Project Title: Market Basket insights

Problem Statement:

Unveiling Customer Behaviour through Association Analysis: Utilize market basket analysis on the provided dataset to uncover hidden patterns and associations between products, aiming to understand customer purchasing behaviour and identify potential cross-selling opportunities for the retail business.

Abstract:

This paper aims to present an approach to detect interrelations among product categories,which are then used to produce a partition of a retailer's business into subsets of categories. The methodology also yields a segmentation of shopping trips based on the composition of each shopping basket.

Objective:

- To understand what Market Basket Insights is and how it is used.
- How does Market Basket insights work?
- Algorithm to implement Market Basket insights in python.
- Benefits of market basket iinsights.

Market Basket insights:

Market basket insights is a data mining technique used by retailers to increase sales by better understanding customer purchasing patterns. It involves analyzing large data sets, such as purchase history, to reveal product groupings, as well as products that are likely to be purchased together.

Implementing market basket insights in python :

The method:

Here are the steps involved in using the apriori algorithm to implement market basket insights.

1.First, define the minimum support and confidence for the association rule.

2.Find out all the subsets in the transactions with higher support(sup) than the minimum support.

3.Find all the rules for these subsets with higher confidence than minimum confidence.

4.Sort these association rules in decreasing order.

5.Analyze the rules along with their confidence and support.

The Dataset:

The Apriori algorithm is frequently used by data scientists. We are required to import the necessary libraries. Python provides the apyori as an API that is required to be imported to run the Apriori Algorithm.

```
import pandas as pd
import numpy as np
from apyori import ap
```

There is no header in the dataset; hence, the first row contains the first transaction, so we have mentioned
header= None here.

```
import pandas as pd
import numpy as np
from apyori import apriori

st_df=pd.read_csv("store_data.csv",header=None)
print(st_df)
```

https://replit.com/@shivanshkausha/Businessanalysis
Once we have read the dataset completely, we are required to get the list of items in every transaction. So we are going to run two loops. One will be for the total number of transactions, and the other will be for the total number of columns in every transaction. The list will work as a training set from where we can generate the list of Association Rules.

```
#converting dataframe into list of lists
l=[]
for i in range(1,7501):
l.append([str(st_df.values[i,j]) for j in range(0,20)])
```

So we are ready with the list of items in our training set, then we need to run the apriori algorithm, which will learn the list of association rules from the training set, i.e., list. So, the minimum support here will be 0.0045, which is taken here as support. Now let us see that we have kept 0.2 as the min confidence. The minimum lift value is taken as 3, and the minimum length is considered as 2 because we have to find an association among a minimum of two items.

```
#applying apriori algorithm
association_rules = apriori(l, min_support=0.0045, min_confidence=0.2, min_lift=3,
min_length=2)
association_results = list(association_rules)
```

After running the above line of code, we generated the list of association rules between the items. So to see these rules, the below line of code needs to be run.

```
for i in range(0, len(association_results)):
    print(association_results[i][0])
```

Output:

```
frozenset({'light cream', 'chicken'})
frozenset({'mushroom cream sauce', 'escalope'})
frozenset({'pasta', 'escalope'})
frozenset({'herb & pepper', 'ground beef'})
frozenset({'tomato sauce', 'ground beef'})
frozenset({'whole wheat pasta', 'olive oil'})
frozenset({'shrimp', 'pasta'})
frozenset({'nan', 'light cream', 'chicken'})
frozenset({'shrimp', 'frozen vegetables', 'chocolate'})
frozenset({'spaghetti', 'cooking oil', 'ground beef'})
frozenset({'mushroom cream sauce', 'nan', 'escalope'})
frozenset({'nan', 'pasta', 'escalope'})
frozenset({'spaghetti', 'frozen vegetables', 'ground beef'})
frozenset({'olive oil', 'frozen vegetables', 'milk'})
frozenset({'shrimp', 'frozen vegetables', 'mineral water'})
frozenset({'spaghetti', 'olive oil', 'frozen vegetables'})
frozenset({'spaghetti', 'shrimp', 'frozen vegetables'})
frozenset({'spaghetti', 'frozen vegetables', 'tomatoes'})
frozenset({'spaghetti', 'grated cheese', 'ground beef'})
frozenset({'herb & pepper', 'mineral water', 'ground beef'})
frozenset({'nan', 'herb & pepper', 'ground beef'})
frozenset({'spaghetti', 'herb & pepper', 'ground beef'})
frozenset({'olive oil', 'milk', 'ground beef'})
frozenset({'nan', 'tomato sauce', 'ground beef'})
frozenset({'spaghetti', 'shrimp', 'ground beef'})
frozenset({'spaghetti', 'olive oil', 'milk'})
frozenset({'soup', 'olive oil', 'mineral water'})
frozenset({'whole wheat pasta', 'nan', 'olive oil'})
frozenset({'nan', 'shrimp', 'pasta'})
frozenset({'spaghetti', 'olive oil', 'pancakes'})
frozenset({'nan', 'shrimp', 'frozen vegetables', 'chocolate'})
frozenset({'spaghetti', 'nan', 'cooking oil', 'ground beef'})
frozenset({'spaghetti', 'nan', 'frozen vegetables', 'ground beef'})
frozenset({'spaghetti', 'frozen vegetables', 'milk', 'mineral water'})
frozenset({'nan', 'frozen vegetables', 'milk', 'olive oil'})
frozenset({'nan', 'shrimp', 'frozen vegetables', 'mineral water'})
frozenset({'spaghetti', 'nan', 'frozen vegetables', 'olive oil'})
frozenset({'spaghetti', 'nan', 'shrimp', 'frozen vegetables'})
frozenset({'spaghetti', 'nan', 'frozen vegetables', 'tomatoes'})
frozenset({'spaghetti', 'nan', 'grated cheese', 'ground beef'})
frozenset({'nan', 'herb & pepper', 'mineral water', 'ground beef'})
frozenset({'spaghetti', 'nan', 'herb & pepper', 'ground beef'})
frozenset({'nan', 'milk', 'olive oil', 'ground beef'})
frozenset({'spaghetti', 'nan', 'shrimp', 'ground beef'})
frozenset({'spaghetti', 'nan', 'milk', 'olive oil'})
frozenset({'soup', 'nan', 'olive oil', 'mineral water'})
frozenset({'spaghetti', 'nan', 'olive oil', 'pancakes'})
frozenset({'spaghetti', 'milk', 'mineral water', 'nan', 'frozen vegetables'})
```

Here we are going to display the Rule, Support, and lift ratio for every above association rule by using for loop.

```
for item in association_results:
   # first index of the inner list
   # Contains base item and add item
   pair = item[0]
   items = [x for x in pair]
   print("Rule: " + items[0] + " -> " + items[1])
   # second index of the inner list
   print("Support: " + str(item[1]))
   # third index of the list located at 0th position
   # of the third index of the inner list
   print("Confidence: " + str(item[2][0][2]))
   print("Lift: " + str(item[2][0][3]))
   print("--------------------------------------------------")
```

Output:

```
Rule: light cream -> chicken
Support: 0.0045333333333333334
Confidence: 0.2905982905982906
Lift: 4.843304843304844
--------------------------------------------------
Rule: mushroom cream sauce -> escalope
Support: 0.005733333333333333
Confidence: 0.30069930069930073
Lift: 3.7903273197390845
--------------------------------------------------
Rule: pasta -> escalope
Support: 0.005866666666666667
Confidence: 0.37288135593220345
Lift: 4.700185158809287
--------------------------------------------------
Rule: herb & pepper -> ground beef
Support: 0.016
Confidence: 0.3234501347708895
Lift: 3.2915549671393096
```

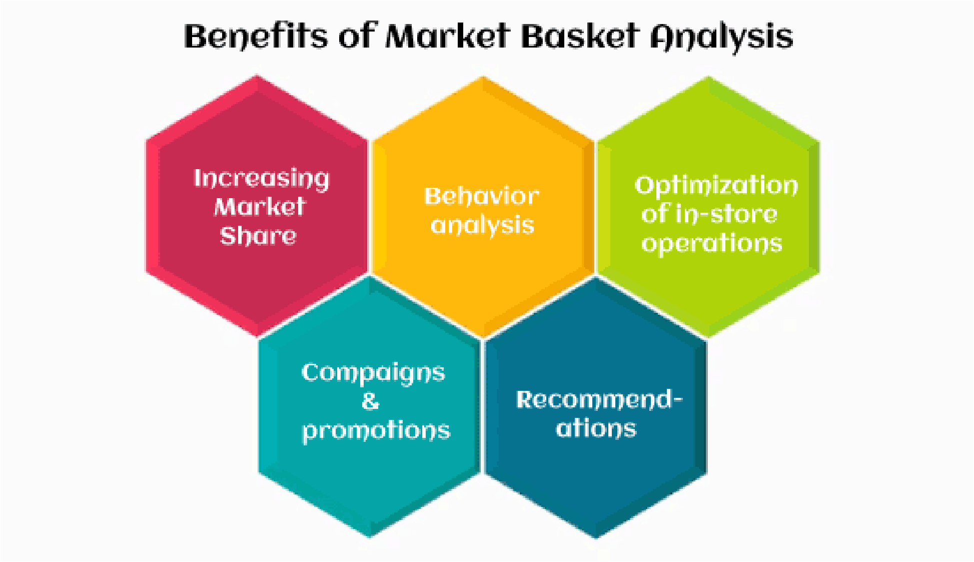
```
--------------------------------------------------
Rule: tomato sauce -> ground beef
Support: 0.005333333333333333
Confidence: 0.37735849056603776
Lift: 3.840147461662528
--------------------------------------------------
Rule: whole wheat pasta -> olive oil
Support: 0.008
Confidence: 0.2714932126696833
Lift: 4.130221288078346
--------------------------------------------------
Rule: shrimp -> pasta
Support: 0.005066666666666666
Confidence: 0.3220338983050848
Lift: 4.514493901473151
--------------------------------------------------
Rule: nan -> light cream
Support: 0.004533333333333334
Confidence: 0.2905982905982906
Lift: 4.843304843304844
--------------------------------------------------
Rule: shrimp -> frozen vegetables
Support: 0.005333333333333333
Confidence: 0.23255813953488372
Lift: 3.260160834601174
--------------------------------------------------
Rule: spaghetti -> cooking oil
Support: 0.0048
Confidence: 0.5714285714285714
Lift: 3.281557646029315
--------------------------------------------------
Rule: mushroom cream sauce -> nan
Support: 0.005733333333333333
Confidence: 0.30069930069930073
Lift: 3.7903273197390845
--------------------------------------------------
Rule: nan -> pasta
Support: 0.005866666666666667
Confidence: 0.37288135593220345
Lift: 4.700185158809287
--------------------------------------------------
Rule: spaghetti -> frozen vegetables
Support: 0.008666666666666666
Confidence: 0.3110047846889952
```

```
Lift: 3.164906221394116
--------------------------------------------------
Rule: olive oil -> frozen vegetables
Support: 0.0048
Confidence: 0.2033898305084745б
Lift: 3.094165778526489
--------------------------------------------------
Rule: shrimp -> frozen vegetables
Support: 0.0072
Confidence: 0.3068181818181818
Lift: 3.2183725365543547
--------------------------------------------------
Rule: spaghetti -> olive oil
Support: 0.005733333333333333
Confidence: 0.20574162679425836
Lift: 3.1299436124887174
--------------------------------------------------
Rule: spaghetti -> shrimp
Support: 0.006
Confidence: 0.21531100478468898
Lift: 3.0183785717479763
--------------------------------------------------
Rule: spaghetti -> frozen vegetables
Support: 0.006666666666666667
Confidence: 0.23923444976076555
Lift: 3.497579674864993
--------------------------------------------------
Rule: spaghetti -> grated cheese
Support: 0.005333333333333333
Confidence: 0.3225806451612903
Lift: 3.282706701098612
--------------------------------------------------
Rule: herb & pepper -> mineral water
Support: 0.006666666666666667
Confidence: 0.390625
Lift: 3.975152645861601
--------------------------------------------------
Rule: nan -> herb & pepper
Support: 0.016
Confidence: 0.3234501347708895
Lift: 3.2915549671393096
--------------------------------------------------
Rule: spaghetti -> herb & pepper
Support: 0.0064
```

```
Confidence: 0.3934426229508197
Lift: 4.003825878061259
--------------------------------------------------
Rule: olive oil -> milk
Support: 0.004933333333333333
Confidence: 0.22424242424242424
Lift: 3.411395906324912
--------------------------------------------------
Rule: nan -> tomato sauce
Support: 0.005333333333333333
Confidence: 0.37735849056603776
Lift: 3.840147461662528
--------------------------------------------------
Rule: spaghetti -> shrimp
Support: 0.006
Confidence: 0.5232558139534884
Lift: 3.004914704939635
--------------------------------------------------
Rule: spaghetti -> olive oil
Support: 0.0072
Confidence: 0.20300751879699247
Lift: 3.0883496774390333
--------------------------------------------------
Rule: soup -> olive oil
Support: 0.0052
Confidence: 0.2254335260115607
Lift: 3.4295161157945335
--------------------------------------------------
Rule: whole wheat pasta -> nan
Support: 0.008
Confidence: 0.2714932126696833
Lift: 4.130221288078346
--------------------------------------------------
Rule: nan -> shrimp
Support: 0.005066666666666666
Confidence: 0.3220338983050848
Lift: 4.514493901473151
--------------------------------------------------
Rule: spaghetti -> olive oil
Support: 0.005066666666666666
Confidence: 0.20105820105820105
Lift: 3.0586947422647217
--------------------------------------------------
Rule: nan -> shrimp
```

```
Support: 0.005333333333333333
Confidence: 0.23255813953488372
Lift: 3.260160834601174
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.0048
Confidence: 0.5714285714285714
Lift: 3.281557646029315
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.008666666666666666
Confidence: 0.3110047846889952
Lift: 3.164906221394116
--------------------------------------------------
Rule: spaghetti -> frozen vegetables
Support: 0.004533333333333334
Confidence: 0.28813559322033905
Lift: 3.0224013274860737
--------------------------------------------------
Rule: nan -> frozen vegetables
Support: 0.0048
Confidence: 0.20338983050847456
Lift: 3.094165778526489
--------------------------------------------------
Rule: nan -> shrimp
Support: 0.0072
Confidence: 0.3068181818181818
Lift: 3.2183725365543547
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.005733333333333333
Confidence: 0.20574162679425836
Lift: 3.1299436124887174
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.006
Confidence: 0.21531100478468898
Lift: 3.0183785717479763
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.006666666666666667
Confidence: 0.23923444976076555
Lift: 3.497579674864993
--------------------------------------------------
```

```
Rule: spaghetti -> nan
Support: 0.005333333333333333
Confidence: 0.3225806451612903
Lift: 3.282706701098612
--------------------------------------------------
Rule: nan -> herb & pepper
Support: 0.006666666666666667
Confidence: 0.390625
Lift: 3.975152645861601
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.0064
Confidence: 0.3934426229508197
Lift: 4.003825878061259
--------------------------------------------------
Rule: nan -> milk
Support: 0.004933333333333333
Confidence: 0.22424242424242424
Lift: 3.411395906324912
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.006
Confidence: 0.5232558139534884
Lift: 3.004914704939635
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.0072
Confidence: 0.20300751879699247
Lift: 3.0883496774390333
--------------------------------------------------
Rule: soup -> nan
Support: 0.0052
Confidence: 0.2254335260115607
Lift: 3.4295161157945335
--------------------------------------------------
Rule: spaghetti -> nan
Support: 0.005066666666666666
Confidence: 0.20105820105820105
Lift: 3.0586947422647217
--------------------------------------------------
Rule: spaghetti -> milk
Support: 0.004533333333333334
Confidence: 0.28813559322033905
Lift: 3.0224013274860737
```



EXAMINING DIFFERENTIAL MARKET BASKET:

This type of analysis is helpful for competition analysis. The system analyzes purchase histories across brands, time periods, seasons, days of the week, etc. to uncover interesting patterns in consumer behavior.

Types of market basket analysis

Retailers should understand the following types of market basket analysis:

- **Predictive market basket analysis.** This type considers items purchased in sequence to determine cross-sell.
- **Differential market basket analysis.** This type considers data across different stores, as well as purchases from different customer groups during different times of the day, month or year. If a rule holds in one dimension, such as store, time period or customer group, but does not hold in the others, analysts can determine the factors responsible for the exception

This package supports the Apriori algorithm, along with the following other mining algorithms:

arulesNBMine,rOpusminer,RKEEL,RSarules

Conclusion:

we discussed Market Basket insights and learned the steps to implement it from scratch using Python. We then implemented Market Basket Analysis using Apriori Algorithm. We also looked into the various uses and advantages of this algorithm.