

Sentimental Analysis on Restaurant Review

```
In [1]: #importing necessary libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import re
import nltk
from textblob import Word, TextBlob
import warnings
warnings.filterwarnings('ignore')
```

```
In [2]: #loading the dataset
data= pd.read_csv("Restaurant_Reviews.tsv",delimiter="\t")
data.shape
```

```
Out[2]: (1000, 2)
```

```
In [3]: data.head(6)
```

```
Out[3]:
```

	Review	Liked
0	Wow... Loved this place.	1
1	Crust is not good.	0
2	Not tasty and the texture was just nasty.	0
3	Stopped by during the late May bank holiday of...	1
4	The selection on the menu was great and so wer...	1
5	Now I am getting angry and I want my damn pho.	0

```
In [4]: data.tail(6)
```

```
Out[4]:
```

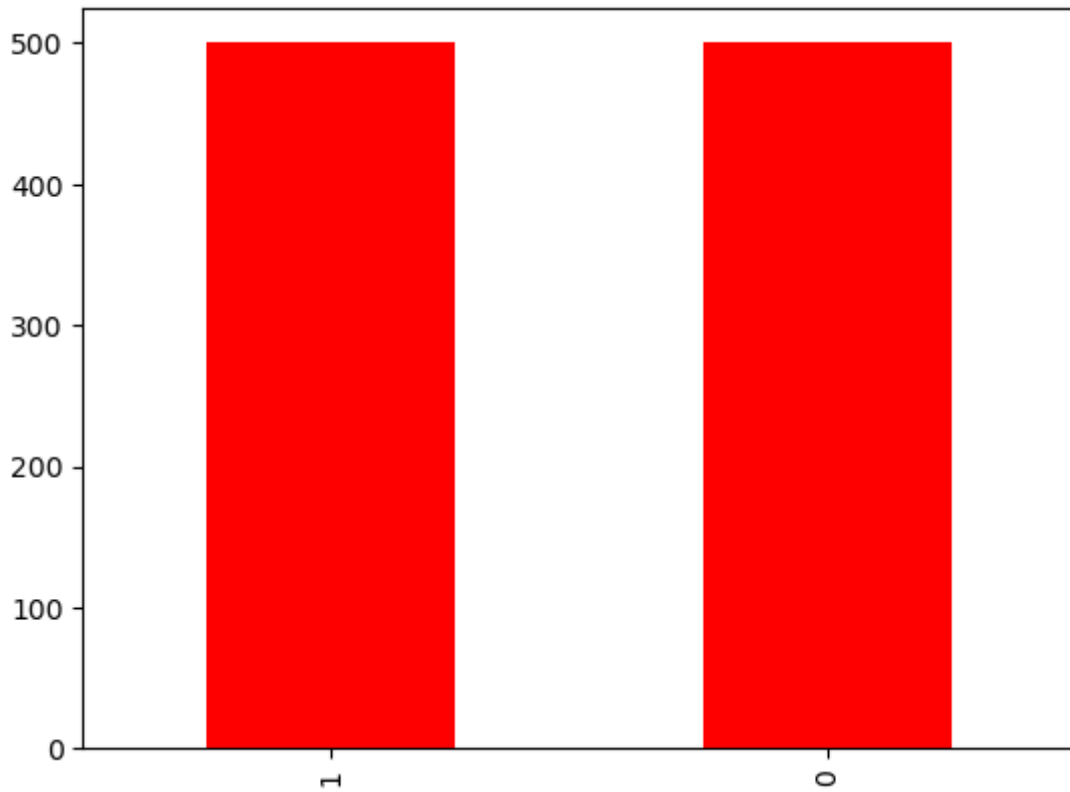
	Review	Liked
994	I can't tell you how disappointed I was.	0
995	I think food should have flavor and texture an...	0
996	Appetite instantly gone.	0
997	Overall I was not impressed and would not go b...	0
998	The whole experience was underwhelming, and I ...	0
999	Then, as if I hadn't wasted enough of my life ...	0

```
In [5]: data['Liked'].unique()
```

```
Out[5]: array([1, 0])
```

```
In [6]: data['Liked'].value_counts().plot.bar(color = 'red')
```

```
Out[6]: <Axes: >
```



```
In [7]: data['Liked'].value_counts()
```

```
Out[7]: 1    500
        0    500
        Name: Liked, dtype: int64
```

```
In [8]: data.duplicated().sum()
```

```
Out[8]: 4
```

```
In [9]: data=data.drop_duplicates()
```

```
In [10]: data.shape
```

```
Out[10]: (996, 2)
```

```
In [11]: data['Liked'].value_counts()
```

```
Out[11]: 1    499
         0    497
         Name: Liked, dtype: int64
```

```
In [12]: data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 996 entries, 0 to 999
Data columns (total 2 columns):
 #   Column  Non-Null Count  Dtype
---  -
 0   Review  996 non-null     object
 1   Liked   996 non-null     int64
dtypes: int64(1), object(1)
memory usage: 23.3+ KB
```

```
In [13]: import matplotlib.pyplot as plt
```

```
# Getting value counts for the 'Liked' column
```

```

value_counts = data['Liked'].value_counts()
ax = value_counts.plot(kind='bar', color=['green', 'red'], rot=0)

for i, v in enumerate(value_counts):
    ax.text(i - 0.1, v + 5, str(v), color='black', fontsize=8)
ax.set_title('Restaurant Reviews Sentiment Analysis')
ax.set_xlabel('Liked')
ax.set_ylabel('Count')
ax.legend(['Liked', 'Disliked'], loc='upper right')

plt.show()

```



```
In [14]: print(data['Review'])
```

```

0          Wow... Loved this place.
1          Crust is not good.
2          Not tasty and the texture was just nasty.
3          Stopped by during the late May bank holiday of...
4          The selection on the menu was great and so wer...
...
995     I think food should have flavor and texture an...
996          Appetite instantly gone.
997     Overall I was not impressed and would not go b...
998     The whole experience was underwhelming, and I ...
999     Then, as if I hadn't wasted enough of my life ...
Name: Review, Length: 996, dtype: object

```

```

In [15]: #Removing Puntuations
import string
exclude = string.punctuation
exclude

```

```
Out[15]: '!"#$%&\'()*+,-./:;<=>?@[\\]^_`{|}~'
```

```
In [16]: def remove_punc(text):
         return text.translate(str.maketrans('', '', exclude))
```

```
In [17]: data['Review']=data['Review'].apply(remove_punc)
```

```
In [18]: #Lowercase all the reviews
data['Review']=data['Review'].str.lower()
data['Review']
```

```
Out[18]: 0          wow loved this place
1          crust is not good
2          not tasty and the texture was just nasty
3  stopped by during the late may bank holiday of...
4  the selection on the menu was great and so wer...
...
995  i think food should have flavor and texture an...
996          appetite instantly gone
997  overall i was not impressed and would not go back
998  the whole experience was underwhelming and i t...
999  then as if i hadnt wasted enough of my life th...
Name: Review, Length: 996, dtype: object
```

```
In [19]: #For removing stopwords
from nltk.corpus import stopwords
```

```
In [20]: def remove_stopwords(text):
         new_text = []

         for word in text.split():
             if word in stopwords.words('english'):
                 new_text.append('')
             else:
                 new_text.append(word)
         x = new_text[:]
         new_text.clear()
         return " ".join(x)
```

```
In [21]: data['Review']= data['Review'].apply(remove_stopwords)
data['Review']
```

```
Out[21]: 0          wow loved place
1          crust good
2          tasty texture nasty
3  stopped late may bank holiday rick steve r...
4          selection menu great prices
...
995  think food flavor texture lacking
996          appetite instantly gone
997          overall impressed would go back
998  whole experience underwhelming think well ...
999  hadnt wasted enough life poured salt ...
Name: Review, Length: 996, dtype: object
```

```
In [22]: #Removing rarewords:
drops = pd.Series(' '.join(data['Review']).split()).value_counts()[-250:]
data['Review'] = data['Review'].apply(lambda x: " ".join(x for x in x.split
```

```
In [23]: data
```

Out[23]:

	Review	Liked
0	wow loved place	1
1	crust good	0
2	tasty texture nasty	0
3	stopped late may bank holiday rick steve recom...	1
4	selection menu great prices	1
...
995	think food flavor texture lacking	0
996	appetite instantly gone	0
997	overall impressed would go back	0
998	whole experience underwhelming think well go n...	0
999	hadnt wasted enough life poured salt wound tim...	0

996 rows × 2 columns

In [24]: `#!pip install textblob`

```
In [25]: from textblob import TextBlob

textblob_list = []

for review_text in data['Review']:
    txtblb = TextBlob(str(review_text))
    textblob_list.append(txtblb)
print(textblob_list)
```

[TextBlob("wow loved place"), TextBlob("crust good"), TextBlob("tasty texture nasty"), TextBlob("stopped late may bank holiday rick steve recommendation loved"), TextBlob("selection menu great prices"), TextBlob("getting angry want damn pho"), TextBlob("honestly didnt taste fresh"), TextBlob("potatoes like rubber could tell made ahead time kept warmer"), TextBlob("fries great"), TextBlob("great touch"), TextBlob("service prompt"), TextBlob("would go back"), TextBlob("cashier care ever say still ended wayyy overpriced"), TextBlob("tried cape cod ravioli chicken cranberrymmm"), TextBlob("disgusted pretty sure human hair"), TextBlob("shocked signs indicate cash"), TextBlob("highly recommended"), TextBlob("waitress little slow service"), TextBlob("place worth time let alone vegas"), TextBlob("like"), TextBlob("burrito s blah"), TextBlob("food amazing"), TextBlob("service also cute"), TextBlob("could care less interior beautiful"), TextBlob("performed"), TextBlob("that's right the red velvet cake ohhh stuff good"), TextBlob("never brought salad asked"), TextBlob("hole wall great mexican street tacos friendly staff"), TextBlob("took hour get food 4 tables restaurant food luke warm server running around like totally overwhelmed"), TextBlob("worst salmon sashimi"), TextBlob("also combos like burger fries beer 23 decent deal"), TextBlob("like final blow"), TextBlob("found place accident could be happier"), TextBlob("seems like good quick place grab bite familiar pub food favor look elsewhere"), TextBlob("overall like place lot"), TextBlob("redeeming quality restaurant inexpensive"), TextBlob("ample portions good prices"), TextBlob("poor service waiter made feel like stupid every time came table"), TextBlob("first visit hiro delight"), TextBlob("service sucks"), TextBlob("shrimp tender moist"), TextBlob("deal good enough would drag establishment"), TextBlob("hard judge whether sides good grossed melted styrofoam didnt want eat fear getting sick"), TextBlob("positive note server attentive provided great service"), TextBlob("frozen pucks disgust worst people behind register"), TextBlob("thing like prime rib dessert section"), TextBlob("bad food damn generic"), TextBlob("burger good beef cooked right"), TextBlob("want sandwich go firehouse"), TextBlob("side greek salad greek dressing tasty pita hummus refreshing"), TextBlob("ordered duck rare pink tender inside nice char outside"), TextBlob("came running us realized husband left sunglasses table"), TextBlob("chow mein good"), TextBlob("horrible attitudes towards customers talk one customers dont enjoy food"), TextBlob("portion huge"), TextBlob("loved it friendly servers great food wonderful imaginative menu"), TextBlob("heart attack grill downtown vegas absolutely flatlined excuse restaurant"), TextBlob("much seafood like 5 strings pasta bottom"), TextBlob("salad right amount sauce power scallop perfectly cooked"), TextBlob("ripped banana ripped petrified tasteless"), TextBlob("least think refill water struggle wait 10 minutes"), TextBlob("place receives stars appetizers"), TextBlob("cocktails handmade delicious"), TextBlob("wed definitely go back"), TextBlob("glad found place"), TextBlob("great food service huge portions give military discount"), TextBlob("always great time dos gringos"), TextBlob("update went back second time still amazing"), TextBlob("got food apparently never heard salt batter fish chewy"), TextBlob("great way finish great"), TextBlob("deal included 5 tastings 2 drinks jeff went beyond expected"), TextBlob("really really good rice time"), TextBlob("service meh"), TextBlob("took 30 min get milkshake nothing chocolate milk"), TextBlob("guess known place would suck inside excalibur didnt use common sense"), TextBlob("scallop dish quite appalling value well"), TextBlob("2 times bad customer service"), TextBlob("sweet potato fries good seasoned well"), TextBlob("today second time ive lunch buffet pretty good"), TextBlob("much good food vegas feel cheated waiting eating opportunity going rice company"), TextBlob("coming like experiencing underwhelming relationship parties cant wait person ask break"), TextBlob("walked place smelled like old grease trap 2 others eating"), TextBlob("turkey roast beef bland"), TextBlob("place"), TextBlob("pan cakes everyone raving taste like sugary disaster tailored palate six year old"), TextBlob("love pho spring rolls oh yummy try"), TextBlob("poor batter meat ratio made chicken tenders unsatisfying"), TextBlob("say food amazing"), TextBlob("omelets die"), TextBlob("everything fresh delicious"), TextBlob("summary largely disappointing dining experience"), TextBlob("like really sexy party mouth youre outrageously flirting hottest person party"), TextBlob("never heard rock casino never ever step forward"), TextBlob("best breakfast buffet")]

t"), TextBlob("say bye bye tip lady"), TextBlob("well never go"), TextBlob("back"), TextBlob("food arrived quickly"), TextBlob("good"), TextBlob("side cafe serves really good food"), TextBlob("server fantastic found wife loves roasted garlic bone marrow added extra meal another marrow go"), TextBlob("good thing waiter helpful kept bloody marys coming"), TextBlob("best buffet town price cannot beat"), TextBlob("loved mussels cooked wine reduction duck tender potato dishes delicious"), TextBlob("one better buffets"), TextBlob("went tigerlilly fantastic afternoon"), TextBlob("food delicious bartender attentive personable got great deal"), TextBlob("ambience wonderful music playing"), TextBlob("go back next trip"), TextBlob("sooooo good"), TextBlob("real sushi lovers lets honest yama good"), TextBlob("least 40min passed us ordering food arriving wasnt busy"), TextBlob("really fantastic thai restaurant definitely worth visit"), TextBlob("nice spicy tender"), TextBlob("good prices"), TextBlob("check"), TextBlob("pretty gross"), TextBlob("ive better atmosphere"), TextBlob("kind hard mess steak"), TextBlob("although much liked look sound place actual experience bit disappointing"), TextBlob("dont know place managed served blandest food ever eaten preparing indian cuisine"), TextBlob("worst service boot least worries"), TextBlob("service fine waitress friendly"), TextBlob("guys steaks steak loving son steak best worst places said best steak hes ever eaten"), TextBlob("thought youd venture away get good sushi place really hit spot night"), TextBlob("host staff lack better word bitches"), TextBlob("bland liking place number reasons dont want waste time bad reviewing ill leave"), TextBlob("phenomenal food service ambience"), TextBlob("wouldnt return"), TextBlob("definitely worth venturing strip pork belly return next time im vegas"), TextBlob("place way overpriced mediocre food"), TextBlob("penne vodka excellent"), TextBlob("good selection food including massive meatloaf sandwich crispy chicken wrap delish tuna melt tasty burgers"), TextBlob("management rude"), TextBlob("delicious nyc bagels good selections cream cheese real lox capers even"), TextBlob("great subway fact good come every subway meet expectations"), TextBlob("seriously solid breakfast"), TextBlob("one best bars food vegas"), TextBlob("extremely rude really many restaurants would love dine weekend vegas"), TextBlob("drink never empty made really great menu suggestions"), TextBlob("dont"), TextBlob("waiter wasnt helpful friendly rarely checked us"), TextBlob("husband ate lunch disappointed food service"), TextBlob("red curry much bamboo shoots wasnt tasty"), TextBlob("nice blanket moz top feel like done cover subpar food"), TextBlob("bathrooms clean place well decorated"), TextBlob("menu always changing food quality going service extremely slow"), TextBlob("service little slow considering served 3 people servers food coming slow pace"), TextBlob("give 2 thumbs"), TextBlob("watched waiter pay lot attention tables ignore us"), TextBlob("fiancé came middle day greeted seated right away"), TextBlob("great restaurant mandalay bay"), TextBlob("waited forty five minutes vain"), TextBlob("crostini came salad stale"), TextBlob("highlights great quality nigiri"), TextBlob("staff friendly joint always clean"), TextBlob("different cut piece day still wonderful tender well well flavored"), TextBlob("ordered voodoo pasta first time id really excellent pasta since going gluten free several years ago"), TextBlob("place good"), TextBlob("unfortunately must hit bakery leftover day everything ordered stale"), TextBlob("came back today since relocated still impressed"), TextBlob("seated immediately"), TextBlob("menu diverse reasonably priced"), TextBlob("avoid cost"), TextBlob("restaurant always full never wait"), TextBlob("delicious"), TextBlob("place handsdown one best places eat phoenix metro area"), TextBlob("dont go looking good food"), TextBlob("ive never treated bad"), TextBlob("bacon hella salty"), TextBlob("also ordered spinach avocado salad ingredients sad dressing literally zero taste"), TextBlob("really vegas fine dining used right menus handed ladies prices listed"), TextBlob("waitresses friendly"), TextBlob("lordy khao soi dish missed curry lovers"), TextBlob("everything menu terrific also thrilled made amazing accommodations vegetarian daughter"), TextBlob("perhaps caught night judging reviews im inspired go back"), TextBlob("service leaves lot desired"), TextBlob("atmosphere modern hip maintaining touch coziness"), TextBlob("weekly haunt definitely place come back every"), TextBlob("literally sat 20 minutes one asking take order"), TextBlob("burger absolutely flavor meat totally bland burger overcooked charcoal flavor"), TextBlob("also decided send back waitress too

ked like verge heart attack"), TextBlob("dressed treated rudely"), TextBlob("probably dirt"), TextBlob("love place hits spot want something healthy lacking quantity flavor"), TextBlob("ordered lemon raspberry ice cocktail also incredible"), TextBlob("food sucked expected sucked could imagined"), TextBlob("interesting decor"), TextBlob("really like crepe station"), TextBlob("also served hot bread butter home made potato chips bacon bits topvery original good"), TextBlob("watch preparing delicious food"), TextBlob("egg rolls fantastic"), TextBlob("order arrived one gyros missing"), TextBlob("salad wings ice cream dessert left feeling quite satisfied"), TextBlob("im really sure joeys voted best hot dog valley readers phoenix magazine"), TextBlob("best place go tasty bowl pho"), TextBlob("live music fridays totally blows"), TextBlob("ive never insulted felt disrespected"), TextBlob("friendly staff"), TextBlob("worth drive"), TextBlob("heard good things place exceeding every hope could dreamed"), TextBlob("food great service"), TextBlob("warm beer didnt help"), TextBlob("great brunch spot"), TextBlob("service friendly inviting"), TextBlob("good lunch spot"), TextBlob("ive lived since 1979 first last time ive stepped foot place"), TextBlob("worst experience ever"), TextBlob("must night place"), TextBlob("sides delish mixed mushrooms yukon gold puree white corn beateous"), TextBlob("bug never showed would given 4 sure side wall bug climbing kitchen"), TextBlob("10 minutes waiting salad realized wasnt coming time soon"), TextBlob("friend loved salmon tartar"), TextBlob("wont go back"), TextBlob("extremely tasty"), TextBlob("waitress good though"), TextBlob("soggy good"), TextBlob("jamaican mojitos delicious"), TextBlob("small worth price"), TextBlob("food rich order accordingly"), TextBlob("shower area outside rinse take full shower unless dont mind nude everyone see"), TextBlob("service bit lacking"), TextBlob("lobster bisque bussell sprouts risotto filet needed salt pepperand course none table s"), TextBlob("hopefully bodes going business someone cook come"), TextBlob("either cold enough flavor bad"), TextBlob("loved bacon wrapped dates"), TextBlob("unbelievable bargain"), TextBlob("folks otto always make us feel welcome special"), TextBlob("mains also uninspired"), TextBlob("place first pho amazing"), TextBlob("wonderful experience made place muststop whenever town"), TextBlob("food isnt bad enough enjoy dealing worlds worstannoying drunk people"), TextBlob("fun chef"), TextBlob("ordered double cheeseburger got single patty falling apart picture uploaded yeah still sucks"), TextBlob("great place couple drinks watch sporting events walls covered tvs"), TextBlob("possible give zero stars theyd"), TextBlob("descriptions said yum yum sauce another said eel sauce yet another said spicy mayowell none rolls sauces"), TextBlob("id say would hardest decision honestly ms dishes taste supposed taste amazing"), TextBlob("rolled may stayed sure go back try"), TextBlob("everyone attentive excellent customer service"), TextBlob("horrible dont waste time money"), TextBlob("dish quite"), TextBlob("time side restaurant almost empty excuse"), TextBlob("wasnt busy either also building cold"), TextBlob("like said couldnt pay eat place"), TextBlob("drinks took close 30 minutes come one point"), TextBlob("seriously flavorful folks"), TextBlob("much better sushi place went vegas"), TextBlob("dark enough set"), TextBlob("subpar service received business wont going back"), TextBlob("owners really great people"), TextBlob("nothing"), TextBlob("greek dressing creamy flavorful"), TextBlob("overall dont think would take place made similar complaints felt"), TextBlob("pizza good sauce tasty"), TextBlob("table service pretty fast"), TextBlob("fantastic service"), TextBlob("well given zero stars possible"), TextBlob("know make"), TextBlob("flavor"), TextBlob("hope place sticks around"), TextBlob("bars vegas ever tap water"), TextBlob("restaurant atmosphere"), TextBlob("good service clean inexpensive boot"), TextBlob("seafood fresh generous portion"), TextBlob("plus 8 bucks"), TextBlob("service par either"), TextBlob("far twice food absolutely delicious time"), TextBlob("good year ago"), TextBlob("coffee cafe disappointed"), TextBlob("world"), TextBlob("cant go wrong food"), TextBlob("cant beat"), TextBlob("stopped place friendly kind staff"), TextBlob("friendly good job"), TextBlob("ive better boba tea even pho"), TextBlob("liked patio service outstanding"), TextBlob("taco didnt meat wow flavor"), TextBlob("think"), TextBlob("salad pretty bland getting"), TextBlob("went bachi burger friends recommendation disappointed"), TextBlob("service"), TextBlob("waited waited"), TextBlob("place quality sushi quality restaurant"), TextBlob("would definitel

localhost:8888/nbconvert/html/Projects/sentimental analysis/Restaurant review Analysis.ipynb?download=false 9/26

tty reasonable considering vegas inside mall"), TextBlob("food incredible n
 othing brings quite like memory pneumatic condiment dispenser"), TextBlob
 ("im probably one people ever go ians like"), TextBlob("kids pizza always h
 it lots great side dish options kiddos"), TextBlob("service perfect family
 atmosphere nice see"), TextBlob("cooked perfection service impeccable"), Te
 xtBlob("one simply disappointment"), TextBlob("overall disappointed quality
 food bouchon"), TextBlob("dont accountant know im getting screwed"), TextBl
 ob("great place eat reminds little mom pop shops san francisco bay area"),
 TextBlob("today first taste bulldogis gourmet hot dog tell ever thought poss
 ible"), TextBlob("left frustrated"), TextBlob("ill definitely soon"), TextB
 lob("food really good got full petty fast"), TextBlob("service fantastic"),
 TextBlob("total waste time"), TextBlob("dont know kind best iced tea"), Tex
 tBlob("come hungry leave happy stuffed"), TextBlob("service give stars"), T
 extBlob("assure wont disappointed"), TextBlob("take little bad service food
 sucks"), TextBlob("gave trying eat crust still"), TextBlob("completely gros
 sed"), TextBlob("really enjoyed eating"), TextBlob("first time going think
 quickly become regular"), TextBlob("server nice even though looked little o
 verwhelmed needs stayed professional friendly end"), TextBlob("dinner told
 fresh nice texture taste"), TextBlob("right next table large green poop"),
 TextBlob("cant even find hours website"), TextBlob("weve tried like place 1
 0 times think done"), TextBlob("mistake"), TextBlob("complaints"), TextBlob
 ("seriously good pizza im expertconnoisseur topic"), TextBlob("waiter jer
 k"), TextBlob("strike 2 wants rushed"), TextBlob("nicest restaurant owners
 ive ever come across"), TextBlob("never come"), TextBlob("loved biscuits"),
 TextBlob("service quick friendly"), TextBlob("ordered appetizer took 40 min
 utes pizza another 10 minutes"), TextBlob("absolutley fantastic"), TextBlob
 ("huge awkward 15lb piece cow 34ths gristle fat"), TextBlob("definitely com
 e back"), TextBlob("like steiners dark feels like bar"), TextBlob("wow spic
 y delicious"), TextBlob("youre familiar check"), TextBlob("ill take busines
 s dinner dollars elsewhere"), TextBlob("id love go back"), TextBlob("anyway
 fs restaurant wonderful breakfastlunch"), TextBlob("nothing special"), Text
 Blob("day week different deal delicious"), TextBlob("mention combination pe
 ars almonds bacon big winner"), TextBlob("back"), TextBlob("sauce tasteles
 s"), TextBlob("food delicious spicy enough sure ask spicier prefer way"), T
 extBlob("ribeye steak cooked perfectly great mesquite flavor"), TextBlob("d
 ont think well going back anytime soon"), TextBlob("food gooodd"), TextBlob
 ("far sushi connoisseur definitely tell difference good food bad food certa
 inly bad food"), TextBlob("insulted"), TextBlob("last 3 times lunch bad"),
 TextBlob("chicken wings contained driest chicken meat ever eaten"), TextBlo
 b("food good enjoyed every mouthful enjoyable relaxed venue couples small f
 amily groups etc"), TextBlob("nargile think great"), TextBlob("best tater t
 ots southwest"), TextBlob("loved place"), TextBlob("definitely worth 3 pai
 d"), TextBlob("vanilla ice cream creamy smooth profiterole fresh enough"),
 TextBlob("im time new spot"), TextBlob("manager worst"), TextBlob("inside r
 eally quite nice clean"), TextBlob("food outstanding prices reasonable"), T
 extBlob("dont think ill running back anytime soon food"), TextBlob("fact to
 ok 20 minutes acknowledged another 35 minutes get kept things"), TextBlob
 ("love margaritas"), TextBlob("first vegas buffet disappoint"), TextBlob("g
 ood though"), TextBlob("one note could use"), TextBlob("great pork sandwic
 h"), TextBlob("dont waste time"), TextBlob("total would much rather go flow
 er coffee"), TextBlob("third cheese friends burger cold"), TextBlob("enjoy
 pizza brunch"), TextBlob("steaks well also perfectly cooked"), TextBlob("gr
 oup would 40 us"), TextBlob("loved"), TextBlob("asked bill leave without ea
 ting didnt bring either"), TextBlob("place vegas ive find ten years"), Text
 Blob("seafood shrimp crab legs crab legs definitely taste fresh"), TextBlob
 ("selection food best"), TextBlob("delicious absolutely back"), TextBlob("i
 snt small family restaurant fine dining establishment"), TextBlob("liked sl
 iced white"), TextBlob("dont think back long time"), TextBlob("station rare
 ly good"), TextBlob("awesome"), TextBlob("back many times soon"), TextBlob
 ("menu much good stuff could"), TextBlob("worse right front horrible"), Tex
 tBlob("filling meals"), TextBlob("always hit group"), TextBlob(""), TextBlo
 b("also really good pretty large"), TextBlob("first experience delicious"),
 TextBlob("chicken fried steak eggs time favorite"), TextBlob("waitress swee
 t"), TextBlob("also taste pancakes butter amazing delicious"), TextBlob("id

rather eat food seriously"), TextBlob("cant say enough good things place"), TextBlob("ambiance incredible"), TextBlob("waitress manager friendly"), TextBlob("would recommend place"), TextBlob("overall wasnt impressed"), TextBlob("basically"), TextBlob("terrible service"), TextBlob("disappointed"), TextBlob("dont much pasta love homemade hand made thin pizzas"), TextBlob("give try happy"), TextBlob("far best ever"), TextBlob("reasonably priced also"), TextBlob("everything perfect night"), TextBlob("food good bar food"), TextBlob("drive get"), TextBlob("first lovely bakery cafe nice ambiance clean friendly staff"), TextBlob("anyway think go back"), TextBlob("point menu order wont disappointed"), TextBlob("oh thing restaurant"), TextBlob("gone go"), TextBlob("meal"), TextBlob("first time last"), TextBlob("burgers amazing"), TextBlob("say word food minutes late"), TextBlob("way"), TextBlob("sure order dessert even need to go tiramisu cannoli die"), TextBlob("first time cant wait next"), TextBlob("bartender also nice"), TextBlob("everything good tasty"), TextBlob("place two thumbs up way"), TextBlob("best place vegas breakfast check sat sun"), TextBlob("love authentic mexican food want whole bunch interesting yet delicious meats choose need try place"), TextBlob("terrible management"), TextBlob("excellent new restaurant experienced frenchman"), TextBlob("zero stars would give zero stars"), TextBlob("great steak great sides great wine amazing desserts"), TextBlob("worst martini ever"), TextBlob("steak shrimp opinion best entrees great"), TextBlob("opportunity today sample amazing pizzas"), TextBlob("waited thirty minutes seated although 8 vacant tables folks waiting"), TextBlob("yellowtail carpaccio melt mouth fresh"), TextBlob("wont try going back even empty"), TextBlob("im going eat potato found strangers hair"), TextBlob("spicy enough perfect actually"), TextBlob("last night second time dining happy decided go back"), TextBlob("even hello right"), TextBlob("desserts bit strange"), TextBlob("boyfriend came first time recent trip vegas could pleased quality food service"), TextBlob("really recommend place go wrong donut place"), TextBlob("nice ambiance"), TextBlob("would recommend saving room"), TextBlob("guess maybe went night disgraceful"), TextBlob("however recent experience particular location good"), TextBlob("know like restaurants something"), TextBlob("avoid establishment"), TextBlob("think restaurant suffers trying hard enough"), TextBlob("tapas dishes delicious"), TextBlob("heart place"), TextBlob("salad bland vinaigrette baby greens hearts palm"), TextBlob("two felt disgusting"), TextBlob("good time"), TextBlob("believe place great stop huge belly hankering sushi"), TextBlob("generous portions great taste"), TextBlob("never go back place never ever recommended place anyone"), TextBlob("servers went back forth several times even much helped"), TextBlob("food delicious"), TextBlob("hour seriously"), TextBlob("consider theft"), TextBlob("eww location needs complete overhaul"), TextBlob("recently witnessed poor quality management towards guests well"), TextBlob("waited waited waited"), TextBlob("also came back check us regularly excellent service"), TextBlob("server super nice checked us many times"), TextBlob("pizza tasted old super chewy good way"), TextBlob("swung give try deeply disappointed"), TextBlob("service good company better"), TextBlob("staff also friendly efficient"), TextBlob("service im fan quick youre served nice folks"), TextBlob("boy sucker dry"), TextBlob("rated"), TextBlob("look authentic thai food go else"), TextBlob("steaks 100 recommended"), TextBlob("pulled car waited another 15 minutes acknowledged"), TextBlob("great food great service clean friendly setting"), TextBlob("assure ill back"), TextBlob("hate things much cheap quality black olives"), TextBlob("breakfast prepared great beautiful presentation 3 giant slices toast lightly dusted powdered sugar"), TextBlob("kids play area nasty"), TextBlob("great place to take eat"), TextBlob("waitress friendly happy accommodate veganveggie options"), TextBlob("omg felt like never eaten thai food dish"), TextBlob("extremely crumbly pretty tasteless"), TextBlob("pale color instead nice char flavor"), TextBlob("croutons also taste homemade extra plus"), TextBlob("got home see driest damn wings ever"), TextBlob("itll regular stop trips phoenix"), TextBlob("really enjoyed crema cafe expanded even told friends best breakfast"), TextBlob("good money"), TextBlob("miss wish one philadelphia"), TextBlob("got sitting fairly fast ended waiting 40 minutes place order another 30 minutes food arrived"), TextBlob("also best cheese crisp town"), TextBlob("good value great food great service"), TextBlob("couldnt ask satisfying meal"), TextBlob("food good"), T

extBlob("awesome"), TextBlob("wanted leave"), TextBlob("made drive way nort
 h scottsdale one bit disappointed"), TextBlob("eating"), TextBlob("owners r
 eally really need quit soooooo cheap let wrap freaking sandwich two papers
 one"), TextBlob("checked place couple years ago impressed"), TextBlob("chic
 ken got definitely reheated ok wedges cold soggy"), TextBlob("sorry getting
 food anytime soon"), TextBlob("absolute must visit"), TextBlob("cow tongue
 cheek tacos amazing"), TextBlob("friend like bloody mary"), TextBlob("despi
 te hard rate businesses actually rare give 1 star"), TextBlob("really want
 make experience good one"), TextBlob("return"), TextBlob("chicken pho taste
 d bland"), TextBlob("disappointing"), TextBlob("grilled chicken tender yell
 ow saffron seasoning"), TextBlob("drive thru means want wait around half ho
 ur food somehow end going make us wait wait"), TextBlob("pretty awesome pla
 ce"), TextBlob("ambience perfect"), TextBlob("best luck rude noncustomer se
 rvice focused new management"), TextBlob("grandmother make roasted chicken
 better one"), TextBlob("asked multiple times wine list time ignored went ho
 stess got one"), TextBlob("staff always super friendly helpful especially c
 ool bring two small boys baby"), TextBlob("four stars food guy blue shirt g
 reat vibe still letting us eat"), TextBlob("roast beef sandwich tasted real
 ly good"), TextBlob("evening drastically sick"), TextBlob("highquality chic
 ken chicken caesar salad"), TextBlob("ordered burger rare came well done"),
 TextBlob("promptly greeted seated"), TextBlob("tried go lunch madhouse"), T
 extBlob("proven dead wrong sushi bar quality great service fast food impecc
 able"), TextBlob("waiting hour seated greatest moods"), TextBlob("good join
 t"), TextBlob("macarons insanely good"), TextBlob("im eating"), TextBlob("w
 aiter attentive friendly informative"), TextBlob("maybe werent cold would s
 omewhat edible"), TextBlob("place lot promise fails deliver"), TextBlob("ba
 d experience"), TextBlob("mistake"), TextBlob("food average best"), TextBlo
 b("great food"), TextBlob("wont going back anytime soon"), TextBlob("disapp
 ointed ordered 35 big bay plater"), TextBlob("great place relax awesome bur
 ger beer"), TextBlob("perfect sitdown family meal get together friends"), T
 extBlob("much flavor poorly constructed"), TextBlob("patio seating comforta
 ble"), TextBlob("fried rice dry well"), TextBlob("hands favorite italian re
 staurant"), TextBlob("screams legit booksomethats also pretty rare vegas"),
 TextBlob("fun experience"), TextBlob("atmosphere great lovely duo violinist
 s playing songs requested"), TextBlob("personally love hummus pita baklava
 falafels baba ganoush amazing eggplant"), TextBlob("convenient since stayin
 g mgm"), TextBlob("owners super friendly staff courteous"), TextBlob("grea
 t"), TextBlob("eclectic selection"), TextBlob("sweet potato tots good onion
 rings perfection close"), TextBlob("staff attentive"), TextBlob("chef gener
 ous time even came around twice take pictures"), TextBlob("owner used work
 nobu place really similar half price"), TextBlob("google mediocre imagine s
 mashburger pop"), TextBlob("dont go"), TextBlob("promise wont disappoint"),
 TextBlob("sushi lover avoid place means"), TextBlob("great double cheesebur
 ger"), TextBlob("awesome service food"), TextBlob("fantastic neighborhood g
 em"), TextBlob("cant wait go back"), TextBlob("plantains worst ive ever tas
 ted"), TextBlob("great place highly recommend"), TextBlob("service slow att
 entive"), TextBlob("gave 5 stars im giving 5 stars"), TextBlob("staff spend
 s time talking"), TextBlob("dessert panna cotta amazing"), TextBlob("good f
 ood great atmosphere1"), TextBlob("damn good steak"), TextBlob("total brunc
 h fail"), TextBlob("prices reasonable flavors spot sauce home made slaw dre
 nched mayo"), TextBlob("decor nice piano music soundtrack pleasant"), TextB
 lob("steak amazingrge fillet relleno best seafood plate ever"), TextBlob("g
 ood food good service"), TextBlob("absolutely amazing"), TextBlob("probably
 wont back honest"), TextBlob("definitely back"), TextBlob("sergeant pepper
 beef sandwich auju sauce excellent sandwich well"), TextBlob("hawaiian bree
 ze mango magic pineapple delight smoothies ive tried far theyre good"), Tex
 tBlob("went lunch service slow"), TextBlob("much say place walked expected
 amazing quickly disappointed"), TextBlob("mortified"), TextBlob("needless s
 ay never back"), TextBlob("anyways food definitely filling price pay expec
 t"), TextBlob("chips came dripping grease mostly edible"), TextBlob("wasnt
 really impressed strip steak"), TextBlob("going since 2007 every meal aweso
 me"), TextBlob("server nice attentive serving staff"), TextBlob("cashier fr
 iendly even brought food"), TextBlob("work hospitality industry paradise va
 lley refrained recommending cibo longer"), TextBlob("atmosphere fun"), Text

Blob("would recommend others"), TextBlob("service quick even go orders like like"), TextBlob("mean really get famous fish chips terrible"), TextBlob("s aid mouths bellies still quite pleased"), TextBlob("thing"), TextBlob("2 thumbs"), TextBlob("reading please dont go"), TextBlob("loved grilled pizza reminded legit italian pizza"), TextBlob("pros large seating area nice bar a rea great simple drink menu best brick oven pizza homemade dough"), TextBlob("really nice atmosphere"), TextBlob("tonight elk filet specialand sucke d"), TextBlob("one bite hooked"), TextBlob("ordered old classics new dishes going times sorely disappointed everything"), TextBlob("cute quaint simple honest"), TextBlob("chicken deliciously seasoned perfect fry outside moist chicken inside"), TextBlob("food great always compliments chef"), TextBlob("special thanks dylan recommendation order yummy tummy"), TextBlob("awesome selection beer"), TextBlob("great food awesome service"), TextBlob("one nice thing added gratuity bill since party larger 6 8 didnt expect tip"), TextBlob("fly apple juice fly"), TextBlob("han nan chicken also tasty"), TextBlob("service thought good"), TextBlob("food barely lukewarm must sitting waiting server bring us"), TextBlob("ryans bar definitely one edinburgh establishment wont revisiting"), TextBlob("nicest chinese restaurant ive"), TextBlob("overall like food service"), TextBlob("also serve indian naan bread hummus spicy pine nut sauce world"), TextBlob("probably never coming back wouldnt recommend"), TextBlob("friends pasta also bad barely touched"), TextBlob("try airport experience tasty food speedy friendly service"), TextBlob("love decor chinese calligraphy wall paper"), TextBlob("never anything complain"), TextBlob("restaurant clean family restaurant feel"), TextBlob("way fried"), TextBlob("im sure long stood long enough begin feel awkwardly place"), TextBlob("opened sandwich impressed good way"), TextBlob("back"), TextBlob("warm feeling service felt like guest special treat"), TextBlob("extensive menu provides lots options breakfast"), TextBlob("always order vegetarian menu dinner wide array options choose"), TextBlob("watched prices inflate portions get smaller management attitudes grow rapidly"), TextBlob("wonderful lil tapas ambience made feel warm fuzzy inside"), TextBlob("got enjoy seafood salad fabulous vinegrette"), TextBlob("wontons thin thick chewy almost melt mouth"), TextBlob("level 5 spicy perfect spice didnt overwhelm soup"), TextBlob("sat right time server get go fantastic"), TextBlob("main thing didnt enjoy crowd older crowd around mid 30s"), TextBlob("im side town definitely spot ill hit"), TextBlob("wait 30 minutes get drink longer get 2 arepas"), TextBlob("great place eat"), TextBlob("jalapeno bacon soooo good"), TextBlob("service poor thats nice"), TextBlob("food good service good prices good"), TextBlob("place clean food oh stale"), TextBlob("chicken dishes ok beef like shoe leather"), TextBlob("service beyond bad"), TextBlob("im happy"), TextBlob("tasted like dirt"), TextBlob("one places phoenix would definately go back"), TextBlob("block amazing"), TextBlob("close house lowkey nonfancy affordable prices good food"), TextBlob("hot sour egg flower soups absolutely 5 stars"), TextBlob("sashimi poor quality soggy tasteless"), TextBlob("great time family dinner sunday night"), TextBlob("food tasty say real traditional hunan style"), TextBlob("bother slow service"), TextBlob("flair bartenders absolutely amazing"), TextBlob("frozen margaritas way sugary taste"), TextBlob("good ordered twice"), TextBlob("nutshell 1 restaurant smells like combination dirty fish market sewer"), TextBlob("girlfriends veal bad"), TextBlob("unfortunately good"), TextBlob("pretty satifying experience"), TextBlob("join club get awesome offers via email"), TextBlob("perfect someone likes beer ice cold case even colder"), TextBlob("bland flavorless good way describing barely tepid meat"), TextBlob("chains im fan beat place easily"), TextBlob("nachos must"), TextBlob("coming back"), TextBlob("dont many words say place everything pretty well"), TextBlob("staff super nice quick even crazy crowds downtown juries lawyers court staff"), TextBlob("great atmosphere friendly fast service"), TextBlob("received pita huge lot meat thumbs"), TextBlob("food arrives meh"), TextBlob("paying 785 hot dog fries looks like came kids meal wienerschnitzel idea good meal"), TextBlob("classic maine lobster roll fantastic"), TextBlob("brother law works mall ate day guess sick night"), TextBlob("good going review place twice he reas tribute place tribute event held last night"), TextBlob("chips salsa really good salsa fresh"), TextBlob("place great"), TextBlob("mediocre food"), TextBlob("get inside youll impressed place"), TextBlob("im super piss

d"), TextBlob("service super friendly"), TextBlob("sad little vegetables overcooked"), TextBlob("place nice surprise"), TextBlob("goldencrispy delicious"), TextBlob("high hopes place since burgers cooked charcoal grill unfortunately taste fell flat way flat"), TextBlob("could eat bruschetta day definitely"), TextBlob("single employee came see ok even needed water refill finally served us food"), TextBlob("lastly mozzarella sticks best thing ordered"), TextBlob("first time ever came amazing experience still tell people awesome duck"), TextBlob("server negligent needs made us feel unwelcome would suggest place"), TextBlob("service terrible though"), TextBlob("place overpriced consistent boba really overpriced"), TextBlob("packed"), TextBlob("say desserts yummy"), TextBlob("seasonal fruit fresh white peach puree"), TextBlob("kept getting worse worse im officially done"), TextBlob("place honestly blown"), TextBlob("definitely would eat"), TextBlob("waste money"), TextBlob("love put food nice plastic containers opposed cramming little paper takeout boxes"), TextBlob("crêpe delicate thin moist"), TextBlob("awful service"), TextBlob("wont ever go"), TextBlob("food quality horrible"), TextBlob("price think place would much rather gone"), TextBlob("service fair best"), TextBlob("love sushi found kabuki overpriced overhip underservices"), TextBlob("favor stay away dish"), TextBlob("poor service"), TextBlob("one table thought food average worth wait"), TextBlob("best service food ever maria server good friendly made day"), TextBlob("excellent"), TextBlob("paid bill tip felt server terrible job"), TextBlob("lunch great experience"), TextBlob("never bland food surprised considering article read focused much spices flavor"), TextBlob("food way overpriced portions fucking small"), TextBlob("recently tried caballeros back every week since"), TextBlob("40 bucks head really expect better food"), TextBlob("food came good pace"), TextBlob("ate twice last visit especially enjoyed salmon salad"), TextBlob("could believe dirty oysters"), TextBlob("place deserves stars"), TextBlob("fact im going round 4 stars awesome"), TextBlob("disbelief dish qualified worst version foods ever tasted"), TextBlob("bad day low tolerance rude customer service people job nice polite wash dishes otherwise"), TextBlob("potatoes great biscuit"), TextBlob("probably would go"), TextBlob("flavorful perfect amount heat"), TextBlob("price reasonable service great"), TextBlob("wife hated meal coconut shrimp friends really enjoy meals either"), TextBlob("fella got huevos rancheros didnt look appealing"), TextBlob("went happy hour great list wines"), TextBlob("may say buffet pricey think get pay place getting quite lot"), TextBlob("probably wont coming back"), TextBlob("worst foodservice ive"), TextBlob("place pretty good nice little vibe restaurant"), TextBlob("talk great customer service course back"), TextBlob("hot dishes hot cold dishes close room tempi watched staff prepare food bare hands gloves everything deep fried oil"), TextBlob("love fries beans"), TextBlob("always pleasure dealing"), TextBlob("plethora salads sandwiches everything ive tried gets seal approval"), TextBlob("place awesome want something light healthy summer"), TextBlob("sushi strip place go"), TextBlob("service great even manager came helped table"), TextBlob("feel dining room college cooking course high class dining service slow best"), TextBlob("started review two stars im editing give one"), TextBlob("worst sushi ever eat besides costcos"), TextBlob("excellent restaurant highlighted great service unique menu beautiful setting"), TextBlob("boyfriend sat bar completely delightful experience"), TextBlob("weird vibe owners"), TextBlob("hardly meat"), TextBlob("ive better bagels grocery store"), TextBlob("go place gyros"), TextBlob("love ownerchef one authentic japanese cool dude"), TextBlob("burgers arent good pizza used amazing doughy flavorless"), TextBlob("found six inch long piece wire salsa"), TextBlob("service terrible food mediocre"), TextBlob("definitely enjoyed"), TextBlob("ordered albondigas soup warm tasted like tomato soup frozen meatballs"), TextBlob("three different occasions asked well done medium well three times got bloodiest piece meat plate"), TextBlob("two bites refused eat anymore"), TextBlob("service extremely slow"), TextBlob("20 minutes wait got table"), TextBlob("seriously killer hot chai latte"), TextBlob("allergy warnings menu waitress absolutely clue meals contain peanuts"), TextBlob("boyfriend tried mediterranean chicken salad fell love"), TextBlob("rotating beers tap also highlight place"), TextBlob("pricing bit concerning mellow mushroom"), TextBlob("worst thai ever"), TextBlob("stay vegas must get breakfast least"), TextBlob("want first say server great perfect se

rvice"), TextBlob("pizza selections good"), TextBlob("strawberry tea good"), TextBlob("highly unprofessional rude loyal patron"), TextBlob("overall great experience"), TextBlob("spend money elsewhere"), TextBlob("regular toasted bread equally satisfying occasional pats butter mmmm"), TextBlob("buffet bellagio far anticipated"), TextBlob("drinks weak people"), TextBlob("order correct"), TextBlob("also feel like chips bought made house"), TextBlob("disappointing dinner went elsewhere dessert"), TextBlob("chips sals amazing"), TextBlob("wont returning"), TextBlob("new fav vegas buffet spot"), TextBlob("seriously cannot believe owner many unexperienced employees running around like chickens heads cut"), TextBlob("sad"), TextBlob("felt insulted disrespected could talk judge another human like"), TextBlob("call steakhouse cant properly cook steak dont understand"), TextBlob("im impressed concept food"), TextBlob("thing wasnt crazy guacamole dont like puréed"), TextBlob("really nothing postinos hope experience better"), TextBlob("got food poisoning buffet"), TextBlob("brought fresh batch fries thinking yay something warm"), TextBlob("hilarious yummy christmas eve dinner remember biggest fail entire trip us"), TextBlob("needless say wont going back anytime soon"), TextBlob("place disgusting"), TextBlob("every time eat see caring team work professional degree"), TextBlob("ri style calamari joke"), TextBlob("however much garlic fondue barely edible"), TextBlob("could barely stomach meal didnt complain business lunch"), TextBlob("bad lost heart finish"), TextBlob("also took forever bring us check asked"), TextBlob("arent ones make scene restaurants dont get itdefinitely lost love one"), TextBlob("disappointing experience"), TextBlob("food par dennys say good"), TextBlob("want wa it mediocre food downright terrible service place"), TextBlob("waaaaaayyyyyy rated saying"), TextBlob("wont going back"), TextBlob("place fairly clean food simply wasnt worth"), TextBlob("place lacked style"), TextBlob("sangria half glass wine full 12 ridiculous"), TextBlob("dont bother coming"), TextBlob("meat pretty dry sliced brisket pulled pork"), TextBlob("building seems pretty neat bathroom pretty trippy wouldnt eat"), TextBlob("equally awful"), TextBlob("probably hurry go back"), TextBlob("slow seating even reservation"), TextBlob("good stretch imagination"), TextBlob("cashew cream sauce bland vegetables undercooked"), TextBlob("chipolte ranch dipping sauce tasteless seemed thin watered heat"), TextBlob("bit sweet really spicy enough lacked flavor"), TextBlob("disappointed"), TextBlob("place horrible way overpriced"), TextBlob("maybe vegetarian fare ive twice thought average best"), TextBlob("wasnt busy know"), TextBlob("tables outside also dirty lot time workers always friendly helpful menu"), TextBlob("ambiance feel like buffet setting douchey indoor garden tea biscuits"), TextBlob("con spotty service"), TextBlob("fries hot neither burger"), TextBlob("came back cold"), TextBlob("food came disappointment ensued"), TextBlob("real disappointment waiter"), TextBlob("husband said rude even apologize bad food anything"), TextBlob("reason eat would fill night binge drinking get carbs stomach"), TextBlob("insults profound deuchebaggery go outside smoke break serving solidify"), TextBlob("someone orders two tacos dont think may part customer service ask combo ala cart"), TextBlob("quite disappointed although blame needs placed door"), TextBlob("rave reviews couldnt wait eat herewhat disappointment"), TextBlob("del taco pretty nasty avoided possible"), TextBlob("hard make decent hamburger"), TextBlob("dont like"), TextBlob("hell go back"), TextBlob("weve gotten much better service pizza place next door services received restaurant"), TextBlob("dont know big deal place wont back yaall"), TextBlob("immediately said wanted talk manager want talk guy shots fireball behind bar"), TextBlob("ambiance isnt much better"), TextBlob("unfortunately set us disappointm entrees"), TextBlob("food wasnt good"), TextBlob("servers suck wait correction server heimer sucked"), TextBlob("happened next prettyoff putting"), TextBlob("bad cause know family owned really wanted like place"), TextBlob("overpriced getting"), TextBlob("vomited bathroom mid lunch"), TextBlob("kept looking time soon become 35 minutes yet still food"), TextBlob("places eat circumstances would ever return tops list"), TextBlob("started tuna sashimi brownish color obviously wasnt fresh"), TextBlob("food average"), TextBlob("sure beat nachos movies would expect little bit coming restaurant"), TextBlob("ha long bay bit flop"), TextBlob("problem charge 1199 sandwich bigger subway sub offers better amount vegetables"), TextBlob("shrimp unwrapped live 12 mile brushfire literally ice cold"), TextBl

```
ob("lacked flavor seemed undercooked dry"), TextBlob("really impressive place
hasnt closed"), TextBlob("would avoid place staying mirage"), TextBlob(
"refried beans came meal dried crusty food bland"), TextBlob("spend money
time place else"), TextBlob("lady table next us found live green caterpillars
salad"), TextBlob("presentation food awful"), TextBlob("cant tell disappointed"),
TextBlob("think food flavor texture lacking"), TextBlob("appetite instantly gone"),
TextBlob("overall impressed would go back"), TextBlob("whole experience underwhelming
think well go ninja sushi next time"), TextBlob("hadnt wasted enough life poured salt
wound time took bring check")]
```

```
In [26]: #tokenization
data["Review"].apply(lambda x: TextBlob(x).words).head()
```

```
Out[26]: 0          [wow, loved, place]
1          [crust, good]
2          [tasty, texture, nasty]
3  [stopped, late, may, bank, holiday, rick, stev...
4          [selection, menu, great, prices]
Name: Review, dtype: object
```

```
In [27]: data
```

```
Out[27]:
```

	Review	Liked
0	wow loved place	1
1	crust good	0
2	tasty texture nasty	0
3	stopped late may bank holiday rick steve recom...	1
4	selection menu great prices	1
...
995	think food flavor texture lacking	0
996	appetite instantly gone	0
997	overall impressed would go back	0
998	whole experience underwhelming think well go n...	0
999	hadnt wasted enough life poured salt wound tim...	0

996 rows × 2 columns

```
In [28]: #stemming
from nltk.stem.porter import PorterStemmer
```

```
In [29]: ps = PorterStemmer()
data['Review'] = data['Review'].apply(lambda x: " ".join([Word(word).lemmatize() for word in x]))
```

```
In [30]: data["Review"].head()
```

```
Out[30]: 0          wow loved place
1          crust good
2          tasty texture nasty
3  stopped late may bank holiday rick steve recom...
4          selection menu great price
Name: Review, dtype: object
```

```
In [31]: #lemmetization
from nltk.stem import WordNetLemmatizer
nltk.download('omw-1.4')
```



```
[nltk_data] Downloading package omw-1.4 to /home/ats/nltk_data...
[nltk_data] Package omw-1.4 is already up-to-date!
```

```
In [ ]: lemmatizer = WordNetLemmatizer()
data['Review'] = data['Review'].apply(lambda x: " ".join([lemmatizer.lemmat
```

```
In [32]: data
```

```
Out[32]:
```

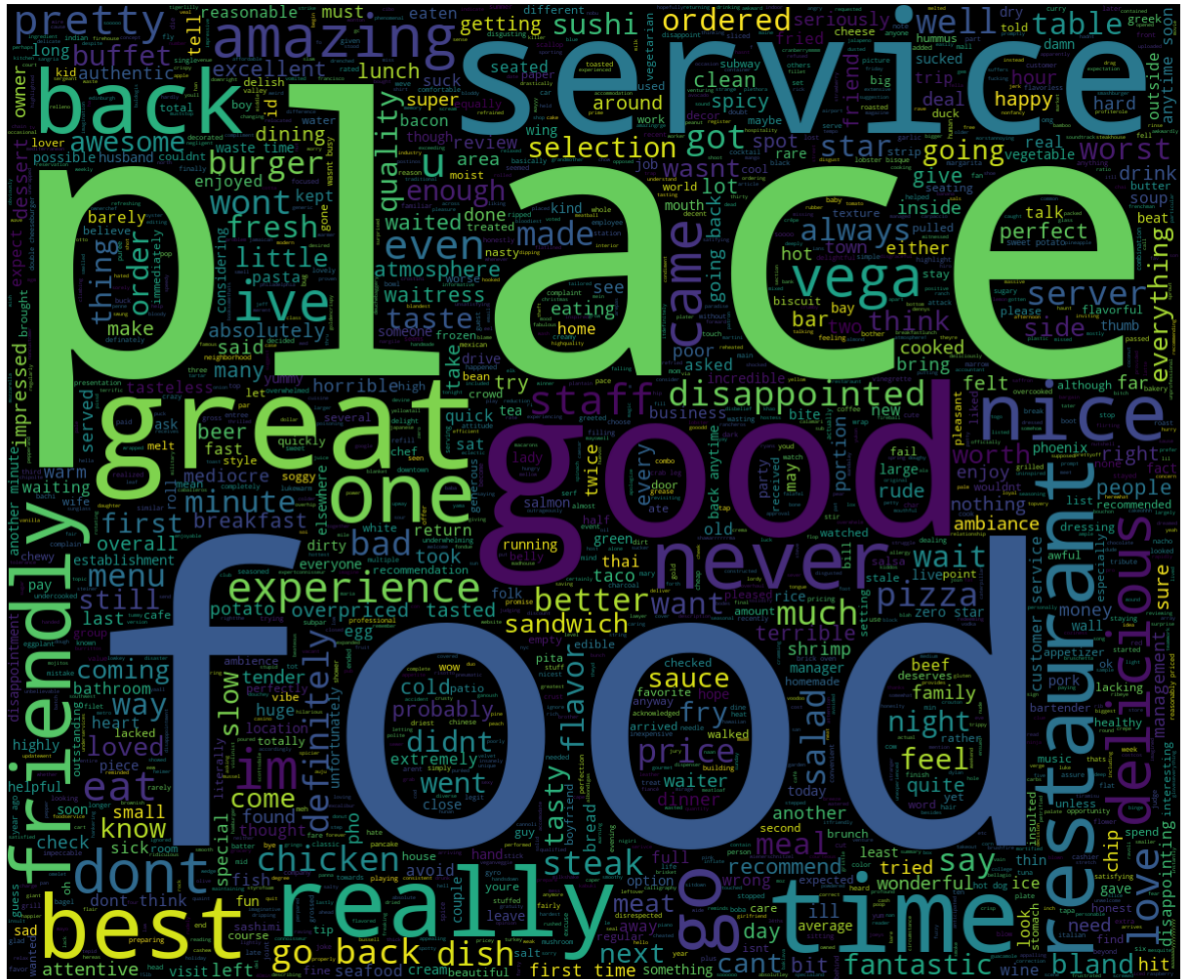
	Review	Liked
0	wow loved place	1
1	crust good	0
2	tasty texture nasty	0
3	stopped late may bank holiday rick steve recom...	1
4	selection menu great price	1
...
995	think food flavor texture lacking	0
996	appetite instantly gone	0
997	overall impressed would go back	0
998	whole experience underwhelming think well go n...	0
999	hadnt wasted enough life poured salt wound tim...	0

996 rows × 2 columns

```
In [33]: #some visualization of reviews
from PIL import Image
from wordcloud import WordCloud, STOPWORDS, ImageColorGenerator
```

```
In [34]: plt.subplots(figsize=(16,13))
wordcloud = WordCloud(
    background_color='black',max_words=5000,
    width=1200,stopwords=STOPWORDS,
    height=1000
).generate(" ".join(data['Review']))
plt.title("MOST USED WORDS",fontsize=20)
plt.imshow(wordcloud.recolor( colormap= 'viridis'))
plt.axis('off')
plt.show()
```

MOST USED WORDS



```
In [35]: #Wordcloud for positive reviews
```

```
positive_reviews=data.loc[data['Liked']==1]['Review']
plt.subplots(figsize=(16,13))
wordcloud = WordCloud(
    background_color='black',max_words=5000,
    width=1200,stopwords=STOPWORDS,
    height=1000
).generate(" ".join(positive_reviews)) #join us
plt.title("MOST USED WORDS",fontsize=20)
plt.imshow(wordcloud.recolor( colmap= 'viridis'))
plt.axis('off')
plt.show()
```

[illegible]

```
negative_reviews=data.loc[data['Liked']==0]['Review']
plt.subplots(figsize=(16,13))
wordcloud = WordCloud(
    background_color='black',max_words=5000,
    width=1200,stopwords=STOPWORDS,
    height=1000
).generate(" ".join(negative_reviews)) #join us
plt.title("MOST USED WORDS",fontsize=20)
plt.imshow(wordcloud.recolor( colmap= 'Pastel2'))
plt.axis('off')
plt.show()
```


[illegible]

```
pos = 0
neg = 0
neu = 0
for review in data['Review']:
    analysis = TextBlob(review)
    if analysis.sentiment[0]>0:
        pos = pos + 1
    elif analysis.sentiment[0]<0:
        neg = neg + 1
    else:
        neu = neu + 1
print("Total Positive = ", pos)
print("Total Negative = ", neg)
print("Total Neutral = ", neu)
```

```
In [38]: from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import MultinomialNB, GaussianNB
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
import xgboost as xgb
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
```

20/26

```
y = data['Liked']
```

```
In [40]: # instantiating CountVectorizer
vectorizer = CountVectorizer()

# fit and transform the text data
X_vectorized = vectorizer.fit_transform(X)
```

```
In [41]: # splitting the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X_vectorized, y, test_s
```

```
In [42]: # instantiating and train the classifiers
clf1 = MultinomialNB()
clf1.fit(X_train, y_train)

clf2 = GaussianNB()
clf2.fit(X_train.toarray(), y_train)

clf3 = xgb.XGBClassifier(objective='binary:logistic', eval_metric='logloss')
clf3.fit(X_train, y_train)

clf4 = RandomForestClassifier(n_estimators=100, random_state=42)
clf4.fit(X_train, y_train)

clf5 = SVC(kernel='linear')
clf5.fit(X_train, y_train)
```

```
Out[42]: SVC
SVC(kernel='linear')
```

```
In [43]: # making predictions on the test data for each classifier
y_pred1 = clf1.predict(X_test)
y_pred2 = clf2.predict(X_test.toarray())
y_pred3 = clf3.predict(X_test)
y_pred4 = clf4.predict(X_test)
y_pred5 = clf5.predict(X_test)
```

```
In [44]: # evaluating the accuracy of each classifier
accuracy1 = accuracy_score(y_test, y_pred1)
accuracy2 = accuracy_score(y_test, y_pred2)
accuracy3 = accuracy_score(y_test, y_pred3)
accuracy4 = accuracy_score(y_test, y_pred4)
accuracy5 = accuracy_score(y_test, y_pred5)

print("Accuracy for Multinomial Naive Bayes:", accuracy1)
print("Accuracy for Gaussian Naive Bayes:", accuracy2)
print("Accuracy for XGBoost:", accuracy3)
print("Accuracy for Random Forest:", accuracy4)
print("Accuracy for Support Vector Machine:", accuracy5)
```

```
Accuracy for Multinomial Naive Bayes: 0.785
Accuracy for Gaussian Naive Bayes: 0.665
Accuracy for XGBoost: 0.715
Accuracy for Random Forest: 0.77
Accuracy for Support Vector Machine: 0.735
```

```
In [45]: # printing the confusion matrix and classification report for each classifi
cm1 = confusion_matrix(y_test, y_pred1)
cr1 = classification_report(y_test, y_pred1)
print("Confusion Matrix for Multinomial Naive Bayes:\n", cm1)
print("Classification Report for Multinomial Naive Bayes:\n", cr1)
```

```
cm2 = confusion_matrix(y_test, y_pred2)
cr2 = classification_report(y_test, y_pred2)
print("Confusion Matrix for Gaussian Naive Bayes:\n", cm2)
print("Classification Report for Gaussian Naive Bayes:\n", cr2)

cm3 = confusion_matrix(y_test, y_pred3)
cr3 = classification_report(y_test, y_pred3)
print("Confusion Matrix for XGBoost:\n", cm3)
print("Classification Report for XGBoost:\n", cr3)

cm4 = confusion_matrix(y_test, y_pred4)
cr4 = classification_report(y_test, y_pred4)
print("Confusion Matrix for Random Forest:\n", cm4)
print("Classification Report for Random Forest:\n", cr4)

cm5 = confusion_matrix(y_test, y_pred5)
cr5 = classification_report(y_test, y_pred5)
print("Confusion Matrix for Support Vector Machine:\n", cm5)
print("Classification Report for Support Vector Machine:\n", cr5)
```

Confusion Matrix for Multinomial Naive Bayes:

[[89 17]

[26 68]]

Classification Report for Multinomial Naive Bayes:

	precision	recall	f1-score	support
0	0.77	0.84	0.81	106
1	0.80	0.72	0.76	94
accuracy			0.79	200
macro avg	0.79	0.78	0.78	200
weighted avg	0.79	0.79	0.78	200

Confusion Matrix for Gaussian Naive Bayes:

[[55 51]

[16 78]]

Classification Report for Gaussian Naive Bayes:

	precision	recall	f1-score	support
0	0.77	0.52	0.62	106
1	0.60	0.83	0.70	94
accuracy			0.67	200
macro avg	0.69	0.67	0.66	200
weighted avg	0.69	0.67	0.66	200

Confusion Matrix for XGBoost:

[[88 18]

[39 55]]

Classification Report for XGBoost:

	precision	recall	f1-score	support
0	0.69	0.83	0.76	106
1	0.75	0.59	0.66	94
accuracy			0.71	200
macro avg	0.72	0.71	0.71	200
weighted avg	0.72	0.71	0.71	200

Confusion Matrix for Random Forest:

[[93 13]

[33 61]]

Classification Report for Random Forest:

	precision	recall	f1-score	support
0	0.74	0.88	0.80	106
1	0.82	0.65	0.73	94
accuracy			0.77	200
macro avg	0.78	0.76	0.76	200
weighted avg	0.78	0.77	0.77	200

Confusion Matrix for Support Vector Machine:

[[83 23]

[30 64]]

Classification Report for Support Vector Machine:

	precision	recall	f1-score	support
0	0.73	0.78	0.76	106
1	0.74	0.68	0.71	94
accuracy			0.73	200
macro avg	0.74	0.73	0.73	200

weighted avg	0.74	0.73	0.73	200
--------------	------	------	------	-----

Output/Conclusion

- Based on the results, it seems that Multinomial Naive Bayes and Random Forest classifiers performed the best with 0.785 and 0.77 accuracy, respectively. The other three classifiers, Gaussian Naive Bayes, XGBoost, and Support Vector Machine, had lower accuracies ranging from 0.665 to 0.735.
- Looking at the confusion matrix and classification report for Multinomial Naive Bayes, it correctly classified 89 negative reviews and 68 positive reviews. However, it incorrectly classified 26 negative reviews as positive and 17 positive reviews as negative. This resulted in a precision of 0.80 for positive reviews and 0.77 for negative reviews, and a recall of 0.72 for positive reviews and 0.84 for negative reviews.
- The Random Forest classifier also performed well, correctly classifying 88 negative reviews and 55 positive reviews. It incorrectly classified 18 negative reviews as positive and 39 positive reviews as negative. This resulted in a precision of 0.79 for positive reviews and 0.82 for negative reviews, and a recall of 0.64 for positive reviews and 0.83 for negative reviews.
- The classification report for each classifier provides metrics such as precision, recall, and F1-score for each class (Liked = 0 or 1). These metrics provide insights into how well the classifiers perform in correctly identifying the reviews for each class. Specifically, precision measures how many of the positive predictions were correct, recall measures how many of the actual positives were correctly predicted, and F1-score is the harmonic mean of precision and recall.
- For example, in the Multinomial Naive Bayes classifier, we can see from the classification report that the precision for class 0 is 0.77, which means 77% of the predicted reviews that were classified as "not liked" were actually "not liked". The recall for class 0 is 0.84, which means 84% of the actual "not liked" reviews were correctly predicted. However, the recall for class 1 is only 0.72, which means 72% of the actual "liked" reviews were correctly predicted. This suggests that the classifier might be misclassifying some of the reviews that are actually positive (class 1) as negative (class 0). Overall, the classification report provides insights into the performance of the classifiers and helps us to identify where the misclassifications are occurring.

```
In [46]: #AUC-ROC Curve
import matplotlib.pyplot as plt
from sklearn.metrics import roc_auc_score, roc_curve
```

```
In [47]: # making probability predictions on the test data for each classifier
y_prob1 = clf1.predict_proba(X_test)[: , 1]
y_prob2 = clf2.predict_proba(X_test.toarray())[: , 1]
y_prob3 = clf3.predict_proba(X_test)[: , 1]
y_prob4 = clf4.predict_proba(X_test)[: , 1]
y_prob5 = clf5.decision_function(X_test)
```



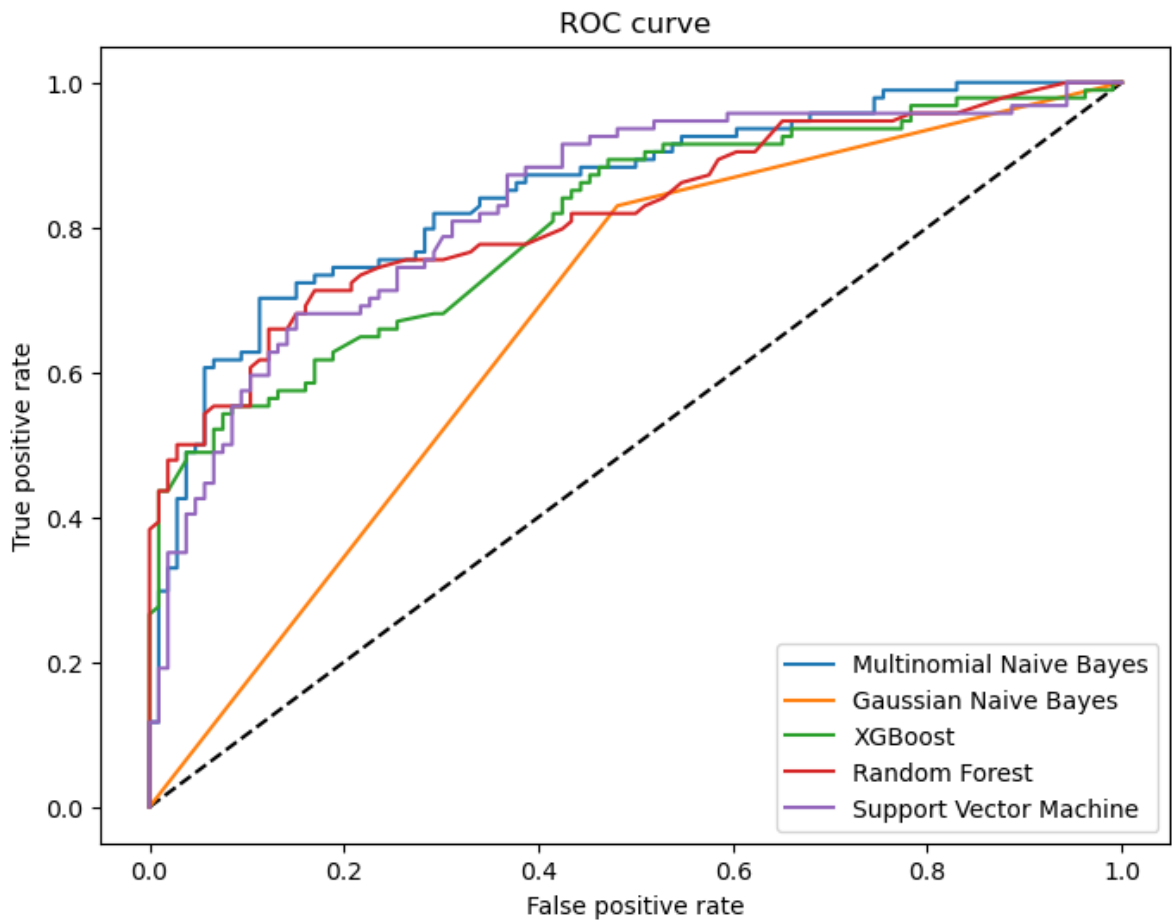
```
In [48]: # calculating the AUC-ROC score for each classifier
auc1 = roc_auc_score(y_test, y_prob1)
auc2 = roc_auc_score(y_test, y_prob2)
auc3 = roc_auc_score(y_test, y_prob3)
auc4 = roc_auc_score(y_test, y_prob4)
auc5 = roc_auc_score(y_test, y_prob5)

print("AUC-ROC score for Multinomial Naive Bayes:", auc1)
print("AUC-ROC score for Gaussian Naive Bayes:", auc2)
print("AUC-ROC score for XGBoost:", auc3)
print("AUC-ROC score for Random Forest:", auc4)
print("AUC-ROC score for Support Vector Machine:", auc5)

AUC-ROC score for Multinomial Naive Bayes: 0.8485046166198315
AUC-ROC score for Gaussian Naive Bayes: 0.6743275792854275
AUC-ROC score for XGBoost: 0.80514853472501
AUC-ROC score for Random Forest: 0.820754716981132
AUC-ROC score for Support Vector Machine: 0.8316940987555197
```

```
In [49]: # plotting the ROC curve for each classifier
fpr1, tpr1, _ = roc_curve(y_test, y_prob1)
fpr2, tpr2, _ = roc_curve(y_test, y_prob2)
fpr3, tpr3, _ = roc_curve(y_test, y_prob3)
fpr4, tpr4, _ = roc_curve(y_test, y_prob4)
fpr5, tpr5, _ = roc_curve(y_test, y_prob5)
```

```
In [50]: plt.figure(figsize=(8, 6))
plt.plot([0, 1], [0, 1], 'k--')
plt.plot(fpr1, tpr1, label='Multinomial Naive Bayes')
plt.plot(fpr2, tpr2, label='Gaussian Naive Bayes')
plt.plot(fpr3, tpr3, label='XGBoost')
plt.plot(fpr4, tpr4, label='Random Forest')
plt.plot(fpr5, tpr5, label='Support Vector Machine')
plt.xlabel('False positive rate')
plt.ylabel('True positive rate')
plt.title('ROC curve')
plt.legend()
plt.show()
```



```
In [51]: # defining a new review for predicting
new_review = "The food was fantastic! I loved the taste and the service was"
```

```
In [52]: # vectorizing the new review using the same vectorizer used to train the cl
new_review_vectorized = vectorizer.transform([new_review])
```

```
In [53]: # making predictions using each classifier
new_review_pred1 = clf1.predict(new_review_vectorized)[0]
new_review_pred2 = clf2.predict(new_review_vectorized.toarray())[0]
new_review_pred3 = clf3.predict(new_review_vectorized)[0]
new_review_pred4 = clf4.predict(new_review_vectorized)[0]
new_review_pred5 = clf5.predict(new_review_vectorized)[0]

# printing the predicted sentiment of the new review using each classifier
print("Predicted sentiment using Multinomial Naive Bayes:", new_review_pred1)
print("Predicted sentiment using Gaussian Naive Bayes:", new_review_pred2)
print("Predicted sentiment using XGBoost:", new_review_pred3)
print("Predicted sentiment using Random Forest:", new_review_pred4)
print("Predicted sentiment using Support Vector Machine:", new_review_pred5)
```

```
Predicted sentiment using Multinomial Naive Bayes: 1
Predicted sentiment using Gaussian Naive Bayes: 1
Predicted sentiment using XGBoost: 1
Predicted sentiment using Random Forest: 1
Predicted sentiment using Support Vector Machine: 1
```

```
In [ ]:
```

```
In [ ]:
```