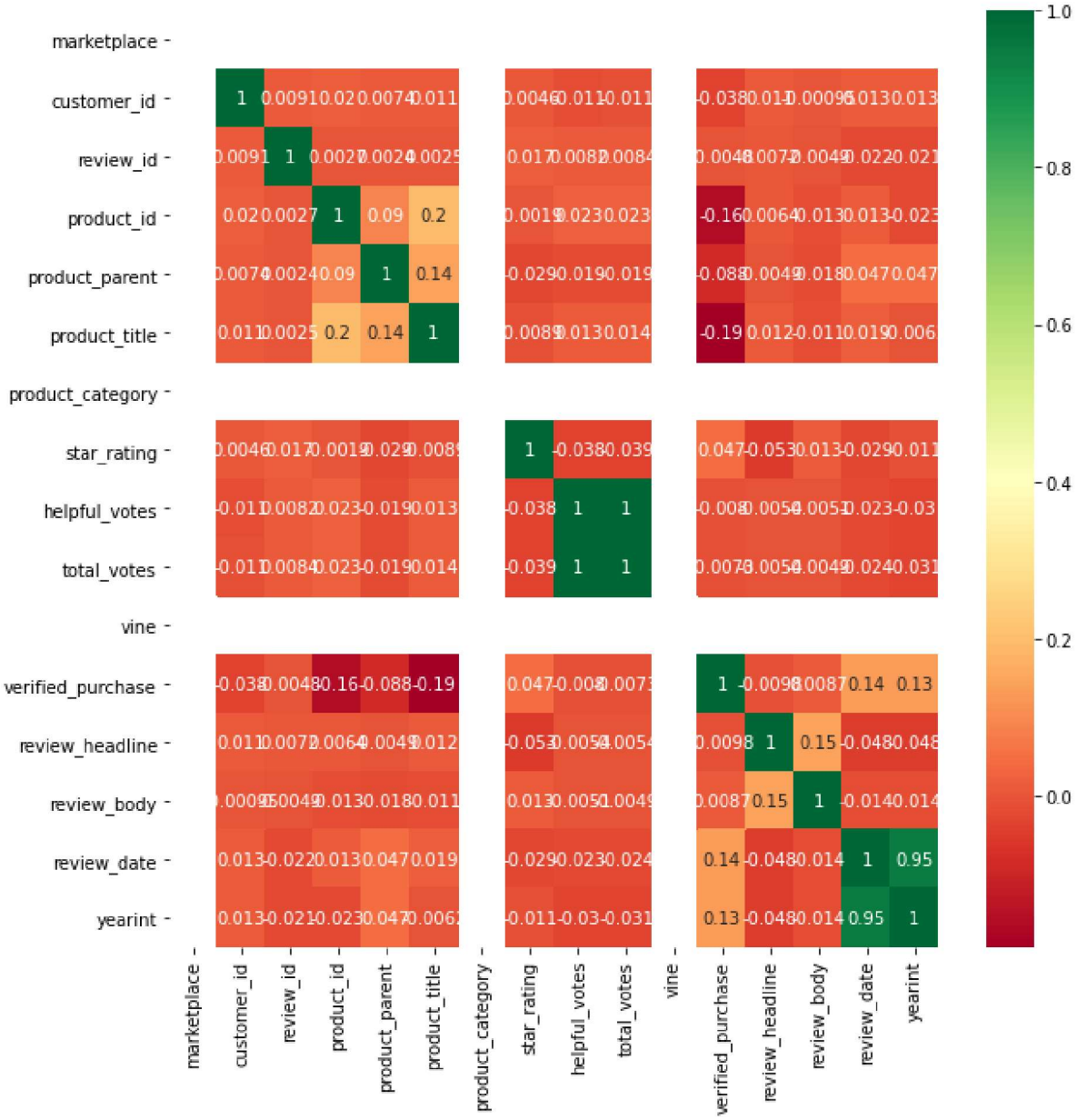
In [0]:
```
'''Heat map plotted to evaluate
correlation between the variables'''
```

In [37]:
```
x=df.corr()
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
plt.subplots(figsize=(10,10))
sns.heatmap(x,cmap='RdYlGn',annot=True)
plt.show()
```

```
/usr/local/lib/python3.6/dist-packages/statsmodels/tools/_testing.py:19: FutureWarning: pandas.util.testing is deprecated. Use the functions in the public API at pandas.testing instead.
  import pandas.util.testing as tm
```

Out[37]:
```
(<Figure size 720x720 with 1 Axes>,
 <matplotlib.axes._subplots.AxesSubplot at 0x7f77238b99e8>)
```

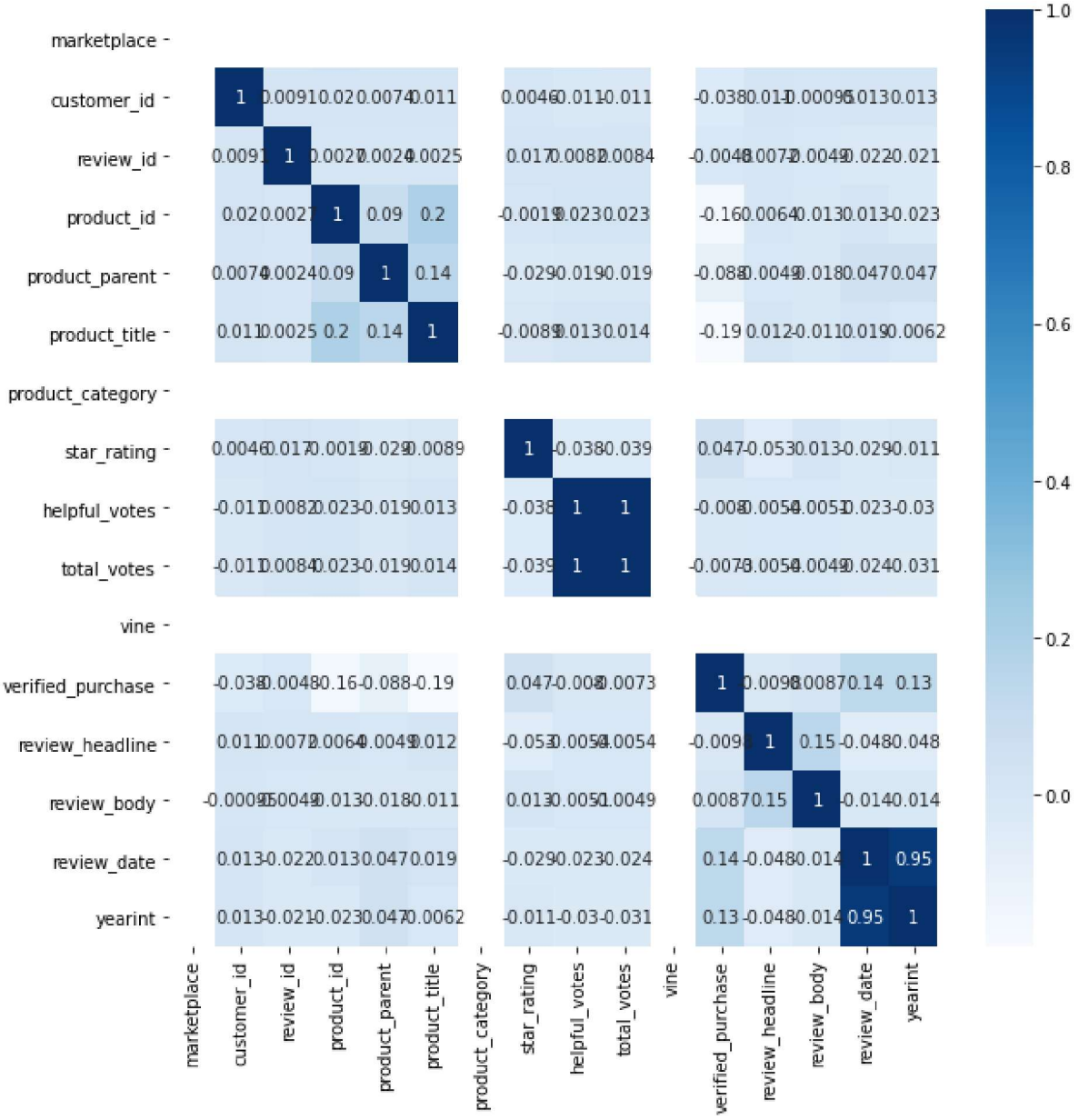
Out[37]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f77238b99e8>
```



In [38]:
```
plt.subplots(figsize=(10,10))
sns.heatmap(x,cmap='Blues',annot=True)
plt.show()
```

Out[38]:
```
(<Figure size 720x720 with 1 Axes>,
 <matplotlib.axes._subplots.AxesSubplot at 0x7f772358b160>)
```

Out[38]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f772358b160>
```



In [0]:
```
!jupyter nbconvert Course1_major_project.ipynb
```

```
[NbConvertApp] Converting notebook Course1_major_project.ipynb to html
[NbConvertApp] Writing 696706 bytes to Course1_major_project.html
```