Installing & Importing Packages

In [ ]:
```
!pip install mlxtend
```

```
Requirement already satisfied: mlxtend in /usr/local/lib/python3.10/dist-packages (0.22.0)
Requirement already satisfied: scipy>=1.2.1 in /usr/local/lib/python3.10/dist-packages (from mlxtend) (1.11.3)
Requirement already satisfied: numpy>=1.16.2 in /usr/local/lib/python3.10/dist-packages (from mlxtend) (1.23.5)
Requirement already satisfied: pandas>=0.24.2 in /usr/local/lib/python3.10/dist-packages (from mlxtend) (1.5.3)
Requirement already satisfied: scikit-learn>=1.0.2 in /usr/local/lib/python3.10/dist-packages (from mlxtend) (1.2.2)
Requirement already satisfied: matplotlib>=3.0.0 in /usr/local/lib/python3.10/dist-packages (from mlxtend) (3.7.1)
Requirement already satisfied: joblib>=0.13.2 in /usr/local/lib/python3.10/dist-packages (from mlxtend) (1.3.2)
Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-packages (from mlxtend) (67.7.2)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.0.0->m
lxtend) (1.1.1)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.0.0->mlxte
nd) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.0.0->
mlxtend) (4.43.1)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.0.0->
mlxtend) (1.4.5)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.0.0->ml
xtend) (23.2)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.0.0->mlxt
end) (9.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.0.0->m
lxtend) (3.1.1)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib>=3.0.
0->mlxtend) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/dist-packages (from pandas>=0.24.2->mlxtend)
(2023.3.post1)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from scikit-learn>=1.
0.2->mlxtend) (3.2.0)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplo
tlib>=3.0.0->mlxtend) (1.16.0)
```

In [ ]:
```
import pandas as pd
import csv
from mlxtend.preprocessing import TransactionEncoder
from mlxtend.frequent_patterns import apriori, association_rules
```

Importing Dataset

In [ ]:
```
dataset = []
with open('Market_Basket_Optimisation.csv') as file:
  reader =  csv.reader(file, delimiter=',')
  for row in reader:
    dataset += [row]
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

In [ ]:
```
dataset[0:11]
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[4]:
```
[['shrimp',
  'almonds',
  'avocado',
  'vegetables mix',
  'green grapes',
  'whole weat flour',
  'yams',
  'cottage cheese',
  'energy drink',
  'tomato juice',
  'low fat yogurt',
  'green tea',
  'honey',
  'salad',
  'mineral water',
  'salmon',
  'antioxydant juice',
  'frozen smoothie',
  'spinach',
  'olive oil'],
 ['burgers', 'meatballs', 'eggs'],
 ['chutney'],
 ['turkey', 'avocado'],
 ['mineral water', 'milk', 'energy bar', 'whole wheat rice', 'green tea'],
 ['low fat yogurt'],
 ['whole wheat pasta', 'french fries'],
 ['soup', 'light cream', 'shallot'],
 ['frozen vegetables', 'spaghetti', 'green tea'],
 ['french fries'],
 ['eggs', 'pet food']]
```

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

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[5]:
```
7501
```

Processing Data

In [ ]:
```
te = TransactionEncoder()
x = te.fit_transform(dataset)
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

In [ ]:
```
x
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[8]:
```
array([[False,  True,  True, ...,  True, False, False],
       [False, False, False, ..., False, False, False],
       [False, False, False, ..., False, False, False],
       ...,
       [False, False, False, ..., False, False, False],
       [False, False, False, ..., False, False, False],
       [False, False, False, ..., False,  True, False]])
```

In [ ]:
```
te.columns_ #Model Parameter that's why there is underscore
```

```
 'brownies',
 'bug spray',
 'burger sauce',
 'burgers',
 'butter',
 'cake',
 'candy bars',
 'carrots',
 'cauliflower',
 'cereals',
 'champagne',
 'chicken',
 'chili',
 'chocolate',
 'chocolate bread',
 'chutney',
 'cider',
 'clothes accessories',
 'cookies',
 'cooking oil',
```

In [ ]:
```
len(te.columns_)
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[12]:
```
120
```

In [ ]:
```
df = pd.DataFrame(x, columns=te.columns_)
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

In [ ]:
```
df
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[14]:

	asparagus	almonds	antioxydant juice	asparagus	avocado	babies food	bacon	barbecue sauce	black tea	blueberries	...	turkey	vegetables mix	water spray	white wine	w
0	False	True	True	False	True	False	False	False	False	False	...	False	True	False	False	
1	False	False	False	False	False	False	False	False	False	False	...	False	False	False	False	F
2	False	False	False	False	False	False	False	False	False	False	...	False	False	False	False	F
3	False	False	False	False	True	False	False	False	False	False	...	True	False	False	False	F
4	False	False	False	False	False	False	False	False	False	False	...	False	False	False	False	F
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
7496	False	False	False	False	False	False	False	False	False	False	...	False	False	False	False	F
7497	False	False	False	False	False	False	False	False	False	False	...	False	False	False	False	F
7498	False	False	False	False	False	False	False	False	False	False	...	False	False	False	False	F
7499	False	False	False	False	False	False	False	False	False	False	...	False	False	False	False	F
7500	False	False	False	False	False	False	False	False	False	False	...	False	False	False	False	F

7501 rows × 120 columns

Finding Frequent itemsets

In [ ]:
```
freq_itemset = apriori(df, min_support=0.02, use_colnames=True)
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

In [ ]:
```
freq_itemset
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[18]:

	support	itemsets
0	0.020397	(almonds)
1	0.033329	(avocado)
2	0.033729	(brownies)
3	0.087188	(burgers)
4	0.030129	(butter)
...	...	...
98	0.020131	(mineral water, whole wheat rice)
99	0.022930	(olive oil, spaghetti)
100	0.025197	(spaghetti, pancakes)
101	0.021197	(spaghetti, shrimp)
102	0.020931	(spaghetti, tomatoes)

103 rows × 2 columns

Finding the Association Rules

In [ ]:
```
rules = association_rules(freq_itemset, metric='confidence', min_threshold=0.25)
rules
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[19]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
0	(burgers)	(eggs)	0.087188	0.179709	0.028796	0.330275	1.837830	0.013128	1.224818	0.499424
1	(burgers)	(french fries)	0.087188	0.170911	0.021997	0.252294	1.476173	0.007096	1.108844	0.353384
2	(burgers)	(mineral water)	0.087188	0.238368	0.024397	0.279817	1.173883	0.003614	1.057552	0.162275
3	(cake)	(mineral water)	0.081056	0.238368	0.027463	0.338816	1.421397	0.008142	1.151921	0.322617
4	(chicken)	(mineral water)	0.059992	0.238368	0.022797	0.380000	1.594172	0.008497	1.228438	0.396502
5	(chocolate)	(mineral water)	0.163845	0.238368	0.052660	0.321400	1.348332	0.013604	1.122357	0.308965
6	(cooking oil)	(mineral water)	0.051060	0.238368	0.020131	0.394256	1.653978	0.007960	1.257349	0.416672
7	(eggs)	(mineral water)	0.179709	0.238368	0.050927	0.283383	1.188845	0.008090	1.062815	0.193648
8	(frozen smoothie)	(mineral water)	0.063325	0.238368	0.020264	0.320000	1.342461	0.005169	1.120047	0.272346
9	(frozen vegetables)	(mineral water)	0.095321	0.238368	0.035729	0.374825	1.572463	0.013007	1.218270	0.402413
10	(frozen vegetables)	(spaghetti)	0.095321	0.174110	0.027863	0.292308	1.678867	0.011267	1.167018	0.446965
11	(ground beef)	(mineral water)	0.098254	0.238368	0.040928	0.416554	1.747522	0.017507	1.305401	0.474369
12	(ground beef)	(spaghetti)	0.098254	0.174110	0.039195	0.398915	2.291162	0.022088	1.373997	0.624943
13	(low fat yogurt)	(mineral water)	0.076523	0.238368	0.023997	0.313589	1.315565	0.005756	1.109585	0.259747
14	(milk)	(mineral water)	0.129583	0.238368	0.047994	0.370370	1.553774	0.017105	1.209650	0.409465
15	(milk)	(spaghetti)	0.129583	0.174110	0.035462	0.273663	1.571779	0.012900	1.137061	0.417935
16	(olive oil)	(mineral water)	0.065858	0.238368	0.027596	0.419028	1.757904	0.011898	1.310962	0.461536
17	(pancakes)	(mineral water)	0.095054	0.238368	0.033729	0.354839	1.488616	0.011071	1.180529	0.362712

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
18	(shrimp)	(mineral water)	0.071457	0.238368	0.023597	0.330224	1.385352	0.006564	1.137144	0.299568
19	(soup)	(mineral water)	0.050527	0.238368	0.023064	0.456464	1.914955	0.011020	1.401255	0.503221
20	(mineral water)	(spaghetti)	0.238368	0.174110	0.059725	0.250559	1.439085	0.018223	1.102008	0.400606
21	(spaghetti)	(mineral water)	0.174110	0.238368	0.059725	0.343032	1.439085	0.018223	1.159314	0.369437
22	(tomatoes)	(mineral water)	0.068391	0.238368	0.024397	0.356725	1.496530	0.008095	1.183991	0.356144
23	(whole wheat rice)	(mineral water)	0.058526	0.238368	0.020131	0.343964	1.442993	0.006180	1.160960	0.326080
24	(olive oil)	(spaghetti)	0.065858	0.174110	0.022930	0.348178	1.999758	0.011464	1.267048	0.535186
25	(pancakes)	(spaghetti)	0.095054	0.174110	0.025197	0.265077	1.522468	0.008647	1.123778	0.379218
26	(shrimp)	(spaghetti)	0.071457	0.174110	0.021197	0.296642	1.703760	0.008756	1.174209	0.444850
27	(tomatoes)	(spaghetti)	0.068391	0.174110	0.020931	0.306043	1.757755	0.009023	1.190117	0.462740

In [ ]:
```
cut = rules[['antecedents', 'consequents', 'support', 'confidence']] #Slicing important rules
cut
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[21]:

	antecedents	consequents	support	confidence
0	(burgers)	(eggs)	0.028796	0.330275
1	(burgers)	(french fries)	0.021997	0.252294
2	(burgers)	(mineral water)	0.024397	0.279817
3	(cake)	(mineral water)	0.027463	0.338816
4	(chicken)	(mineral water)	0.022797	0.380000
5	(chocolate)	(mineral water)	0.052660	0.321400
6	(cooking oil)	(mineral water)	0.020131	0.394256
7	(eggs)	(mineral water)	0.050927	0.283383
8	(frozen smoothie)	(mineral water)	0.020264	0.320000
9	(frozen vegetables)	(mineral water)	0.035729	0.374825
10	(frozen vegetables)	(spaghetti)	0.027863	0.292308
11	(ground beef)	(mineral water)	0.040928	0.416554
12	(ground beef)	(spaghetti)	0.039195	0.398915
13	(low fat yogurt)	(mineral water)	0.023997	0.313589
14	(milk)	(mineral water)	0.047994	0.370370
15	(milk)	(spaghetti)	0.035462	0.273663
16	(olive oil)	(mineral water)	0.027596	0.419028
17	(pancakes)	(mineral water)	0.033729	0.354839
18	(shrimp)	(mineral water)	0.023597	0.330224
19	(soup)	(mineral water)	0.023064	0.456464
20	(mineral water)	(spaghetti)	0.059725	0.250559
21	(spaghetti)	(mineral water)	0.059725	0.343032
22	(tomatoes)	(mineral water)	0.024397	0.356725
23	(whole wheat rice)	(mineral water)	0.020131	0.343964
24	(olive oil)	(spaghetti)	0.022930	0.348178
25	(pancakes)	(spaghetti)	0.025197	0.265077

	antecedents	consequents	support	confidence
26	(shrimp)	(spaghetti)	0.021197	0.296642
27	(tomatoes)	(spaghetti)	0.020931	0.306043

In [ ]:
```
rules[rules['antecedents']=={'cake'}]
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[26]:

	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
3	(cake)	(mineral water)	0.081056	0.238368	0.027463	0.338816	1.421397	0.008142	1.151921	0.322617

In [ ]:
```
cut[rules['antecedents']=={'shrimp'}]
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[27]:

	antecedents	consequents	support	confidence
18	(shrimp)	(mineral water)	0.023597	0.330224
26	(shrimp)	(spaghetti)	0.021197	0.296642

In [ ]:
```
rules[rules['antecedents']=={'cake'}]['consequents']
```

```
/usr/local/lib/python3.10/dist-packages/ipykernel/ipkernel.py:283: DeprecationWarning: `should_run_async` will not ca
ll `transform_cell` automatically in the future. Please pass the result to `transformed_cell` argument and any except
ion that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.
  and should_run_async(code)
```

Out[28]:
```
3    (mineral water)
Name: consequents, dtype: object
```