OBJECTIVE:

1. APPLYING ALL FOUR VECTORIZATIONS FOR K-MEANS
2. FINDING BEST VALUE OF N_CLUSTERS USING ELBOW METHOD
3. PLOTTING OF K VALUES VS INERTIA_LOSS FOR ALL VECTORIZATION
4. REPRESENTING WORDS OF EACH CLUSTER USING WORDCLOUD LIBRARY

In [0]:
```
from sklearn.model_selection import train_test_split  #importing the ne
cessary libraries
from sklearn.model_selection import RandomizedSearchCV
from sklearn.datasets import *
from sklearn import naive_bayes
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
import numpy as np
import pandas as pd
from sklearn import *
import warnings
warnings.filterwarnings("ignore")
from gensim.models import Word2Vec
from tqdm import tqdm
```

In [0]:
```
from google.colab import drive
drive.mount('/content/gdrive')#geeting the content from the google driv
e
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?
client_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleuser
content.com&redirect_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%3Aoob&scope=emai
l%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fdocs.test%20https%3A%2F%2
Fwww.googleapis.com%2Fauth%2Fdrive%20https%3A%2F%2Fwww.googleapis.com%2
Fauth%2Fdrive.photos.readonly%20https%3A%2F%2Fwww.googleapis.com%2Faut
h%2Fpeopleapi.readonly&response_type=code
```

```
Enter your authorization code:
··········
Mounted at /content/gdrive
```

In [0]:
```
final_processed_data=pd.read_csv("gdrive/My Drive/final_new_data.csv")#
loading the preprocessed data  with 100k points into dataframe
```

In [0]:
```
data=final_processed_data.sample(50000)# taking sample data
```

In [0]:
```
print("shape of our new data is ",data.shape)#printing the shape
print("data is as follows:")
print(data.head())#printing
```

```
shape of our new data is  (50000, 2)
data is as follows:
       Score                                        CleanedText
33138      1  buy sourc regular heartili recommend price ser...
93503      1  chines barbequ sauc turn dull pork roast banqu...
70749      1  tri mani sugar free chocol best especi enjoy c...
67889      0  like product fact toss bottl trash expect dip ...
49594      1  littl product great vietnamas coffe filter set...
```

In [0]:
```
vectorizer=CountVectorizer(min_df=500)#building the vertorizer with wor
d counts equal and more then 2
train_bow=vectorizer.fit_transform(data['CleanedText'])#fitting the mod
el on training data
print(train_bow.shape)
```

```
(50000, 622)
```

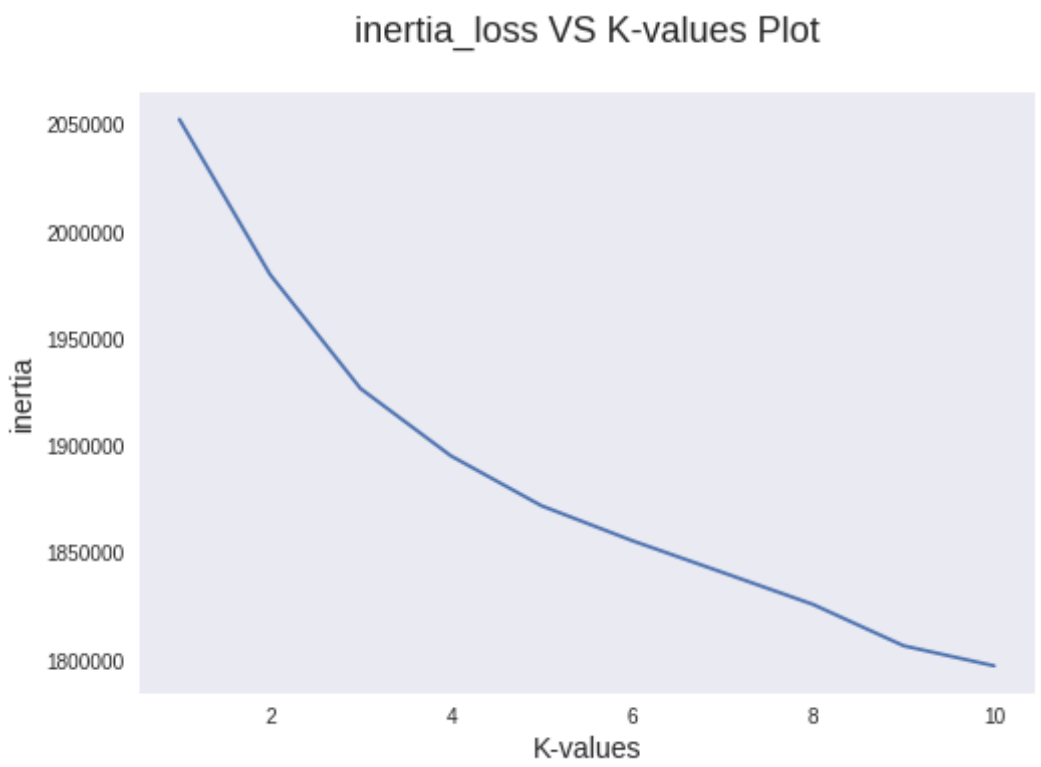
In [0]:
```
#applying model and calculating the squared_loss for each value of k
from sklearn.cluster import KMeans
k_range=[1,2,3,4,5,6,7,8,9,10]
inertia=[]

for i in k_range:
     model=KMeans(n_clusters=i,n_jobs=-1).fit(train_bow)
```

```
    inertia.append(model.inertia_)
```

In [0]:
```
print(inertia)
```

```
[2052699.577120008, 1980305.7635806473, 1926976.5435900143, 1895475.504
6704914, 1872175.0219863206, 1855896.4522775796, 1841022.9884740529, 18
26069.6313661423, 1806757.1600919934, 1797381.8976447172]
```

In [0]:
```
# Draw Loss VS K values plot
import matplotlib.pyplot as plt
plt.plot(k_range, inertia)
plt.xlabel('K-values',size=14)
plt.ylabel('inertia',size=14)
plt.title('inertia_loss VS K-values Plot\n',size=18)
plt.grid()
plt.show()
```



BEST VALUE OF K IS FOUND AS 4

In [0]:
```
km = KMeans(n_clusters=4, n_init=1)
y=km.fit(train_bow)
```

NOW PLOTTING WORDS FOR EACH CLUSTERS

In [0]:
```
#adding words to each clusters
cluster1=[]
cluster2=[]
```

```
cluster3=[]
cluster4=[]
order_centroids = km.cluster_centers_.argsort()[:, ::-1]
terms = vectorizer.get_feature_names()
for i in range(4):
     for ind in order_centroids[i, :15]:
          if i==0:
             cluster1.append(terms[ind])
          if i==1:
             cluster2.append(terms[ind])
          if i==2:
             cluster3.append(terms[ind])
          if i==3:
             cluster4.append(terms[ind])
```

In [0]:

```
from wordcloud import WordCloud #here we are printing the top features
 of cluster 1 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster1))

# plot the WordCloud image
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
```

In [0]:
```
#here we are printing the top features for cluster 2 using wordcloud li
brary

from wordcloud import WordCloud
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster2))

# plot the WordCloud image
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)
```

```
plt.show()
```

In [0]:
```
 #here we are printing the top features for cluster 3 using wordcloud l
ibrary

from wordcloud import WordCloud
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster3))

# plot the WordCloud image
plt.figure(figsize = (8, 8), facecolor = None)
```

```
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
```

In [0]:
```
from wordcloud import WordCloud #here we are printing the top features
 for cluster 4 using wordcloud library
import matplotlib.pyplot as plt
wordcloud = WordCloud(width = 1500, height = 1000,
                background_color ='white',

                min_font_size = 10).generate(str(cluster4))

# plot the WordCloud image
```

```
plt.figure(figsize = (8, 8), facecolor = None)
plt.imshow(wordcloud)
plt.axis("off")
plt.tight_layout(pad = 0)

plt.show()
```

TFIDF VECTORIZATION FOR K_MEANS ALGORITHM

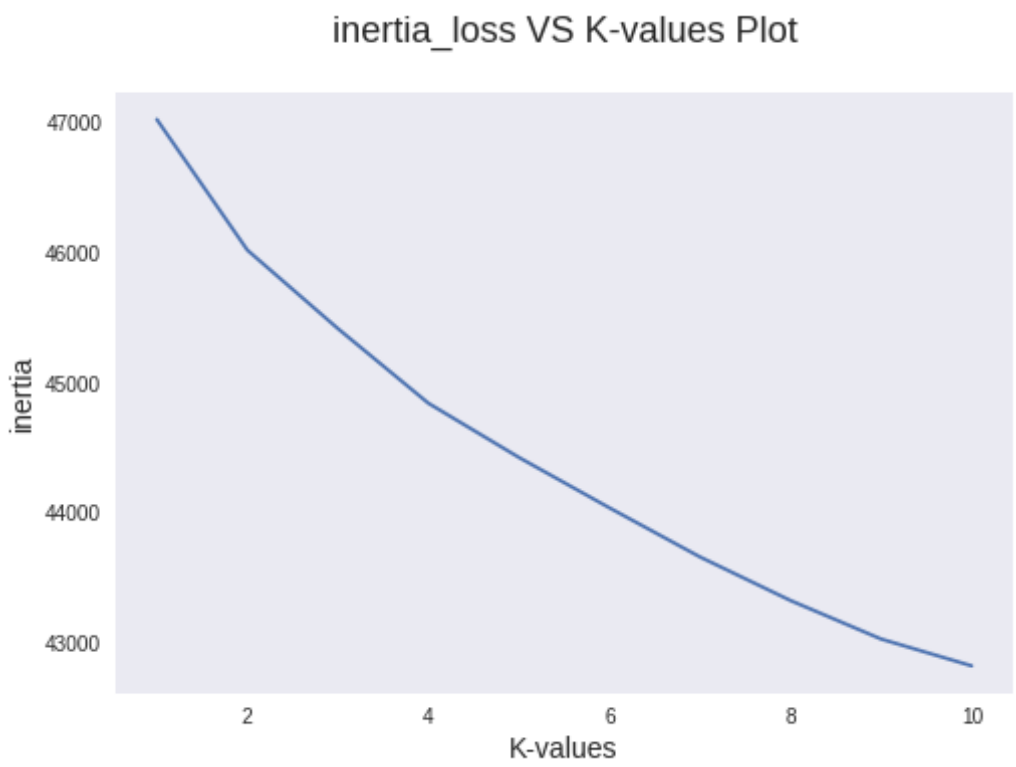
In [0]:
```
vectorizer=TfidfVectorizer(min_df=1000)#building the vertorizer with wo
rd counts equal and more then 1000
train_tfidf=vectorizer.fit_transform(data['CleanedText'])#fitting the m
```

```
odel on training data
print(train_tfidf.shape)
```

```
(50000, 329)
```

In [0]:
```
from sklearn.cluster import KMeans
k_range=[1,2,3,4,5,6,7,8,9,10]
inertia=[]

for i in k_range:
     model=KMeans(n_clusters=i,n_jobs=-1).fit(train_tfidf)
     inertia.append(model.inertia_)
```

In [0]:
```
# Draw Loss VS K values plot
import matplotlib.pyplot as plt
plt.plot(k_range, inertia)
plt.xlabel('K-values',size=14)
plt.ylabel('inertia',size=14)
plt.title('inertia_loss VS K-values Plot\n',size=18)
plt.grid()
plt.show()
```



FROM ABOVE PLOT , BEST N_CLUSTER IS FOUND AS 4

In [0]:
```
km = KMeans(n_clusters=4, n_jobs=-1)
y=km.fit(train_tfidf)
```

In [0]:
```
cluster1=[]
cluster2=[]
cluster3=[]
cluster4=[]
order_centroids = km.cluster_centers_.argsort()[:, ::-1]
terms = vectorizer.get_feature_names()
```

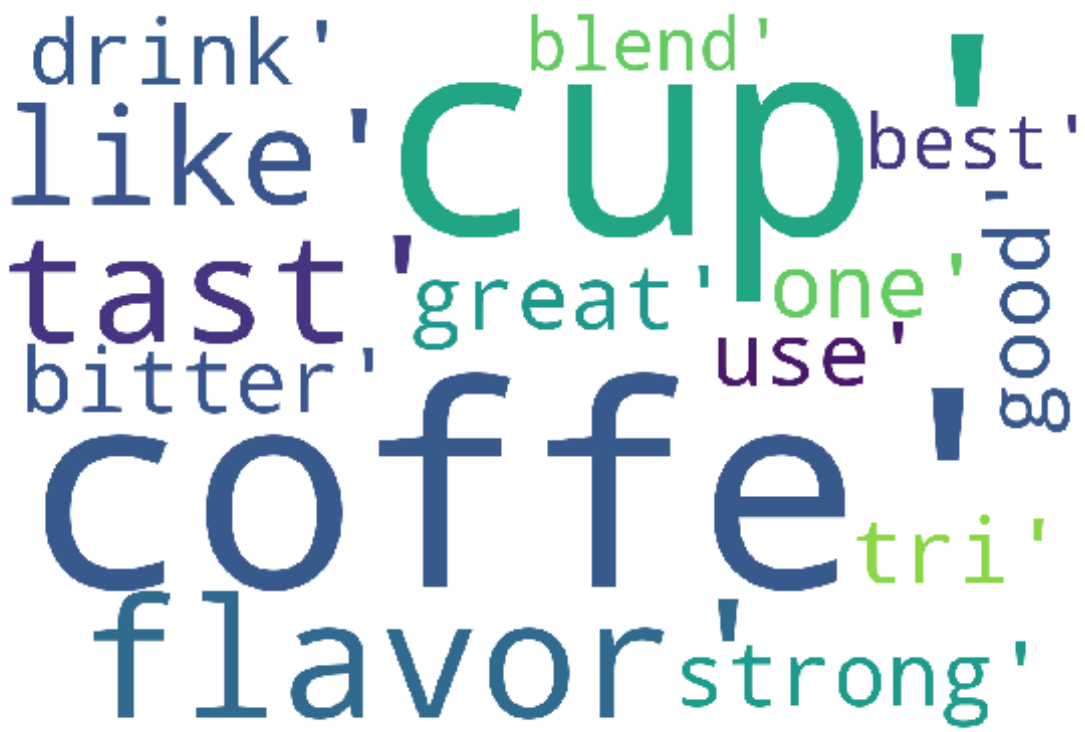
```
for i in range(4):
     for ind in order_centroids[i, :15]:
          if i==0:
             cluster1.append(terms[ind])
          if i==1:
             cluster2.append(terms[ind])
          if i==2:
             cluster3.append(terms[ind])
          if i==3:
             cluster4.append(terms[ind])
```

In [0]:

```
#PRINTING THE  WORDS FOR EACH CLUSTER USING WORDCLOUD
cluster_list=[cluster1,cluster2,cluster3,cluster4]
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
count=1;
for i in  cluster_list:
 wordcloud = WordCloud(width = 1500, height = 1000,background_color ='w
hite',min_font_size = 10).generate(str(i))
 # plot the WordCloud image
 print(" WORDS FOR CLUSTER  %d  ARE AS FOLLOWS" % count )
 plt.figure(figsize = (8, 8), facecolor = None)
 plt.imshow(wordcloud)
 plt.axis("off")
 plt.tight_layout(pad = 0)
 plt.show()
 count=count+1
```

```
 WORDS FOR CLUSTER  1  ARE AS FOLLOWS
```

WORDS FOR CLUSTER 2 ARE AS FOLLOWS



WORDS FOR CLUSTER 3 ARE AS FOLLOWS

WORDS FOR CLUSTER 4 ARE AS FOLLOWS

AVG WORD 2 VEC VECTORIZATION FOR KMEANS

In [0]:
```
list_of_sent=[]
for sent in data['CleanedText'] :
 list_of_sent.append(sent.split())#splitting of sentences into words AN
D appending them to list
print(list_of_sent[0])
word_to_vector=Word2Vec(list_of_sent,min_count=1000,size=50,workers=3)#
```

```
constructing my our word to vector
w_t_c_words=list(word_to_vector.wv.vocab)
print("**************************************************************
*******")
print("sample words ", w_t_c_words[0:50])
```

```
['buy', 'sourc', 'regular', 'heartili', 'recommend', 'price', 'servic',
'qualiti', 'product', 'cours', 'tiptop', 'account', 'thank']
**************************************************************
sample words  ['buy', 'regular', 'recommend', 'price', 'qualiti', 'prod
uct', 'thank', 'sauc', 'turn', 'roast', 'whole', 'famili', 'one', 'kno
w', 'food', 'good', 'high', 'get', 'wont', 'last', 'long', 'tri', 'man
i', 'sugar', 'free', 'chocol', 'best', 'especi', 'enjoy', 'actual', 'or
der', 'orang', 'cream', 'bit', 'sweet', 'fast', 'great', 'compani', 'li
ke', 'fact', 'bottl', 'expect', 'oil', 'got', 'color', 'big', 'black',
'someth', 'mayb', 'cook']
```

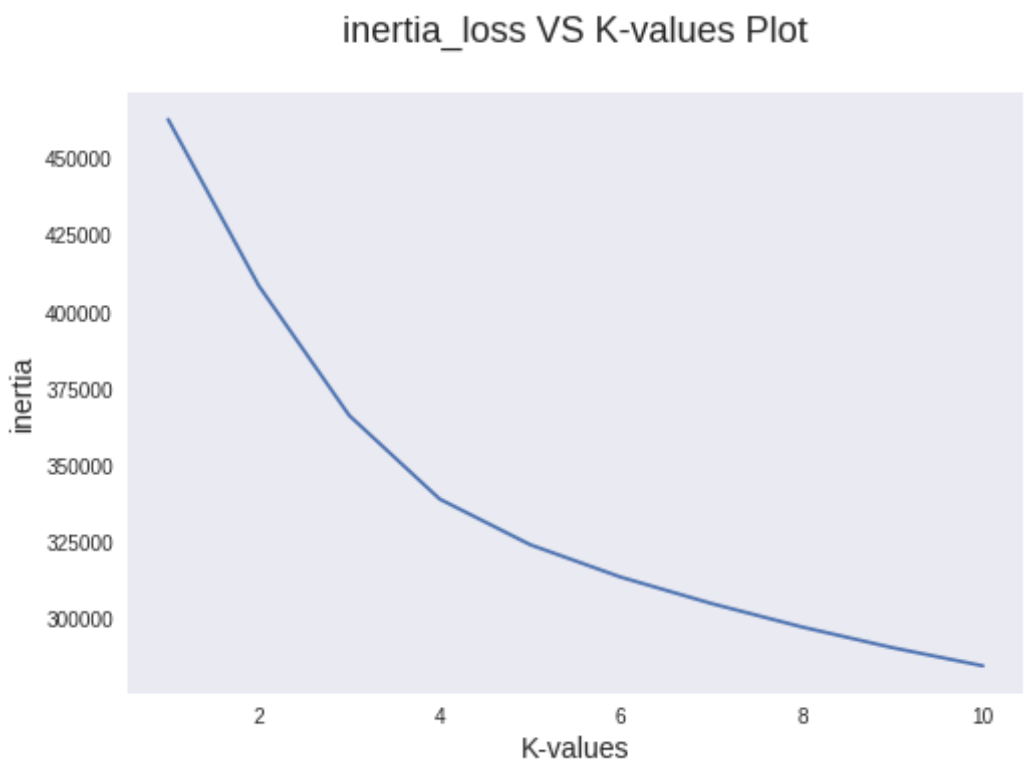
In [0]:

```
###### NOW STARTING AVERAGE WORD TO VEC ##############################
###################################
train_sent_vectors = []; # the avg-w2v for each sentence/review is stor
ed in this list
for sent in tqdm(list_of_sent): # for each review/sentence
 sent_vec = np.zeros(50) # as word vectors are of zero length
 cnt_words =0; # num of words with a valid vector in the sentence/revie
w
 for word in sent: # for each word in a review/sentence
   if word in w_t_c_words:
     vec = word_to_vector.wv[word]
     sent_vec += vec
     cnt_words += 1
 if cnt_words != 0:
  sent_vec /= cnt_words
 train_sent_vectors.append(sent_vec)
print(len(train_sent_vectors))
print(len(train_sent_vectors[0]))
```

```
100%|██████████| 50000/50000 [00:11<00:00, 4350.46it/s]
50000
50
```

In [0]:
```
#BUILDING THE MODEL
from sklearn.cluster import KMeans
k_range=[1,2,3,4,5,6,7,8,9,10]
inertia=[]

for i in k_range:
     model=KMeans(n_clusters=i,n_jobs=-1).fit(train_sent_vectors)
     inertia.append(model.inertia_)
```

In [0]:
```
# Draw Loss VS K values plot
import matplotlib.pyplot as plt
plt.plot(k_range, inertia)
plt.xlabel('K-values',size=14)
plt.ylabel('inertia',size=14)
plt.title('inertia_loss VS K-values Plot\n',size=18)
plt.grid()
plt.show()
```



FROM HERE BEST N_CLUSTERS VALUE IS FOUND TO AS 5

In [0]:
```
km = KMeans(n_clusters=5, n_jobs=-1)
y=km.fit(train_sent_vectors)
```

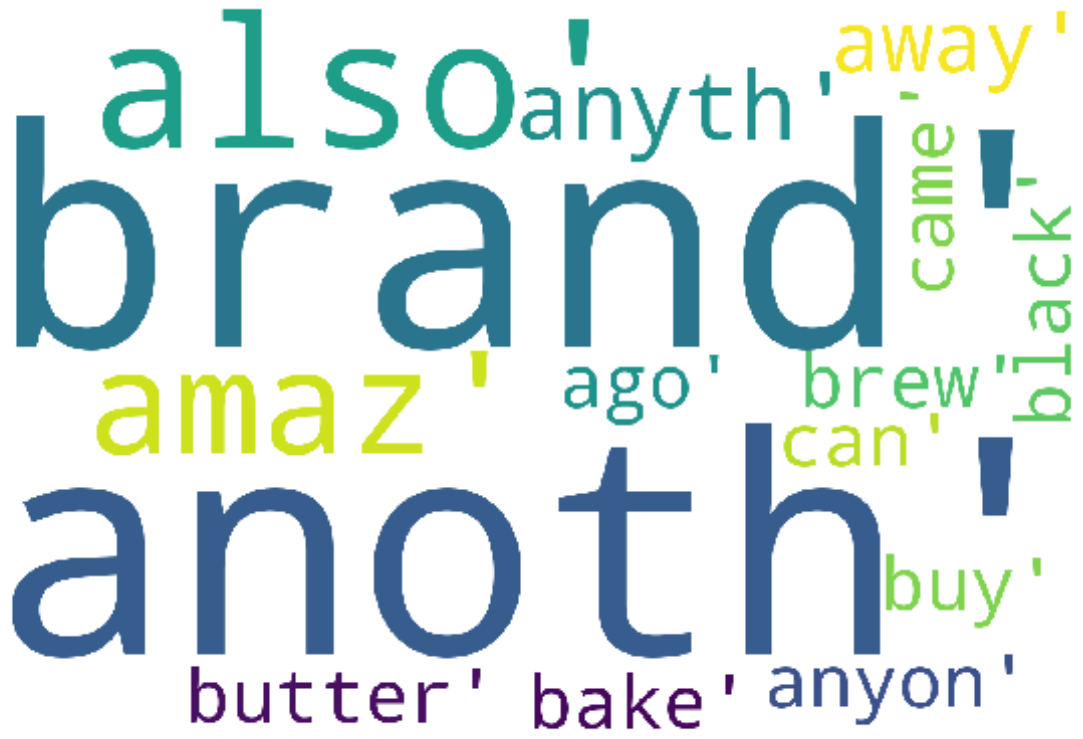
In [0]:
```
cluster1=[]
cluster2=[]
cluster3=[]
cluster4=[]
cluster5=[]
order_centroids = km.cluster_centers_.argsort()[:, ::-1]
```

```
terms = vectorizer.get_feature_names()
for i in range(5):
     for ind in order_centroids[i, :15]:
          if i==0:
             cluster1.append(terms[ind])
          if i==1:
             cluster2.append(terms[ind])
          if i==2:
             cluster3.append(terms[ind])
          if i==3:
             cluster4.append(terms[ind])
          if i==4:
             cluster5.append(terms[ind])
```

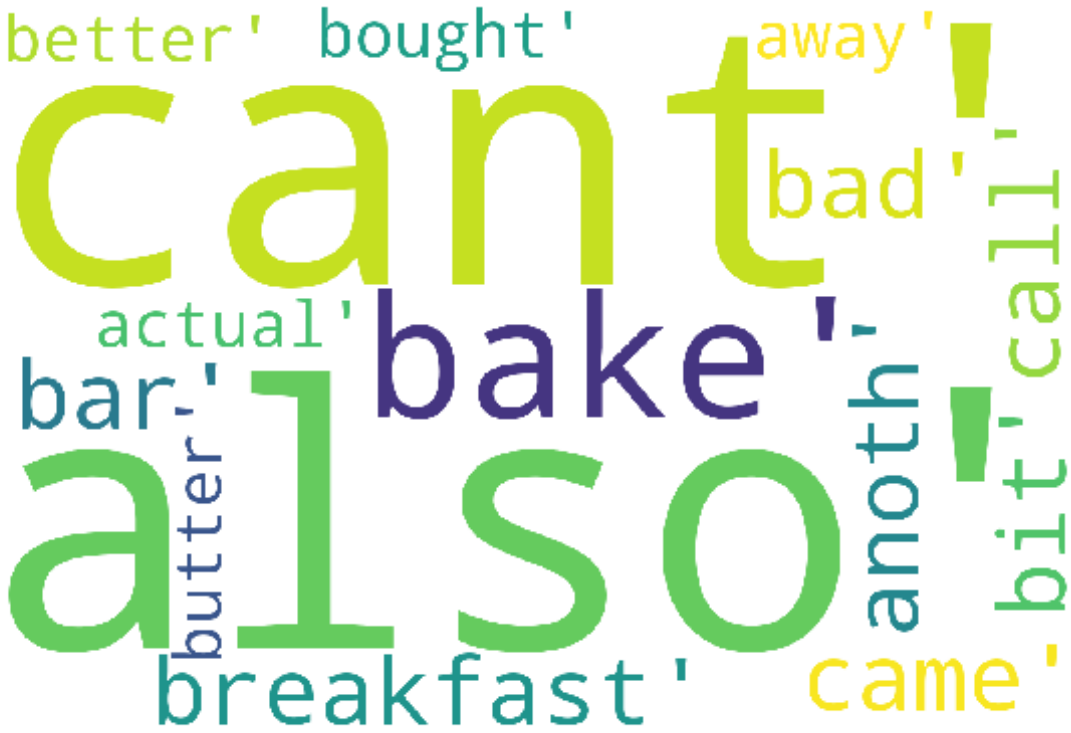
In [0]:

```
#PRINTING THE WORDS FOR EACH CLUSTERS USING WORDCLOUD
cluster_list=[cluster1,cluster2,cluster3,cluster4,cluster5]
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
count=1;
for i in  cluster_list:
 wordcloud = WordCloud(width = 1500, height = 1000,background_color ='w
hite',min_font_size = 10).generate(str(i))
 # plot the WordCloud image
 print(" WORDS FOR CLUSTER  %d  ARE AS FOLLOWS" % count )
 plt.figure(figsize = (8, 8), facecolor = None)
 plt.imshow(wordcloud)
 plt.axis("off")
 plt.tight_layout(pad = 0)
 plt.show()
 count=count+1
```

```
 WORDS FOR CLUSTER  1  ARE AS FOLLOWS
```



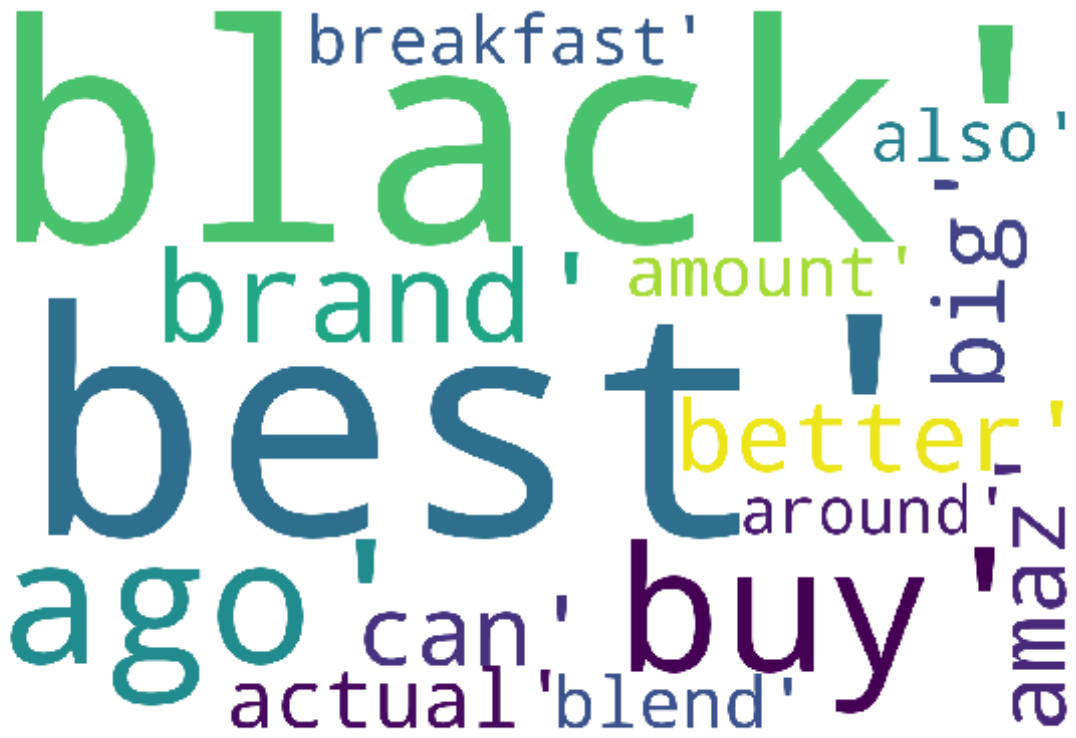
WORDS FOR CLUSTER 2 ARE AS FOLLOWS



WORDS FOR CLUSTER 3 ARE AS FOLLOWS

WORDS FOR CLUSTER 4 ARE AS FOLLOWS

WORDS FOR CLUSTER 5 ARE AS FOLLOWS



TFIDF WIEGHTED WORD2VECTORIZATION FOR

KMEANS

In [0]:
```
# Training my own Word2Vec model using your own text corpus
list_of_sent=[]
for sent in data['CleanedText']:
 list_of_sent.append(sent.split())#splitting of sentences into words AN
D appending them to list
print(list_of_sent[0])
word_to_vector=Word2Vec(list_of_sent,min_count=1000,size=100,workers=2)
#constructing my our word to vector
w_t_c_words=list(word_to_vector.wv.vocab)
print("**********************************************************************
*******")
print("sample words ", w_t_c_words[0:20])
print("total_words ", len(w_t_c_words))
```

```
['buy', 'sourc', 'regular', 'heartili', 'recommend', 'price', 'servic',
'qualiti', 'product', 'cours', 'tiptop', 'account', 'thank']
**********************************************************************
sample words  ['buy', 'regular', 'recommend', 'price', 'qualiti', 'prod
uct', 'thank', 'sauc', 'turn', 'roast', 'whole', 'famili', 'one', 'kno
w', 'food', 'good', 'high', 'get', 'wont', 'last']
total_words  385
```

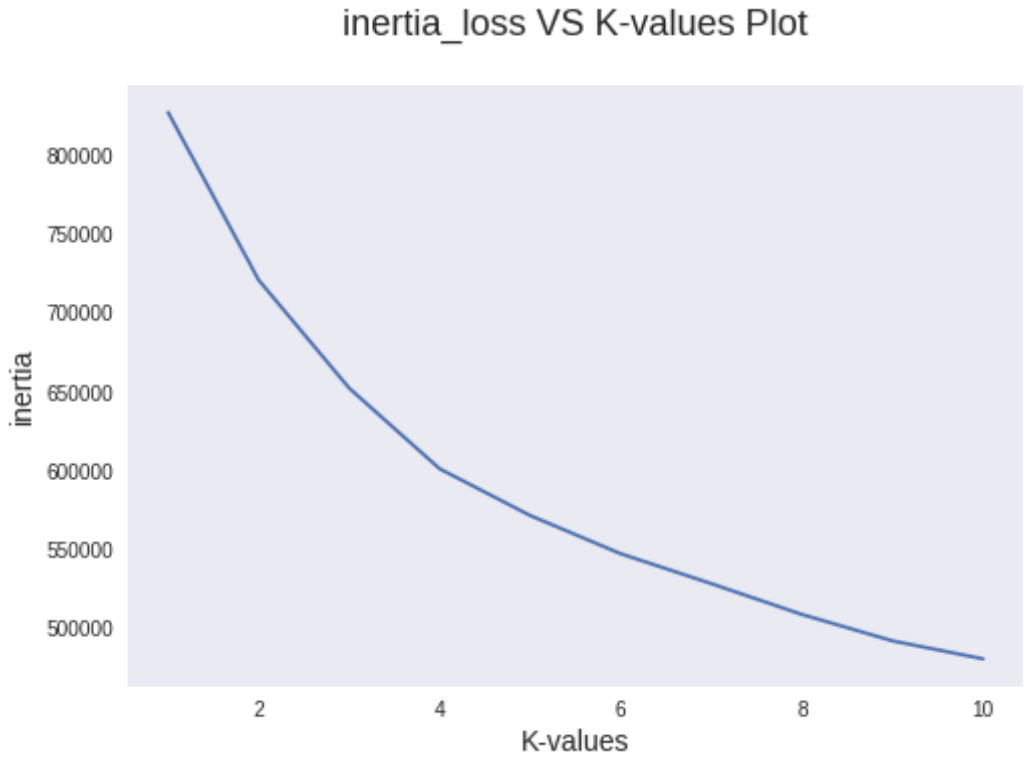
In [0]:
```
###### NOW STARTING TFIDF WORD TO VEC FOR TRAIN DATA##################
##############################################
#NOW STARTING TF-IDF WEIGHTED WORD-TO-VEC
model = TfidfVectorizer()
tf_idf_matrix = model.fit_transform(data['CleanedText'])
# we are converting a dictionary with word as a key, and the idf as a v
alue
dictionary = dict(zip(model.get_feature_names(), list(model.idf_)))
train_tfidf_sent_vectors =[]# the tfidf-w2v for each sentence/review is
 stored in this list

for sent in tqdm(list_of_sent): # for each review/sentence
  sent_vec = np.zeros(100) # as word vectors are of zero length
  weight_sum =0; # num of words with a valid vector in the sentence/rev
```

```
iew
  for word in sent: # for each word in a review/sentence
   if word in w_t_c_words:
     vec = word_to_vector.wv[word]
     tf_idf = dictionary[word]*(sent.count(word)/len(sent))# dictionary
[word] = idf value of word in whole courpus
     sent_vec += (vec * tf_idf)# sent.count(word) = tf valeus of word i
n this review
     weight_sum += tf_idf
  if weight_sum != 0:
   sent_vec /= weight_sum
   train_tfidf_sent_vectors.append(sent_vec)
```

```
100%|██████████| 50000/50000 [00:17<00:00, 2868.12it/s]
```

In [0]:
```
from sklearn.cluster import KMeans
k_range=[1,2,3,4,5,6,7,8,9,10]
inertia=[]

for i in k_range:
     model=KMeans(n_clusters=i,n_jobs=-1).fit( train_tfidf_sent_vectors
)
     inertia.append(model.inertia_)
```

In [0]:
```
# Draw Loss VS K values plot
import matplotlib.pyplot as plt
plt.plot(k_range, inertia)
plt.xlabel('K-values',size=14)
plt.ylabel('inertia',size=14)
plt.title('inertia_loss VS K-values Plot\n',size=18)
plt.grid()
plt.show()
```



FROM HERE BEST N_CLUSTERS VALUE IS FOUND TO AS 5

In [0]:
```
km = KMeans(n_clusters=5, n_jobs=-1)
y=km.fit(train_sent_vectors)
```

In [0]:
```
cluster1=[]
cluster2=[]
cluster3=[]
cluster4=[]
cluster5=[]
order_centroids = km.cluster_centers_.argsort()[:, ::-1]
terms = vectorizer.get_feature_names()
```

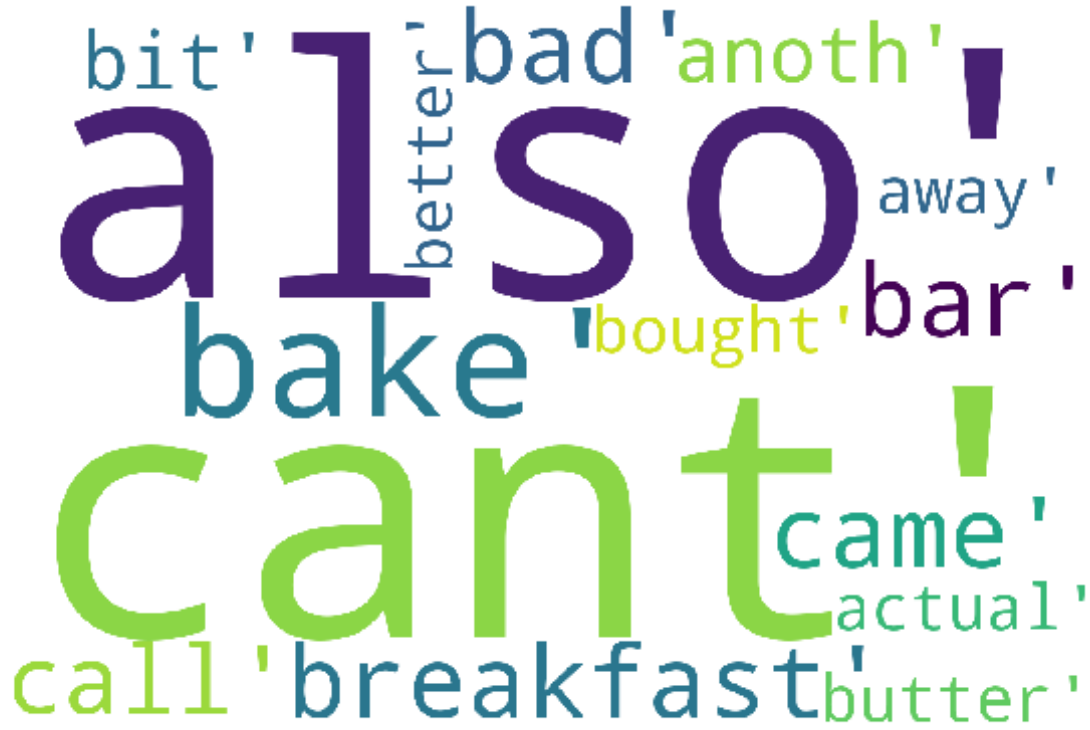
```
for i in range(5):
     for ind in order_centroids[i, :15]:
          if i==0:
             cluster1.append(terms[ind])
          if i==1:
             cluster2.append(terms[ind])
          if i==2:
             cluster3.append(terms[ind])
          if i==3:
             cluster4.append(terms[ind])
          if i==4:
             cluster5.append(terms[ind])
```

In [0]:

```
#PRINTING WORDS FOR EACH CLUSTERS USING WORDCLOUD LIBRARY
cluster_list=[cluster1,cluster2,cluster3,cluster4,cluster5]
from wordcloud import WordCloud #here we are printing the top features
 using wordcloud library
import matplotlib.pyplot as plt
count=1;
for i in  cluster_list:
 wordcloud = WordCloud(width = 1500, height = 1000,background_color ='w
hite',min_font_size = 10).generate(str(i))
 # plot the WordCloud image
 print(" WORDS FOR CLUSTER  %d  ARE AS FOLLOWS" % count )
 plt.figure(figsize = (8, 8), facecolor = None)
 plt.imshow(wordcloud)
 plt.axis("off")
 plt.tight_layout(pad = 0)
 plt.show()
 count=count+1
```

```
 WORDS FOR CLUSTER  1  ARE AS FOLLOWS
```

WORDS FOR CLUSTER 2 ARE AS FOLLOWS



WORDS FOR CLUSTER 3 ARE AS FOLLOWS

WORDS FOR CLUSTER 4 ARE AS FOLLOWS

WORDS FOR CLUSTER 5 ARE AS FOLLOWS

KMEANS FOR ALL FOUR VECTORIZATIONS IS DONE