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

### so that u dont have warnings
from warnings import filterwarnings
filterwarnings('ignore')
```

In [2]:
```
# Reading restaurants data
data_path = 'C:/Users/Kartikay/Documents/zomato.csv'
from pandas import read_csv

df= read_csv(data_path)

# Results
print(f'Dataset shape: {df.shape}')
df.head()
```

```
Dataset shape: (51717, 17)
```

Out[2]:

	url	address	name	online_order	book_table	
0	https://www.zomato.com/bangalore/jalsa-banasha...	942, 21st Main Road, 2nd Stage, Banashankari, ...	Jalsa	Yes	Yes	4
1	https://www.zomato.com/bangalore/spice-elephan...	2nd Floor, 80 Feet Road, Near Big Bazaar, 6th ...	Spice Elephant	Yes	No	4
2	https://www.zomato.com/SanchurroBangalore?cont...	1112, Next to KIMS Medical College, 17th Cross...	San Churro Cafe	Yes	No	3
3	https://www.zomato.com/bangalore/addhuri-udupi...	1st Floor, Annakuteera, 3rd Stage, Banashankar...	Addhuri Udupi Bhojana	No	No	3
4	https://www.zomato.com/bangalore/grand-village...	10, 3rd Floor, Lakshmi Associates, Gandhi Baza...	Grand Village	No	No	3

Features we have: url: contains the url of the restaurant in the zomato website; address: contains the address of the restaurant in Bengaluru; name: contains the name of the restaurant; online-order: whether online ordering is available in the restaurant or not; book-table: table book option available or not; rate: contains the overall rating of the restaurant out of 5; votes: contains total number of rating for the restaurant as of the above mentioned date; phone: contains the phone number of the restaurant; location: contains the neighborhood in which the restaurant is located; rest-type: restaurant type.

An overview from the data

In [3]:
```
#df.info()
```

In [4]:
```
df.isnull().sum()
```

Out[4]:
```
url                            0
address                        0
name                           0
online_order                   0
book_table                     0
rate                        7775
votes                          0
phone                       1208
location                      21
rest_type                    227
dish_liked                 28078
cuisines                      45
approx_cost(for two people)  346
reviews_list                   0
menu_item                      0
listed_in(type)                0
listed_in(city)                0
dtype: int64
```

In [5]:
```
feature_na=[feature for feature in df.columns if df[feature].isnull().sum()>0]
feature_na    #OR appending values using for loop
```

Out[5]:
```
['rate',
 'phone',
 'location',
 'rest_type',
 'dish_liked',
 'cuisines',
 'approx_cost(for two people)']
```

In [6]:
```
#% of missing values
import numpy as np
for feature in feature_na:
    print('{} has {} % missing values'.format(feature,np.round(df[feature].isnull(
```

```
rate has 15.0337 % missing values
phone has 2.3358 % missing values
location has 0.0406 % missing values
rest_type has 0.4389 % missing values
dish_liked has 54.2916 % missing values
cuisines has 0.087 % missing values
approx_cost(for two people) has 0.669 % missing values
```

In [7]:
```
##        Pre-Processing and Removing duplicate files

# Making a copy of the data to work on
data = df.copy()
```

In [8]:
```
# Dropping duplicates -
```

In [9]:
```
#Lets aggregate data of listed_in(type) into list

grouped=data.groupby(["name", "address"]).agg({"listed_in(type)" : list})
grouped
```

Out[9]:

		listed_in(type)
name	**address**	
#FeelTheROLL	**Opposite Mantri Commercio, Outer Ring Road, Devarabisanahalli, Near Sakra World Hospital**	[Delivery, Delivery]
#L-81 Cafe	**Sector 6, HSR Layout, HSR**	[Delivery, Dine-out, Delivery, Dine-out, Deliv...
#Vibes Restro	**Marasur Gate, Chandapura - Anekal Road, Near Aliance Collage, Electronic City, Bangalore**	[Buffet, Delivery, Dine-out]
#refuel	**7, Ground Floor, RR Commercial Complex, Akshay Nagar, Bannerghatta Road, Bangalore**	[Cafes, Delivery, Dine-out]
'Brahmins' Thatte Idli	**19, 1st main, 2nd cross, 3rd stage, 3rd block, Basaveshwara Nagar, Bangalore**	[Dine-out]
...	**...**	...
nu.tree	**47/7 First floor, DoddaThogur Road, Near Velankani Gate 2, Phase 1, Electronic City, Bangalore**	[Delivery]
	Ground Floor-Lobby Area, Brigade IRV Centre, Nallurhalli Road, Whitefield, Bangalore	[Delivery, Delivery, Delivery]
re:cess - Hilton Bangalore Embassy GolfLinks	**Hilton Bangalore Embassy GolfLinks, Embassy Golf Links Business Park, Inner Ring Road, Domlur, Bangalore**	[Dine-out, Dine-out, Pubs and bars]
repEAT Hub	**67/4, Bhoganahalli Road, JCR Layout, Panathur, Marathahalli, Bangalore**	[Delivery, Dine-out]
sCoolMeal	**197/293-3, 32nd Main, 1st Stage, BTM, Bangalore**	[Delivery, Delivery, Delivery, Delivery, Deliv...

12499 rows × 1 columns

In [10]:
```
df.columns
```

Out[10]:
```
Index(['url', 'address', 'name', 'online_order', 'book_table', 'rate', 'votes',
       'phone', 'location', 'rest_type', 'dish_liked', 'cuisines',
       'approx_cost(for two people)', 'reviews_list', 'menu_item',
```

```
       'listed_in(type)', 'listed_in(city)'],
      dtype='object')
```

In [11]:
```
#merge your both the dataframe
newdata = pd.merge(grouped, data, on = (["name", "address"]))
```

In [12]:
```
#newdata.columns
```

In [13]:
```
#newdata['listed_in(type)_y'].dtype
```

In [14]:
```
#newdata.shape (51717,18)
```

In [15]:
```
newdata.drop_duplicates(subset = ["name", "address", "listed_in(type)_y"], inplace
```

In [16]:
```
#newdata.shape(20915, 18)
```

In [17]:
```
# resetting your index
newdata = newdata.reset_index(drop = True)
```

In [18]:
```
newdata.head()
```

Out[18]:

	name	address	listed_in(type)_x	url	online_
0	#FeelTheROLL	Opposite Mantri Commercio, Outer Ring Road, De...	[Delivery, Delivery]	https://www.zomato.com/bangalore/feeltherolll-b...	
1	#L-81 Cafe	Sector 6, HSR Layout, HSR	[Delivery, Dine-out, Delivery, Dine-out, Deliv...	https://www.zomato.com/bangalore/l-81-cafe-hsr...	
2	#L-81 Cafe	Sector 6, HSR Layout, HSR	[Delivery, Dine-out, Delivery, Dine-out, Deliv...	https://www.zomato.com/bangalore/l-81-cafe-hsr...	
3	#Vibes Restro	Marasur Gate, Chandapura - Anekal Road, Near A...	[Buffet, Delivery, Dine-out]	https://www.zomato.com/bangalore/vibes-restro-...	

	name	address	listed_in(type)_x	url	online_
4	#Vibes Restro	Marasur Gate, Chandapura - Anekal Road, Near A...	[Buffet, Delivery, Dine-out]	https://www.zomato.com/bangalore/vibes-restro-...	

In [19]:
```
newdata.shape
```

Out[19]:
```
(20915, 18)
```

In [20]:
```
##       Perform Discretisation to ready your Target Feature
```

In [21]:
```
newdata['rate'].unique()
```

Out[21]:
```
array(['3.4/5', '3.9/5', nan, '3.7/5', '3.2/5', '3.5/5', '4.6/5', '4.1/5',
       '4.2 /5', '4.3 /5', '4.2/5', '4.0/5', '4.0 /5', '3.9 /5', '4.1 /5',
       '3.7 /5', '4.3/5', '3.1 /5', '3.6/5', '3.1/5', '3.3/5', '3.0/5',
       '3.5 /5', '4.4/5', '4.5 /5', 'NEW', '3.3 /5', '3.8/5', '3.2 /5',
       '3.6 /5', '4.5/5', '3.8 /5', '3.4 /5', '2.7/5', '2.7 /5', '2.8/5',
       '3.0 /5', '2.9/5', '2.5 /5', '2.9 /5', '2.8 /5', '4.9/5', '4.7/5',
       '4.8/5', '4.8 /5', '4.4 /5', '1.8/5', '2.4/5', '2.1/5', '2.5/5',
       '-', '2.2/5', '4.7 /5', '2.6/5', '4.6 /5', '4.9 /5', '2.3/5',
       '2.0 /5', '2.3 /5', '2.6 /5', '2.4 /5', '2.0/5'], dtype=object)
```

In [22]:
```
#newdata['rate'].dtype    0
```

In [23]:
```
# Transforming the ratings column
newdata["rating"] = newdata["rate"].str[:3] # Extracting the first three character
```

In [24]:
```
newdata["rating"].replace('NEW',0,inplace=True)
newdata["rating"].replace('-',0,inplace=True)
```

In [25]:
```
# Converting ratings to a numeric column so we can discretize it
newdata["rating"] = pd.to_numeric(newdata["rating"])
```

In [26]:
```
#newdata['rate'].dtype      float64
```

In [27]:
```
# Discretizing the ratings into a categorical feature with 4 levels
## ie if less than 3, assign 0
## ie if less than 3.5, assign 1
## ie if less than 4.0, assign 2
## ie if less than 5.o assign 3
```

```
## We can think of these as 0-Very Low, 1-Low, 2-Medium and 3-High.
```

In [28]:
```
#newdata["rating"].head()
```

In [29]:
```
newdata['rating'].unique()
```

Out[29]:
```
array([3.4, 3.9, nan, 3.7, 3.2, 3.5, 4.6, 4.1, 4.2, 4.3, 4. , 3.1, 3.6,
       3.3, 3. , 4.4, 4.5, 0. , 3.8, 2.7, 2.8, 2.9, 2.5, 4.9, 4.7, 4.8,
       1.8, 2.4, 2.1, 2.2, 2.6, 2.3, 2. ])
```

In [30]:
```
#newdata.isnull().sum()
```

In [31]:
```
#newdata.shape (20915, 19)
```

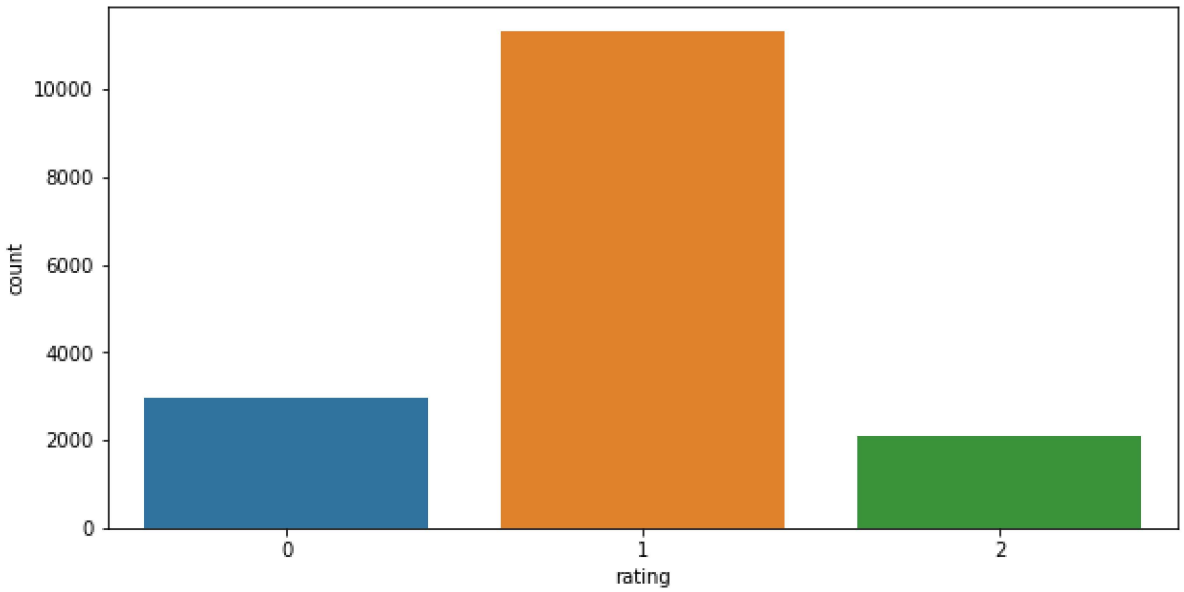
In [32]:
```
## bins = [1, 3.25, 4.1, 5.0]
## it means if it is b/w 1 to 3.25, assign label as 0
## if b/w 3.25 to 4.1, assign label as 1 & so on------

newdata["rating"]=pd.cut(newdata["rating"], bins = [1, 3.25, 4.1, 5.0], labels = [
```

In [33]:
```
# Visualizing the rating class distribution
plt.figure(figsize = (10, 5))
sns.countplot(newdata["rating"])

#To check the imbalance(majority and minority in data)
```

Out[33]:
```
<AxesSubplot:xlabel='rating', ylabel='count'>
```



In [34]:
```
##       Prepare your review list feature using regular expressions
# Summary statistics
newdata.describe(include = "all")
```

Out[34]:

	name	address	listed_in(type)_x	url	online_order
count	20915	20915	20915	20915	20915
unique	8792	11495	927	20915	2
top	Cafe Coffee Day	Delivery Only	[Delivery, Dine-out]	https://www.zomato.com/bangalore/andhra-chetti...	Yes
freq	78	36	2418	1	11605
mean	NaN	NaN	NaN	NaN	NaN
std	NaN	NaN	NaN	NaN	NaN
min	NaN	NaN	NaN	NaN	NaN
25%	NaN	NaN	NaN	NaN	NaN
50%	NaN	NaN	NaN	NaN	NaN
75%	NaN	NaN	NaN	NaN	NaN
max	NaN	NaN	NaN	NaN	NaN

Agenda We will use the reviews_list, menu_item, dish_liked and cuisines columns for our analysisFirst, we will look at the customer reviews and pull out the most common words and phrases.

In [35]:
```
newdata['reviews_list'][0]
```

Out[35]:
```
'[(\'Rated 5.0\', "RATED\\n  Had an egg chicken roll and a paneer roll... Really y
ummy... A must visit place... It would be good if you guys can keep the shop open
on Sunday\'s as well.. Good luck... :-)"), (\'Rated 5.0\', \'RATED\\n  Not just th
e Roll but the filling tastes great. I would highly recommend to others to try the
ir rolls. Owners hospitality is also good and very friendly.\'), (\'Rated 4.5\',
\'RATED\\n  Very nice place complete value for money ? Highly recommend.Must visit
for any foodie . I would recommend the egg chicken roll . #feeltheroll\'), (\'Rate
d 5.0\', \'RATED\\n  Had an amazing mouth-watering ?chicken roll?Worth every bit
e..A must try for every foodie?A variety of rolls and sandwiches are available as
well .. A budding rafflesia ?\')]'
```

In [36]:
```
rev=newdata['reviews_list'][0].lower()
rev
```

Out[36]:
```
'[(\'rated 5.0\', "rated\\n  had an egg chicken roll and a paneer roll... really y
ummy... a must visit place... it would be good if you guys can keep the shop open
on sunday\'s as well.. good luck... :-)"), (\'rated 5.0\', \'rated\\n  not just th
e roll but the filling tastes great. i would highly recommend to others to try the
ir rolls. owners hospitality is also good and very friendly.\'), (\'rated 4.5\',
\'rated\\n  very nice place complete value for money ? highly recommend.must visit
for any foodie . i would recommend the egg chicken roll . #feeltheroll\'), (\'rate
d 5.0\', \'rated\\n  had an amazing mouth-watering ?chicken roll?worth every bit
e..a must try for every foodie?a variety of rolls and sandwiches are available as
well .. a budding rafflesia ?\')]'
```

In [37]:
```
import re
rev2=re.sub('[^a-zA-Z]', ' ',rev)  #substitute except a-z
```

```
rev2
```

Out[37]:
```
'   rated        rated n  had an egg chicken roll and a paneer roll    really yumm
y    a must visit place    it would be good if you guys can keep the shop open on
sunday s as well   good luck             rated        rated n  not just the roll b
ut the filling tastes great  i would highly recommend to others to try their rolls
owners hospitality is also good and very friendly       rated        rated n  very
nice place complete value for money   highly recommend must visit for any foodie
i would recommend the egg chicken roll    feeltheroll      rated        rated n  h
ad an amazing mouth watering  chicken roll worth every bite  a must try for every
foodie a variety of rolls and sandwiches are available as well    a budding raffle
sia     '
```

In [38]:
```
rev3=re.sub('rated', ' ',rev2)
rev3
```

Out[38]:
```
'              n  had an egg chicken roll and a paneer roll    really yummy    a m
ust visit place    it would be good if you guys can keep the shop open on sunday s
as well   good luck                        n  not just the roll but the filling ta
stes great  i would highly recommend to others to try their rolls  owners hospital
ity is also good and very friendly                  n  very nice place complete va
lue for money   highly recommend must visit for any foodie   i would recommend the
egg chicken roll    feeltheroll                 n  had an amazing mouth watering
chicken roll worth every bite  a must try for every foodie a variety of rolls and
sandwiches are available as well    a budding rafflesia     '
```

In [39]:
```
rev4=re.sub('x',' ',rev3)
rev4
```

Out[39]:
```
'              n  had an egg chicken roll and a paneer roll    really yummy    a m
ust visit place    it would be good if you guys can keep the shop open on sunday s
as well   good luck                        n  not just the roll but the filling ta
stes great  i would highly recommend to others to try their rolls  owners hospital
ity is also good and very friendly                  n  very nice place complete va
lue for money   highly recommend must visit for any foodie   i would recommend the
egg chicken roll    feeltheroll                 n  had an amazing mouth watering
chicken roll worth every bite  a must try for every foodie a variety of rolls and
sandwiches are available as well    a budding rafflesia     '
```

In [40]:
```
rev5=re.sub(' +',' ',rev4)   #remove multiple spaces(more than one _spaces)
rev5
```

Out[40]:
```
' n had an egg chicken roll and a paneer roll really yummy a must visit place it w
ould be good if you guys can keep the shop open on sunday s as well good luck n no
t just the roll but the filling tastes great i would highly recommend to others to
try their rolls owners hospitality is also good and very friendly n very nice plac
e complete value for money highly recommend must visit for any foodie i would reco
mmend the egg chicken roll feeltheroll n had an amazing mouth watering chicken rol
l worth every bite a must try for every foodie a variety of rolls and sandwiches a
re available as well a budding rafflesia '
```

In [41]:
```
#newdata.shape (20915, 19)
```

In [42]:
```
##            Generate your word-cloud
sample=newdata.sample(n=2000)
```

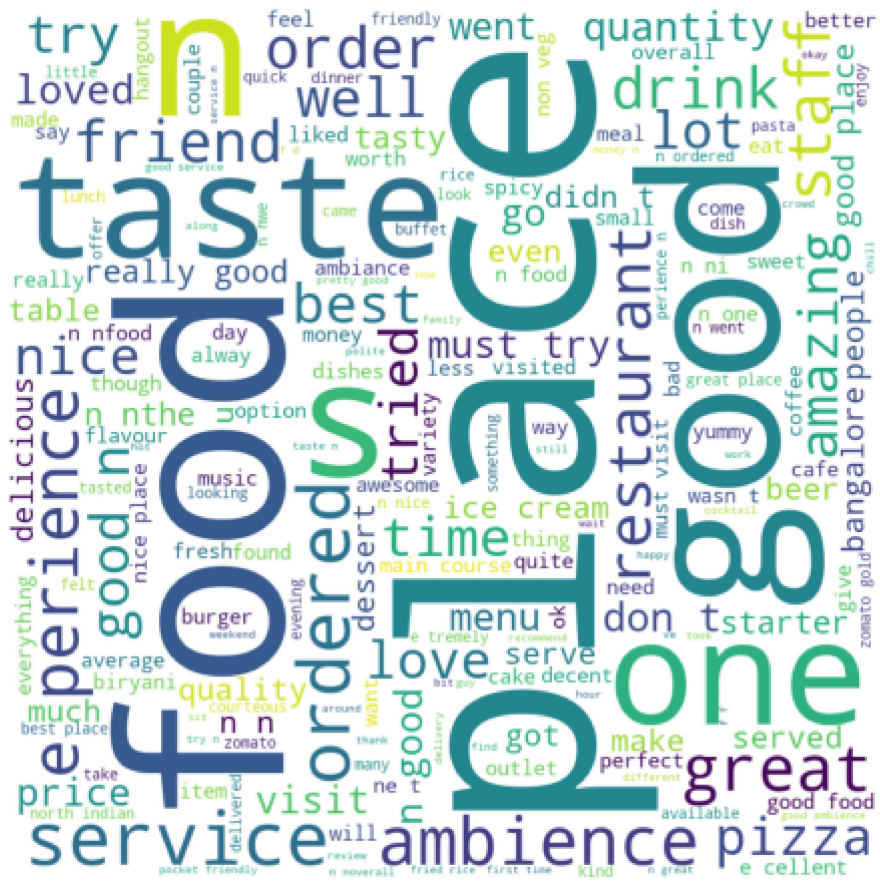
In [43]:
```
total_review=' '
for review in sample['reviews_list']:
    review=review.lower()
    review=re.sub('[^a-zA-Z]', ' ',review)
    review=re.sub('rated', ' ',review)
    review=re.sub('x',' ',review)
    review=re.sub(' +',' ',review)
    total_review=total_review + str(review)
```

In [44]:
```
## generate wordcloud
import wordcloud
from wordcloud import WordCloud,STOPWORDS
```

In [45]:
```
stopwords=set(STOPWORDS)   #a,an,he,she,it,must (no sense words)
```

In [46]:
```
wordcloud = WordCloud(width = 800, height = 800,
                background_color ='white',
                stopwords = stopwords,
                min_font_size = 10).generate(total_review)
# plot the WordCloud image
plt.figure(figsize = (8, 8))
plt.imshow(wordcloud)
plt.axis("off")
```

Out[46]: (-0.5, 799.5, 799.5, -0.5)



In [47]:
```
##         Data Cleaning on review list
```

Observations
Of the 50 most frequent words across customer reviews, best are:
place,food,taste,ambience,good..
The only negative word in the top 50 is "bad".

In [48]:
```
###but it is hard to estimate over here which words wins by how much??
```

for this u can use plots/charts

In [49]:
```
from nltk.corpus import RegexpTokenizer as regextoken
```

In [50]:
```
# Converting all the text to lowercase
newdata["reviews_list"] = newdata["reviews_list"].apply(lambda x: x.lower())

'''
#OR
def apply_lower(x):
    return x.lower()
 newdata["reviews_list"] = newdata["reviews_list"].apply(apply_lower)
'''
```

Out[50]:
```
'\n#OR\ndef apply_lower(x):\n    return x.lower()\n newdata["reviews_list"] = newd
ata["reviews_list"].apply(apply_lower)\n'
```

In [51]:
```
##  Creating a regular expression tokenizer that have only alphabets , ie it remov
from nltk.corpus import RegexpTokenizer as regextoken
tokenizer = regextoken("[a-zA-Z]+")
```

In [55]:
```
# Applying the tokenizer to each row of the reviews
review_tokens = newdata["reviews_list"].apply(tokenizer.tokenize)
```

In [56]:
```
# Examining the tokens created for the first row / restaurant
print(review_tokens[0])
```

```
['rated', 'rated', 'n', 'had', 'an', 'egg', 'chicken', 'roll', 'and', 'a', 'panee
r', 'roll', 'really', 'yummy', 'a', 'must', 'visit', 'place', 'it', 'would', 'be',
'good', 'if', 'you', 'guys', 'can', 'keep', 'the', 'shop', 'open', 'on', 'sunday',
's', 'as', 'well', 'good', 'luck', 'rated', 'rated', 'n', 'not', 'just', 'the', 'r
oll', 'but', 'the', 'filling', 'tastes', 'great', 'i', 'would', 'highly', 'recomme
nd', 'to', 'others', 'to', 'try', 'their', 'rolls', 'owners', 'hospitality', 'is',
'also', 'good', 'and', 'very', 'friendly', 'rated', 'rated', 'n', 'very', 'nice',
'place', 'complete', 'value', 'for', 'money', 'highly', 'recommend', 'must', 'visi
t', 'for', 'any', 'foodie', 'i', 'would', 'recommend', 'the', 'egg', 'chicken', 'r
oll', 'feeltheroll', 'rated', 'rated', 'n', 'had', 'an', 'amazing', 'mouth', 'wate
ring', 'chicken', 'roll', 'worth', 'every', 'bite', 'a', 'must', 'try', 'for', 'ev
ery', 'foodie', 'a', 'variety', 'of', 'rolls', 'and', 'sandwiches', 'are', 'availa
ble', 'as', 'well', 'a', 'budding', 'rafflesia']
```

In [57]:
```
### now from this above list,we will figure out we have some stopwords, it means w
```

In [58]:
```
##       What are stopwords and how to remove from the data
from nltk.corpus import stopwords
```

In [59]:
```
stop=stopwords.words('english')
print(stop)
```

```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're", "yo
u've", "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves', 'he', 'him',
'his', 'himself', 'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'its',
'itself', 'they', 'them', 'their', 'theirs', 'themselves', 'what', 'which', 'who',
'whom', 'this', 'that', "that'll", 'these', 'those', 'am', 'is', 'are', 'was', 'we
re', 'be', 'been', 'being', 'have', 'has', 'had', 'having', 'do', 'does', 'did',
'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'because', 'as', 'until', 'wh
ile', 'of', 'at', 'by', 'for', 'with', 'about', 'against', 'between', 'into', 'thr
ough', 'during', 'before', 'after', 'above', 'below', 'to', 'from', 'up', 'down',
'in', 'out', 'on', 'off', 'over', 'under', 'again', 'further', 'then', 'once', 'he
re', 'there', 'when', 'where', 'why', 'how', 'all', 'any', 'both', 'each', 'few',
'more', 'most', 'other', 'some', 'such', 'no', 'nor', 'not', 'only', 'own', 'sam
e', 'so', 'than', 'too', 'very', 's', 't', 'can', 'will', 'just', 'don', "don't",
'should', "should've", 'now', 'd', 'll', 'm', 'o', 're', 've', 'y', 'ain', 'aren',
"aren't", 'couldn', "couldn't", 'didn', "didn't", 'doesn', "doesn't", 'hadn', "had
n't", 'hasn', "hasn't", 'haven', "haven't", 'isn', "isn't", 'ma', 'mightn', "might
n't", 'mustn', "mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "should
n't", 'wasn', "wasn't", 'weren', "weren't", 'won', "won't", 'wouldn', "wouldn't"]
```

In [60]:
```
### we will figure out there are some more stopwords in my data, that we can add i
```

In [61]:
```
# Adding custom words to stopwords
stop.extend(["rated", "n", "nan", "x"])
```

In [63]:
```
### with respect to very first row, how to remove stopwords
rev=review_tokens[0]
```

In [64]:
```
print([token for token in rev if token not in stop]) #list comprehension
"""
#OR
review=[]
for token in rev:
    if token not in stop:
        review.append(token)
print(review)"""
```

```
['egg', 'chicken', 'roll', 'paneer', 'roll', 'really', 'yummy', 'must', 'visit',
'place', 'would', 'good', 'guys', 'keep', 'shop', 'open', 'sunday', 'well', 'goo
d', 'luck', 'roll', 'filling', 'tastes', 'great', 'would', 'highly', 'recommend',
'others', 'try', 'rolls', 'owners', 'hospitality', 'also', 'good', 'friendly', 'ni
ce', 'place', 'complete', 'value', 'money', 'highly', 'recommend', 'must', 'visi
t', 'foodie', 'would', 'recommend', 'egg', 'chicken', 'roll', 'feeltheroll', 'amaz
ing', 'mouth', 'watering', 'chicken', 'roll', 'worth', 'every', 'bite', 'must', 't
```

```
ry', 'every', 'foodie', 'variety', 'rolls', 'sandwiches', 'available', 'well', 'bu
dding', 'rafflesia']
```

Out[64]:
```
'\n#OR\nreview=[]\nfor token in rev:\n    if token not in stop:\n        review.ap
pend(token)\nprint(review)'
```

In [65]:
```
### using function
```

In [66]:
```
def remove_stopwords(text):
    updated_text=[token for token in text if token not in stop]
    return updated_text
review_tokens=review_tokens.apply(remove_stopwords)
```

In [67]:
```
#OR
#review_tokens=review_tokens.apply(lambda x:[token for token in text if token not
```

In [72]:
```
# Concatenating all the reviews as we have to count frequency of each word
all_reviews = review_tokens.astype(str).str.cat()
```

In [73]:
```
all_reviews[0:200]
```

Out[73]:
```
"['egg', 'chicken', 'roll', 'paneer', 'roll', 'really', 'yummy', 'must', 'visit',
'place', 'would', 'good', 'guys', 'keep', 'shop', 'open', 'sunday', 'well', 'goo
d', 'luck', 'roll', 'filling', 'tastes'"
```

In [74]:
```
type(all_reviews)
```

Out[74]:
```
str
```

In [75]:
```
len(all_reviews) #single list with all different reviews
```

Out[75]:
```
129341038
```

In [76]:
```
## perform tokenization to convert your string(all_reviews) into list,so that we w
cleaned_reviews = tokenizer.tokenize(all_reviews)
```

In [77]:
```
len(cleaned_reviews)
```

Out[77]:
```
13376224
```

In [78]:
```
type(cleaned_reviews)
```

Out[78]:
```
list
```

In [79]:
```
print(cleaned_reviews[0:200])
```

```
['egg', 'chicken', 'roll', 'paneer', 'roll', 'really', 'yummy', 'must', 'visit',
```

```
'place', 'would', 'good', 'guys', 'keep', 'shop', 'open', 'sunday', 'well', 'goo
d', 'luck', 'roll', 'filling', 'tastes', 'great', 'would', 'highly', 'recommend',
'others', 'try', 'rolls', 'owners', 'hospitality', 'also', 'good', 'friendly', 'ni
ce', 'place', 'complete', 'value', 'money', 'highly', 'recommend', 'must', 'visi
t', 'foodie', 'would', 'recommend', 'egg', 'chicken', 'roll', 'feeltheroll', 'amaz
ing', 'mouth', 'watering', 'chicken', 'roll', 'worth', 'every', 'bite', 'must', 't
ry', 'every', 'foodie', 'variety', 'rolls', 'sandwiches', 'available', 'well', 'bu
dding', 'rafflesia', 'little', 'cafe', 'set', 'beautiful', 'location', 'ambiance',
'good', 'nthe', 'burger', 'filled', 'taste', 'chicken', 'nthe', 'banana', 'chocola
te', 'sandwich', 'variety', 'would', 'never', 'find', 'restaurants', 'bangalore',
'drinks', 'wonderful', 'lot', 'flavours', 'choose', 'nit', 'took', 'little', 'tim
e', 'expected', 'food', 'served', 'table', 'nall', 'dishes', 'seemed', 'priced',
'moderately', 'well', 'nfood', 'nambiance', 'nservice', 'ntheir', 'chefs', 'brilli
ant', 'job', 'creating', 'new', 'dishes', 'variety', 'na', 'wonderful', 'place',
'friends', 'cozy', 'cafe', 'near', 'silk', 'board', 'came', 'boarding', 'bus', 'to
tally', 'open', 'air', 'especially', 'comfortable', 'night', 'staff', 'friendly',
'serve', 'food', 'fast', 'quite', 'cheap', 'good', 'bite', 'ncons', 'come', 'weath
er', 'good', 'toilets', 'lights', 'ni', 'recommend', 'beetroot', 'juice', 'nice',
'place', 'hang', 'open', 'space', 'must', 'visit', 'place', 'night', 'looks', 'awe
some', 'food', 'items', 'tasty', 'friend', 'ordered', 'onion', 'pakoda', 'masala',
'soda', 'rose', 'falooda', 'corn', 'sandwich', 'chocolate', 'sandwich', 'items',
'tasty', 'love', 'visit', 'place', 'love', 'ambiance', 'perfect', 'way', 'spend',
'sunday', 'food', 'really', 'good', 'value']
```

In [80]:

```
# obtain the frequency of individual words in the reviews, for this u have to use
```

In [99]:

```
newdata.head()
```

Out[99]:

	name	address	listed_in(type)_x	url	online_
0	#FeelTheROLL	Opposite Mantri Commercio, Outer Ring Road, De...	[Delivery, Delivery]	https://www.zomato.com/bangalore/feeltheroll-b...	
1	#L-81 Cafe	Sector 6, HSR Layout, HSR	[Delivery, Dine-out, Delivery, Dine-out, Deliv...	https://www.zomato.com/bangalore/l-81-cafe-hsr...	
2	#L-81 Cafe	Sector 6, HSR Layout, HSR	[Delivery, Dine-out, Delivery, Dine-out, Deliv...	https://www.zomato.com/bangalore/l-81-cafe-hsr...	
3	#Vibes Restro	Marasur Gate, Chandapura - Anekal Road, Near A...	[Buffet, Delivery, Dine-out]	https://www.zomato.com/bangalore/vibes-restro-...	

	name	address	listed_in(type)_x	url	online_
4	#Vibes Restro	Marasur Gate, Chandapura - Anekal Road, Near A...	[Buffet, Delivery, Dine-out]	https://www.zomato.com/bangalore/vibes-restro-...	

Analysing your cuisines

In [100]:
```
#unigram analysis
#data cleaning -- ready analysis purpose
#missing values->lowercase operation->tokenization->text doc->tokenization-list--f
```

In [101]:
```
cuisines=newdata[['cuisines','rating']]
cuisines.isnull().sum()
```

Out[101]:
```
cuisines      23
rating      4524
dtype: int64
```

In [102]:
```
cuisines.dropna(inplace=True)
```

In [103]:
```
# Converting to lowercase
cuisines["cuisines"] = cuisines["cuisines"].apply(lambda x: x.lower())

# Tokenizing the cuisines
cuisine_tokens = cuisines["cuisines"].apply(tokenizer.tokenize)

#press tab for tokenizer
```

In [104]:
```
cuisine_tokens[0]
```

Out[104]:
```
['fast', 'food']
```

In [105]:
```
type(cuisine_tokens[0])
```

Out[105]:
```
list
```

In [106]:
```
type(cuisine_tokens)
```

Out[106]:
```
pandas.core.series.Series
```

In [107]:
```
# Concatenating all the cuisine names into one text document
all_cuisines = cuisine_tokens.astype(str).str.cat()
```

In [108]:
```
type(all_cuisines)
```

Out[108]:
```
str
```

In [109]:
```
all_cuisines[0:50]
```

Out[109]:
```
"['fast', 'food']['fast', 'food', 'beverages']['fas"
```

In [110]:
```
cleaned_cuisines = tokenizer.tokenize(all_cuisines)
```

In [111]:
```
type(cleaned_cuisines)
```

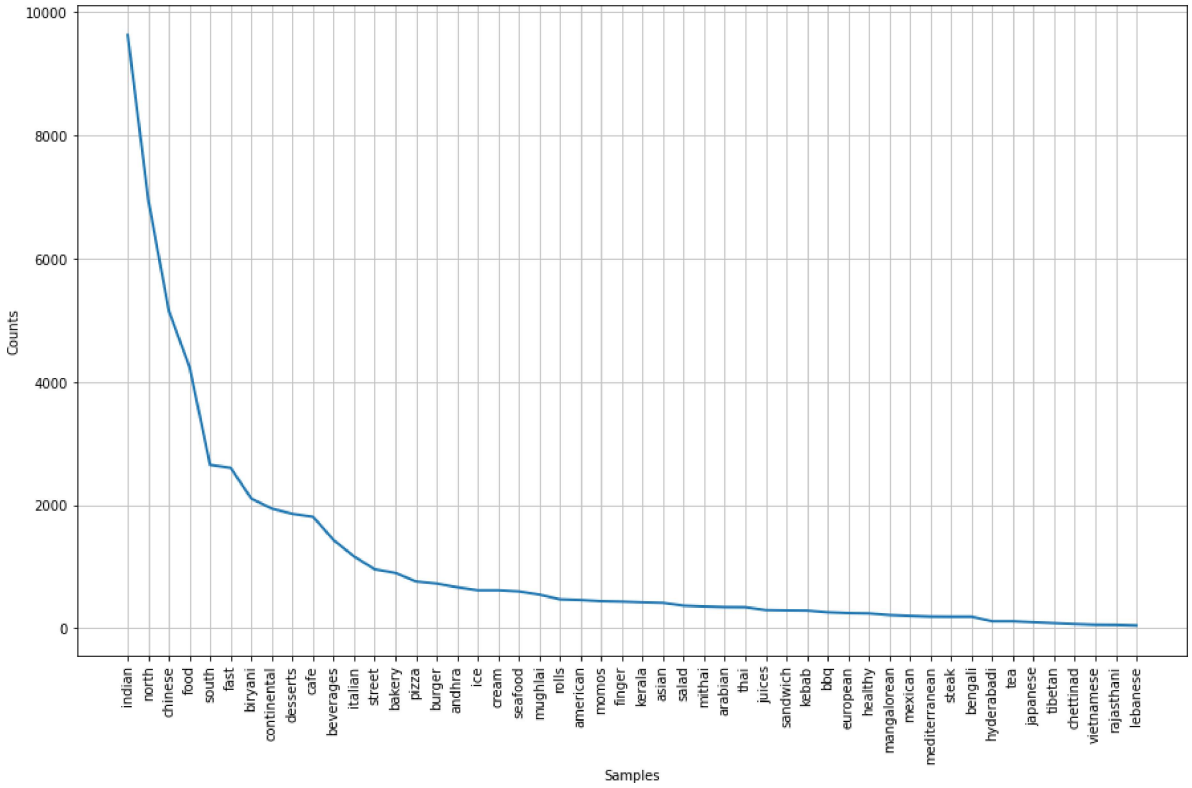
Out[111]:
```
list
```

In [112]:
```
# Generating cuisine frequencies
fd_cuisine = FreqDist()
for cuisine in cleaned_cuisines:
    fd_cuisine[cuisine] += 1

# Printing the 50 most common cuisines (top 50)
print(fd_cuisine.most_common(5))
```

```
[('indian', 9622), ('north', 6941), ('chinese', 5143), ('food', 4239), ('south', 2
650)]
```

In [113]:
```
plt.figure(figsize=(15,9))
fd_cuisine.plot(50)
```



Out[113]: <AxesSubplot:xlabel='Samples', ylabel='Counts'>

In [114]:
```
## How to prepare our data for Machine Learning
```

Now start applying algo but before that u have to pre-process your data

In [115]:
```
#newdata.columns
```

In [116]:
```
#newdata.dtypes
```

In [117]:
```
#### considering "reviews_list", "menu_item", "dish_liked", "cuisines", u can thin
### so we can store  ("reviews_list", "menu_item", "dish_liked", "cuisines") in a
```

In [118]:
```
# Converting all the text to strings

newdata[["reviews_list", "menu_item", "dish_liked", "cuisines"]] = newdata[["revie

# Combining all the text data into a single feature called "text"
newdata["text"] = newdata["reviews_list"] + " " + newdata["menu_item"] + " " + new
```

In [119]:
```
#newdata.head()
```

In [120]:
```
# Creating a new dataset with text and restaurant ratings
text_data = newdata[["text", "rating"]]
```

In [121]:
```
text_data.head()
```

Out[121]:

	text	rating
0	[('rated 5.0', "rated\n had an egg chicken ro...	1
1	[('rated 4.0', 'rated\n this little cafe is s...	1
2	[('rated 4.0', 'rated\n this little cafe is s...	1
3	[('rated 5.0', "rated\n great service and don...	NaN
4	[('rated 5.0', "rated\n great service and don...	NaN

In [122]:
```
text_data['rating'].unique()
```

Out[122]:
```
['1', NaN, '0', '2']
Categories (3, object): ['0' < '1' < '2']
```

In [123]:
```
from sklearn.preprocessing import LabelEncoder
```

In [124]:
```
le=LabelEncoder()
```

In [125]:
```
text_data.dropna(inplace=True)
```

In [126]:
```
text_data['rating']=le.fit_transform(text_data['rating'])
```

In [127]:
```
text_data['rating'].unique()
```

Out[127]:
```
array([1, 0, 2])
```

In [128]:
```
text_data['rating'].dtype
```

Out[128]:
```
dtype('int32')
```

what all things, u have to apply on your text column, basically
a.lowercase
b.tokenization
c.remove stopwords
d.lemmatization

In [129]:
```
# Converting text to lowercase
text_data["text"] = text_data["text"].apply(lambda x: x.lower())


import warnings
```

```
from warnings import filterwarnings
filterwarnings('ignore')   #to ignore all warnings
```

In [130]:
```
text_data.shape
```

Out[130]:
```
(16391, 2)
```

In [131]:
```
df=text_data.sample(n=2000)
```

In [132]:
```
df.reset_index(inplace=True)
```

In [133]:
```
df.drop('index',axis=1,inplace=True)
```

In [134]:
```
df.head()
```

Out[134]:

	text	rating
0	[('rated 1.0', 'rated\n the worst customer ca...	0
1	[('rated 5.0', 'rated\n hot dog, pav bhaji, g...	1
2	[('rated 3.0', 'rated\n ambience was fine... ...	1
3	[('rated 4.0', 'rated\n i have ordered beef k...	1
4	[('rated 5.0', "rated\n this lassi reminds me...	1

In [135]:
```
df.isnull().sum()
```

Out[135]:
```
text      0
rating    0
dtype: int64
```

In [136]:
```
df.dropna(inplace=True)
```

In [137]:
```
df.shape
```

Out[137]:
```
(2000, 2)
```

In [138]:
```
# Tokenizing the text as we have to remove stopwords from data
tokens = df["text"].apply(tokenizer.tokenize)
```

In [139]:
```
type(tokens)
```

Out[139]:
```
pandas.core.series.Series
```

In [140]:

```
print(tokens[0])
```

```
['rated', 'rated', 'n', 'the', 'worst', 'customer', 'care', 'services', 'nthe', 'f
ood', 'bought', 'was', 'not', 'hot', 'rated', 'rated', 'n', 'must', 'try', 'once',
'been', 'to', 'this', 'place', 'must', 'try', 'the', 'indian', 'special', 'a', 'qu
iet', 'catchy', 'garage', 'start', 'up', 'by', 'youngster', 'to', 'start', 'of',
'with', 'a', 'pocket', 'friendly', 'menus', 'nan', 'pizza']
```

In [141]:
```
len(tokens)
```

Out[141]:
```
2000
```

In [142]:
```
# Removing stopwords
tokens = tokens.apply(lambda x: [token for token in x if token not in stop])
#OR
tokens.apply(remove_stopwords)
```

Out[142]:
```
0       [worst, customer, care, services, nthe, food, ...
1       [hot, dog, pav, bhaji, grilled, sandwich, heav...
2       [ambience, fine, staff, kinda, slow, service, ...
3       [ordered, beef, kothu, parotta, good, one, wud...
4       [lassi, reminds, lassi, delhi, punjab, thick, ...
                              ...
1995    [really, good, place, hangout, evening, chicke...
1996    [ordered, home, delivery, nfood, good, deliver...
1997    [nice, place, hangout, kids, one, part, iona, ...
1998                                       [south, indian]
1999    [nice, gygienic, food, usually, crowded, satur...
Name: text, Length: 2000, dtype: object
```

In [143]:
```
##How to Lemmatize your data
```

In [144]:
```
from nltk.stem import WordNetLemmatizer
```

In [145]:
```
wl = WordNetLemmatizer()
```

In [146]:
```
print(tokens[0])
```

```
['worst', 'customer', 'care', 'services', 'nthe', 'food', 'bought', 'hot', 'must',
'try', 'place', 'must', 'try', 'indian', 'special', 'quiet', 'catchy', 'garage',
'start', 'youngster', 'start', 'pocket', 'friendly', 'menus', 'pizza']
```

In [147]:
```
data=tokens[0]
```

In [148]:
```
print([wl.lemmatize(word) for word in data])
```

```
['worst', 'customer', 'care', 'service', 'nthe', 'food', 'bought', 'hot', 'must',
'try', 'place', 'must', 'try', 'indian', 'special', 'quiet', 'catchy', 'garage',
'start', 'youngster', 'start', 'pocket', 'friendly', 'menu', 'pizza']
```

In [149]:

```
# Writing a function to lemmatize words

def lem(text):
    return [wl.lemmatize(word) for word in text]
```

In [150]:
```
# Applying the function to each row of the text
# i.e. reducing each word to its lemma

tokens_new = tokens.apply(lem)

type(tokens_new)
tokens_new.head()
```

Out[150]:
```
0    [worst, customer, care, service, nthe, food, b...
1    [hot, dog, pav, bhaji, grilled, sandwich, heav...
2    [ambience, fine, staff, kinda, slow, service, ...
3    [ordered, beef, kothu, parotta, good, one, wud...
4    [lassi, reminds, lassi, delhi, punjab, thick, ...
Name: text, dtype: object
```

In [151]:
```
##Peform Feature encoding on data
```

In [152]:
```
df['rating'].unique()
```

Out[152]:
```
array([0, 1, 2])
```

In [153]:
```
df['rating'].dtype
```

Out[153]:
```
dtype('int32')
```

In [154]:
```
df['rating'].value_counts()
```

Out[154]:
```
1    1376
0     371
2     253
Name: rating, dtype: int64
```

In [155]:
```
#Label encoder  '0' ->0  (string to numerical)
```

In [156]:
```
from sklearn.preprocessing import LabelEncoder
```

In [157]:
```
le=LabelEncoder()
```

In [158]:
```
df['rating']=le.fit_transform(df['rating'])
```

In [159]:
```
#term frequency,inverse document frequency
#TF.IDF->vector representaion
#doc means line
```

```
#TF=No of occurence of a word in a doc/Total no of words in that doc
#IDF=log(total no of docs/no of docs containing words)

##   Applying TF-IDF on your text data
```

In [160]:
```
print(tokens_new[0])
```

```
['worst', 'customer', 'care', 'service', 'nthe', 'food', 'bought', 'hot', 'must',
'try', 'place', 'must', 'try', 'indian', 'special', 'quiet', 'catchy', 'garage',
'start', 'youngster', 'start', 'pocket', 'friendly', 'menu', 'pizza']
```

In [161]:
```
' '.join(tokens_new[0])
```

Out[161]:
```
'worst customer care service nthe food bought hot must try place must try indian s
pecial quiet catchy garage start youngster start pocket friendly menu pizza'
```

In [162]:
```
tokens_new.index
```

Out[162]:
```
Int64Index([   0,    1,    2,    3,    4,    5,    6,    7,    8,    9,
            ...
            1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999],
           dtype='int64', length=2000)
```

In [163]:
```
## collect entire data into corpus as we have to NLP techniques to this corpus to
corpus=[]

for i in tokens_new.index:
    review=' '.join(tokens_new[i])
    corpus.append(review)
#huge corpus file
```

In [164]:
```
from sklearn.feature_extraction.text import TfidfVectorizer
cv = TfidfVectorizer()
X = cv.fit_transform(corpus).toarray()
```

In [165]:
```
X.shape
```

Out[165]:
```
(2000, 26301)
```

In [166]:
```
df['rating'].value_counts()
```

Out[166]:
```
1    1376
0     371
2     253
Name: rating, dtype: int64
```