

```
In [1]: !pip install apyori
```

```
Collecting apyori
  Downloading apyori-1.1.2.tar.gz (8.6 kB)
Building wheels for collected packages: apyori
  Building wheel for apyori (setup.py): started
  Building wheel for apyori (setup.py): finished with status 'done'
  Created wheel for apyori: filename=apyori-1.1.2-py3-none-any.whl size=5974 sha25
6=d510312129e93580e9873c87442a1a27a0c78d2c0ad359fd168e18fe9e9bfd1b
  Stored in directory: c:\users\nithi\appdata\local\pip\cache\wheels\32\2a\54\10c5
95515f385f3726642b10c60bf788029e8f3a1323e3913a
Successfully built apyori
Installing collected packages: apyori
Successfully installed apyori-1.1.2
```

```
In [61]: #import all required packages..
import pandas as pd
import numpy as np
from apyori import apriori
```

```
In [62]: #Loading market basket dataset..
```

```
df = pd.read_csv('Market_Basket_Optimisation.csv', header=None)
df.head()
```

Out[62]:

|   | 0             | 1         | 2       | 3              | 4                | 5                 | 6    | 7              | 8            | 9            | 10             |
|---|---------------|-----------|---------|----------------|------------------|-------------------|------|----------------|--------------|--------------|----------------|
| 0 | shrimp        | almonds   | avocado | vegetables mix | green grapes     | whole wheat flour | yams | cottage cheese | energy drink | tomato juice | low fat yogurt |
| 1 | burgers       | meatballs |         | eggs           | NaN              | NaN               | NaN  | NaN            | NaN          | NaN          | NaN            |
| 2 | chutney       |           | NaN     |                | NaN              | NaN               | NaN  | NaN            | NaN          | NaN          | NaN            |
| 3 | turkey        | avocado   |         | NaN            | NaN              | NaN               | NaN  | NaN            | NaN          | NaN          | NaN            |
| 4 | mineral water |           | milk    | energy bar     | whole wheat rice | green tea         | NaN  | NaN            | NaN          | NaN          | NaN            |

In [63]: #replacing empty value with 0.  
df.fillna(0,inplace=True)  
df.head()

Out[63]:

|   | 0             | 1         | 2       | 3              | 4                | 5                 | 6    | 7              | 8            | 9            | 10             |
|---|---------------|-----------|---------|----------------|------------------|-------------------|------|----------------|--------------|--------------|----------------|
| 0 | shrimp        | almonds   | avocado | vegetables mix | green grapes     | whole wheat flour | yams | cottage cheese | energy drink | tomato juice | low fat yogurt |
| 1 | burgers       | meatballs |         | eggs           | 0                | 0                 | 0    | 0              | 0            | 0            | 0              |
| 2 | chutney       |           | 0       |                | 0                | 0                 | 0    | 0              | 0            | 0            | 0              |
| 3 | turkey        | avocado   |         | 0              | 0                | 0                 | 0    | 0              | 0            | 0            | 0              |
| 4 | mineral water |           | milk    | energy bar     | whole wheat rice | green tea         | 0    | 0              | 0            | 0            | 0              |

```
In [64]: #for using aprori need to convert data in List format..
# transaction = [['apple', 'almonds'], ['apple'], ['banana', 'apple']]....
transactions = []
for i in range(0, len(df)):
    transactions.append([str(df.values[i, j]) for j in range(0, 20) if str(df.values[i, j]) != 'nan'])
```

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In [65]: transactions[0]
```

```
Out[65]: ['shrimp',
'almonds',
'avocado',
'vegetables mix',
'green grapes',
'whole wheat 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']
```

```
In [66]: #Call apriori function which requires minimum support, confidance and lift, min len
rules = apriori(transactions,min_support=0.003,min_confidance=0.2,min_lift=3,min_le
#it generates a set of rules in a generator file...
rules
```

```
Out[66]: <generator object apriori at 0x000001709FEF8040>
```

```
In [67]: # all rules need to be converted in a List..
Results = list(rules)
Results
```

```
Out[67]: [RelationRecord(items=frozenset({'cottage cheese', 'brownies'}), support=0.0034662045060658577, ordered_statistics=[OrderedStatistic(items_base=frozenset({'brownies'}), items_add=frozenset({'cottage cheese'}), confidence=0.10276679841897232, lift=3.225329518580382), OrderedStatistic(items_base=frozenset({'cottage cheese'}), items_add=frozenset({'brownies'}), confidence=0.10878661087866107, lift=3.2253295185803816)], RelationRecord(items=frozenset({'chicken', 'light cream'}), support=0.004532728969470737, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken'}), items_add=frozenset({'light cream'}), confidence=0.07555555555555556, lift=4.843950617283951), OrderedStatistic(items_base=frozenset({'light cream'}), items_add=frozenset({'chicken'}), confidence=0.29059829059829057, lift=4.84395061728395)], RelationRecord(items=frozenset({'mushroom cream sauce', 'escalope'}), support=0.05732568990801226, ordered_statistics=[OrderedStatistic(items_base=frozenset({'escalope'}), items_add=frozenset({'mushroom cream sauce'}), confidence=0.0722689075630252, lift=3.7908326967150496), OrderedStatistic(items_base=frozenset({'mushroom cream sauce'}), items_add=frozenset({'escalope'}), confidence=0.3006993006993007, lift=3.790832696715049)], RelationRecord(items=frozenset({'pasta', 'escalope'}), support=0.005865884548726837, ordered_statistics=[OrderedStatistic(items_base=frozenset({'escalope'}), items_add=frozenset({'pasta'}), confidence=0.07394957983193277, lift=4.700811850163794), OrderedStatistic(items_base=frozenset({'pasta'}), items_add=frozenset({'escalope'}), confidence=0.3728813559322034, lift=4.700811850163794)], RelationRecord(items=frozenset({'tomato juice', 'fresh bread'}), support=0.004266097853619517, ordered_statistics=[OrderedStatistic(items_base=frozenset({'fresh bread'}), items_add=frozenset({'tomato juice'}), confidence=0.09907120743034055, lift=3.2593558198902826), OrderedStatistic(items_base=frozenset({'tomato juice'}), items_add=frozenset({'fresh bread'}), confidence=0.14035087719298245, lift=3.2593558198902826)], RelationRecord(items=frozenset({'honey', 'fresh tuna'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'fresh tuna'}), items_add=frozenset({'honey'}), confidence=0.17964071856287428, lift=3.7850703088205613), OrderedStatistic(items_base=frozenset({'honey'}), items_add=frozenset({'fresh tuna'}), confidence=0.08426966292134831, lift=3.7850703088205613)], RelationRecord(items=frozenset({'fromage blanc', 'honey'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'fromage blanc'}), items_add=frozenset({'honey'}), confidence=0.2450980392156863, lift=5.164270764485569), OrderedStatistic(items_base=frozenset({'honey'}), items_add=frozenset({'fromage blanc'}), confidence=0.0702247191011236, lift=5.16427076448557)], RelationRecord(items=frozenset({'herb & pepper', 'ground beef'}), support=0.015997866951073192, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'herb & pepper'}), confidence=0.1628222523744912, lift=3.291993841134928), OrderedStatistic(items_base=frozenset({'herb & pepper'}), items_add=frozenset({'ground beef'}), confidence=0.3234501347708895, lift=3.2919938411349285)], RelationRecord(items=frozenset({'tomato sauce', 'ground beef'}), support=0.005332622317024397, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'tomato sauce'}), confidence=0.054274084124830396, lift=3.840659481324083), OrderedStatistic(items_base=frozenset({'tomato sauce'}), items_add=frozenset({'ground beef'}), confidence=0.3773584905660377, lift=3.840659481324083)], RelationRecord(items=frozenset({'olive oil', 'light cream'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'light cream'}), items_add=frozenset({'olive oil'}), confidence=0.20512820512820515, lift=3.147098515519573), OrderedStatistic(items_base=frozenset({'olive oil'}), items_add=frozenset({'light cream'}), confidence=0.048582995951417005, lift=3.114709851551957)], RelationRecord(items=frozenset({'whole wheat pasta', 'olive oil'}), support=0.007998933475536596, ordered_statistics=[OrderedStatistic(items_base=frozenset({'olive oil'}), items_add=frozenset({'whole wheat pasta'}), confidence=0.12145748987854252, lift=4.1224100976422955), OrderedStatistic(items_base=frozenset({'whole wheat pasta'}), items_add=frozenset({'olive oil'}), confidence=0.2714932126696833, lift=4.122410097642296)], RelationRecord(items=frozenset({'pasta', 'shrimp'}), support=0.00506599120117317, ordered_statistics=[OrderedStatistic(items_base=frozenset({'pasta'}), items_add=frozenset({'shrimp'}))]]
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=frozenset({'shrimp'}), confidence=0.3220338983050847, lift=4.506672147735896), OrderedStatistic(items_base=frozenset({'shrimp'}), items_add=frozenset({'pasta'}), confidence=0.0708955223880597, lift=4.506672147735896]),
RelationRecord(items=frozenset({'milk', 'spaghetti', 'avocado'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'milk'}), items_add=frozenset({'spaghetti', 'avocado'}), confidence=0.025720164609053502, lift=3.2154492455418384), OrderedStatistic(items_base=frozenset({'spaghetti', 'avocado'}), items_add=frozenset({'milk'}), confidence=0.41666666666666663, lift=3.215449245541838)],),
RelationRecord(items=frozenset({'cake', 'burgers', 'milk'}), support=0.0037328356219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'burgers'}), items_add=frozenset({'cake', 'milk'}), confidence=0.04281345565749235, lift=3.211437308868501), OrderedStatistic(items_base=frozenset({'cake', 'milk'}), items_add=frozenset({'burgers'}), confidence=0.27999999999999997, lift=3.211437308868501)],
RelationRecord(items=frozenset({'burgers', 'chocolate', 'turkey'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'burgers'}), items_add=frozenset({'chocolate', 'turkey'}), confidence=0.035168195718654434, lift=3.1034898363014927), OrderedStatistic(items_base=frozenset({'chocolate', 'turkey'}), items_add=frozenset({'burgers'}), confidence=0.27058823529411763, lift=3.1034898363014927)],
RelationRecord(items=frozenset({'milk', 'burgers', 'turkey'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'burgers'}), items_add=frozenset({'milk', 'turkey'}), confidence=0.03669724770642202, lift=3.2384241770102538), OrderedStatistic(items_base=frozenset({'milk', 'turkey'}), items_add=frozenset({'burgers'}), confidence=0.2823529411764706, lift=3.2384241770102533)],
RelationRecord(items=frozenset({'cake', 'tomatoes', 'frozen vegetables'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'cake', 'tomatoes'}), confidence=0.03216783216783217, lift=3.83001443001443), OrderedStatistic(items_base=frozenset({'tomatoes'}), items_add=frozenset({'cake', 'frozen vegetables'}), confidence=0.04483430799220273, lift=4.367560314928736), OrderedStatistic(items_base=frozenset({'cake', 'frozen vegetables'}), items_add=frozenset({'tomatoes'}), confidence=0.2987012987012987, lift=4.367560314928736), OrderedStatistic(items_base=frozenset({'cake', 'tomatoes'}), items_add=frozenset({'frozen vegetables'}), confidence=0.36507936507936506, lift=3.8300144300144296)],
RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'cereals'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'cereals'}), items_add=frozenset({'spaghetti', 'ground beef'}), confidence=0.11917098445595856, lift=3.040481477565119), OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'spaghetti', 'cereals'}), confidence=0.03120759837177748, lift=4.681763907734057), OrderedStatistic(items_base=frozenset({'spaghetti'}), items_add=frozenset({'ground beef', 'cereals'}), confidence=0.01761102603369066, lift=3.885303125844519), OrderedStatistic(items_base=frozenset({'ground beef', 'cereals'}), items_add=frozenset({'spaghetti'}), confidence=0.6764705882352942, lift=3.8853031258445188), OrderedStatistic(items_base=frozenset({'spaghetti', 'cereals'}), items_add=frozenset({'ground beef'}), confidence=0.45999999999999996, lift=4.681763907734057), OrderedStatistic(items_base=frozenset({'spaghetti', 'ground beef'}), items_add=frozenset({'cereals'}), confidence=0.0782312925170068, lift=3.0404814775651197)],
RelationRecord(items=frozenset({'milk', 'ground beef', 'chicken'}), support=0.0038661511798426876, ordered_statistics=[OrderedStatistic(items_base=frozenset({'milk'}), items_add=frozenset({'ground beef', 'chicken'}), confidence=0.02983539094650206, lift=3.1520460209818584), OrderedStatistic(items_base=frozenset({'ground beef', 'chicken'}), items_add=frozenset({'milk'}), confidence=0.40845070422535207, lift=3.152046020981858)],
RelationRecord(items=frozenset({'milk', 'chicken', 'olive oil'}), support=0.0035995200639914677, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken'}), items_add=frozenset({'milk', 'olive oil'}), confidence=0.06, lift=3.51609375), OrderedStatistic(items_base=frozenset({'milk'}), items_add=frozenset({'chicken', 'olive oil'}), confidence=0.02777777777777778, lift=3.8585390946502063), OrderedStatistic(items_base=frozenset({'olive oil'}), items_add=frozenset({'milk', 'chicken'}), confidence=0.054655870445344125, lift=3.6934566145092456), OrderedStatistic(items_base=frozenset({'milk', 'chicken'}), items_add=frozenset({'olive oil'})),

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confidence=0.24324324324324323, lift=3.693456614509246), OrderedStatistic(items_base=frozenset({'chicken', 'olive oil'}), items_add=frozenset({'milk'}), confidence=0.5, lift=3.858539094650206), OrderedStatistic(items_base=frozenset({'milk', 'olive oil'}), items_add=frozenset({'chicken'}), confidence=0.2109375, lift=3.51609375]),
    RelationRecord(items=frozenset({'milk', 'pancakes', 'chicken'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken'}), items_add=frozenset({'milk', 'pancakes'}), confidence=0.05111111111111114, lift=3.091810035842294), OrderedStatistic(items_base=frozenset({'milk', 'pancakes'}), items_add=frozenset({'chicken'}), confidence=0.18548387096774194, lift=3.091810035842294)]),
    RelationRecord(items=frozenset({'spaghetti', 'chicken', 'olive oil'}), support=0.0034662045060658577, ordered_statistics=[OrderedStatistic(items_base=frozenset({'olive oil'}), items_add=frozenset({'spaghetti', 'chicken'}), confidence=0.05263157894736842, lift=3.0603835169318647), OrderedStatistic(items_base=frozenset({'spaghetti', 'chicken'}), items_add=frozenset({'olive oil'}), confidence=0.20155038759689922, lift=3.0603835169318647)]),
    RelationRecord(items=frozenset({'frozen vegetables', 'chocolate', 'shrimp'}), support=0.005332622317024397, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'chocolate', 'shrimp'}), confidence=0.055944055944055944, lift=3.1084175084175087), OrderedStatistic(items_base=frozenset({'shrimp'}), items_add=frozenset({'chocolate', 'frozen vegetables'}), confidence=0.07462686567164178, lift=3.2545123221103784), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate'}), items_add=frozenset({'shrimp'}), confidence=0.23255813953488375, lift=3.2545123221103784), OrderedStatistic(items_base=frozenset({'chocolate', 'shrimp'}), items_add=frozenset({'frozen vegetables'}), confidence=0.29629629629629634, lift=3.1084175084175087)]),
    RelationRecord(items=frozenset({'herb & pepper', 'ground beef', 'chocolate'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'herb & pepper', 'chocolate'}), confidence=0.0407055630936228, lift=4.490182775959774), OrderedStatistic(items_base=frozenset({'herb & pepper'}), items_add=frozenset({'ground beef', 'chocolate'}), confidence=0.08086253369272238, lift=3.5060685851393676), OrderedStatistic(items_base=frozenset({'ground beef', 'chocolate'}), items_add=frozenset({'herb & pepper'}), confidence=0.17341040462427748, lift=3.5060685851393676), OrderedStatistic(items_base=frozenset({'herb & pepper', 'chocolate'}), items_add=frozenset({'ground beef'}), confidence=0.4411764705882354, lift=4.4901827759597746)]),
    RelationRecord(items=frozenset({'milk', 'soup', 'chocolate'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'milk'}), items_add=frozenset({'soup', 'chocolate'}), confidence=0.030864197530864203, lift=3.0462150747238472), OrderedStatistic(items_base=frozenset({'soup', 'chocolate'}), items_add=frozenset({'milk'}), confidence=0.3947368421052632, lift=3.0462150747238472)],
    RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'cooking oil'}), support=0.004799360085321957, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'spaghetti', 'cooking oil'}), confidence=0.048846675712347354, lift=3.078982474943844), OrderedStatistic(items_base=frozenset({'spaghetti'}), items_add=frozenset({'ground beef', 'cooking oil'}), confidence=0.027565084226646247, lift=3.2819951870487856), OrderedStatistic(items_base=frozenset({'ground beef', 'cooking oil'}), items_add=frozenset({'spaghetti'}), confidence=0.5714285714285714, lift=3.2819951870487856), OrderedStatistic(items_base=frozenset({'spaghetti', 'cooking oil'}), items_add=frozenset({'ground beef'}), confidence=0.3025210084033613, lift=3.0789824749438446)]),
    RelationRecord(items=frozenset({'herb & pepper', 'eggs', 'ground beef'}), support=0.0041327822956939075, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'herb & pepper', 'eggs'}), confidence=0.04206241519674356, lift=3.3564912381997174), OrderedStatistic(items_base=frozenset({'herb & pepper'}), items_add=frozenset({'eggs', 'ground beef'}), confidence=0.08355795148247978, lift=4.178454627133872), OrderedStatistic(items_base=frozenset({'eggs', 'ground beef'}), items_add=frozenset({'herb & pepper'}), confidence=0.2066666666666667, lift=4.178454627133872), OrderedStatistic(items_base=frozenset({'herb & pepper', 'eggs'}), items_add=frozenset({'ground beef'}), confidence=0.3297872340425532, lift=3.3564912381997174)]),
    RelationRecord(items=frozenset({'red wine', 'spaghetti', 'eggs'}), support=0.0037

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lift=3.7467532467532467)]], RelationRecord(items=frozenset({'spaghetti', 'tomatoes', 'frozen vegetables'}), support=0.006665777896280496, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'spaghetti', 'tomatoes'}), confidence=0.06993006993006994, lift=3.341053850607991), OrderedStatistic(items_base=frozenset({'tomatoes'}), items_add=frozenset({'spaghetti', 'frozen vegetables'}), confidence=0.09746588693957116, lift=3.4980460188216425), OrderedStatistic(items_base=frozenset({'spaghetti', 'frozen vegetables'}), items_add=frozenset({'tomatoes'}), confidence=0.23923444976076558, lift=3.4980460188216425), OrderedStatistic(items_base=frozenset({'spaghetti', 'tomatoes'}), items_add=frozenset({'frozen vegetables'}), confidence=0.3184713375796179, lift=3.341053850607991)]], RelationRecord(items=frozenset({'grated cheese', 'spaghetti', 'ground beef'}), support=0.005332622317024397, 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363636363636364, lift=3.3084538103406027), OrderedStatistic(items_base=frozenset
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ms_base=frozenset({'herb & pepper'}), items_add=frozenset({'mineral water', 'groun
d beef'}), confidence=0.1347708894878706, lift=3.292887433382793), OrderedStatistic(
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ence=0.0782312925170068, lift=5.535970992170453), OrderedStatistic(items_base=froz

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        RelationRecord(items=frozenset({'milk', 'mineral water', 'soup'}), support=0.008532195707239034, ordered_statistics=[OrderedStatistic(items_base=frozenset({'soup'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.16886543535620052, lift=3.518498973907945), OrderedStatistic(items_base=frozenset({'milk', 'mineral water'}), items_add=frozenset({'soup'}), confidence=0.17777777777777776, lift=3.5184989739079446)]),
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up'}), items_add=frozenset({'mineral water', 'olive oil'}), confidence=0.102902374
6701847, lift=3.7288440212611373), OrderedStatistic(items_base=frozenset({'mineral
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ms_add=frozenset({'olive oil'}), confidence=0.4027777777777778, lift=6.11586257309
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rozenset({'spaghetti', 'whole wheat rice'}), items_add=frozenset({'tomatoes'}), con
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confidence=0.15789473684210528, lift=4.452512861100119), OrderedStatistic(items_base=frozenset({'spaghetti', 'frozen smoothie'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.20512820512820515, lift=4.274074074074075), OrderedStatistic(items_base=frozenset({'milk', 'mineral water'}), items_add=frozenset({'spaghetti', 'frozen smoothie'}), confidence=0.06666666666666668, lift=4.274074074074075), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti'}), items_add=frozenset({'mineral water', 'frozen smoothie'}), confidence=0.09022556390977443, lift=4.452512861100119), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'milk', 'frozen smoothie'}), confidence=0.053571428571428575, lift=3.755073431241657), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.4705882352941177, lift=3.631566206729606), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti', 'mineral water'}), items_add=frozenset({'frozen smoothie'}), confidence=0.2033898305084746, lift=3.211846565566459)], RelationRecord(items=frozenset({'milk', 'mineral water', 'ground beef', 'frozen vegetables'}), support=0.0037328356219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'milk', 'mineral water', 'ground beef'}), confidence=0.03916083916083916, lift=3.5391018619934282), OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'milk', 'mineral water', 'frozen vegetables'}), confidence=0.037991858887381276, lift=3.433457030292132), OrderedStatistic(items_base=frozenset({'milk'}), items_add=frozenset({'mineral water', 'ground beef', 'frozen vegetables'}), confidence=0.02880658436213992, lift=3.1315679608755294), OrderedStatistic(items_base=frozenset({'ground beef', 'frozen vegetables'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.22047244094488186, lift=4.593788276465442), OrderedStatistic(items_base=frozenset({'milk', 'frozen vegetables'}), items_add=frozenset({'mineral water', 'ground beef'}), confidence=0.1581920903954802, lift=3.865142899206831), OrderedStatistic(items_base=frozenset({'mineral water', 'frozen vegetables'}), items_add=frozenset({'milk', 'mineral water', 'frozen vegetables'}), confidence=0.411764705882353, lift=3.177620430888405)])

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_add=frozenset({'milk', 'ground beef'}), confidence=0.10447761194029849, lift=4.74
9615558570782), OrderedStatistic(items_base=frozenset({'milk', 'ground beef'}), it
ems_add=frozenset({'mineral water', 'frozen vegetables'}), confidence=0.1696969696
969697, lift=4.749615558570782), OrderedStatistic(items_base=frozenset({'mineral w
ater', 'ground beef'}), items_add=frozenset({'milk', 'frozen vegetables'}), confid
ence=0.09120521172638436, lift=3.865142899206831), OrderedStatistic(items_base=fro
zensest({'milk', 'mineral water'}), items_add=frozenset({'ground beef', 'frozen veg
etables'}), confidence=0.07777777777777778, lift=4.593788276465442), OrderedStatis
tic(items_base=frozenset({'mineral water', 'ground beef', 'frozen vegetables'}), i
tems_add=frozenset({'milk'}), confidence=0.40579710144927533, lift=3.1315679608755
294), OrderedStatistic(items_base=frozenset({'milk', 'mineral water', 'frozen vege
tables'}), items_add=frozenset({'ground beef'}), confidence=0.3373493975903614, li
ft=3.4334570302921317), OrderedStatistic(items_base=frozenset({'milk', 'mineral wa
ter', 'ground beef'}), items_add=frozenset({'frozen vegetables'}), confidence=0.33
73493975903614, lift=3.539101861993428)]),
RelationRecord(items=frozenset({'milk', 'spaghetti', 'ground beef', 'frozen veget
ables'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(item
s_base=frozenset({'frozen vegetables'}), items_add=frozenset({'milk', 'spaghetti',
'ground beef'}), confidence=0.03216783216783217, lift=3.3053549190535496), Order
edStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'milk', 'spa
ghetti', 'frozen vegetables'}), confidence=0.03120759837177748, lift=3.77561605462
424), OrderedStatistic(items_base=frozenset({'spaghetti'}), items_add=frozenset
({'milk', 'ground beef', 'frozen vegetables'}), confidence=0.01761102603369066, li
ft=3.0721001460165964), OrderedStatistic(items_base=frozenset({'ground beef', 'fro
zen vegetables'}), items_add=frozenset({'milk', 'spaghetti'}), confidence=0.181102
3622047244, lift=5.1069504469836), OrderedStatistic(items_base=frozenset({'milk',
'frozen vegetables'}), items_add=frozenset({'spaghetti', 'ground beef'}), confiden
ce=0.12994350282485875, lift=3.315327260847842), OrderedStatistic(items_base=froze
nset({'spaghetti', 'frozen vegetables'}), items_add=frozenset({'milk', 'ground bee
f'}), confidence=0.11004784688995216, lift=5.002841815282007), OrderedStatistic(it
ems_base=frozenset({'milk', 'ground beef'}), items_add=frozenset({'spaghetti', 'fr
zen vegetables'}), confidence=0.1393939393939394, lift=5.002841815282007), Ordere
dStatistic(items_base=frozenset({'spaghetti', 'ground beef'}), items_add=frozenset
({'milk', 'frozen vegetables'}), confidence=0.0782312925170068, lift=3.31532726084
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zensest({'ground beef', 'frozen vegetables'}), confidence=0.08646616541353383, lift
=5.1069504469836), OrderedStatistic(items_base=frozenset({'milk', 'ground beef',
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302326, lift=3.0721001460165964), OrderedStatistic(items_base=frozenset({'milk',
'spaghetti', 'frozen vegetables'}), items_add=frozenset({'ground beef'}), confiden
ce=0.3709677419354839, lift=3.7756160546242397), OrderedStatistic(items_base=froze
nset({'milk', 'spaghetti', 'ground beef'}), items_add=frozenset({'frozen vegetable
s'}), confidence=0.3150684931506849, lift=3.305354919053549)],),
RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'ground beef', 'fro
zen vegetables'}), support=0.004399413411545127, ordered_statistics=[OrderedStatis
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ral water', 'frozen vegetables'}), confidence=0.04477611940298508, lift=3.73184079
6019901), OrderedStatistic(items_base=frozenset({'ground beef', 'frozen vegetable
s'}), items_add=frozenset({'spaghetti', 'mineral water'}), confidence=0.2598425196
8503935, lift=4.350622187851519), OrderedStatistic(items_base=frozenset({'mineral
water', 'frozen vegetables'}), items_add=frozenset({'spaghetti', 'ground beef'}),
confidence=0.12313432835820895, lift=3.1416006701187937), OrderedStatistic(items_b
ase=frozenset({'spaghetti', 'frozen vegetables'}), items_add=frozenset({'mineral w
ater', 'ground beef'}), confidence=0.15789473684210528, lift=3.857877593005315),
OrderedStatistic(items_base=frozenset({'mineral water', 'ground beef'}), items_add=
frozenset({'spaghetti', 'frozen vegetables'}), confidence=0.10749185667752444, lif
t=3.857877593005315), OrderedStatistic(items_base=frozenset({'spaghetti', 'ground
beef'}), items_add=frozenset({'mineral water', 'frozen vegetables'}), confidence=
0.11224489795918367, lift=3.1416006701187937), OrderedStatistic(items_base=froz
enset({'spaghetti', 'mineral water'}), items_add=frozenset({'ground beef', 'frozen ve
getables'}), confidence=0.07366071428571429, lift=4.350622187851518), OrderedStati
stic(items_base=frozenset({'spaghetti', 'mineral water', 'frozen vegetables'}), it
ems_add=frozenset({'ground beef'}), confidence=0.36666666666666667, lift=3.73184079
60199007)]),

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RelationRecord(items=frozenset({'milk', 'mineral water', 'frozen vegetables', 'olive oil'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'milk', 'mineral water', 'olive oil'}), confidence=0.03496503496503497, lift=4.098011363636364), OrderedStatistic(items_base=frozenset({'milk'}), items_add=frozenset({'mineral water', 'frozen vegetables', 'olive oil'}), confidence=0.025720164609053502, lift=3.9372847904593944), OrderedStatistic(items_base=frozenset({'olive oil'}), items_add=frozenset({'milk', 'mineral water', 'frozen vegetables'}), confidence=0.05060728744939272, lift=4.573557387444516), OrderedStatistic(items_base=frozenset({'milk', 'frozen vegetables'}), items_add=frozenset({'mineral water', 'olive oil'}), confidence=0.14124293785310735, lift=5.118180081334097), OrderedStatistic(items_base=frozensest({'mineral water', 'frozen vegetables'}), items_add=frozenset({'milk', 'olive oil'}), confidence=0.09328358208955223, lift=5.4665636660447765), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'olive oil'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.29411764705882354, lift=6.12826797385621), OrderedStatistic(items_base=frozenset({'milk', 'mineral water'}), items_add=frozenset({'frozen vegetables', 'olive oil'}), confidence=0.06944444444444445, lift=6.128267973856209), OrderedStatistic(items_base=frozenset({'milk', 'olive oil'}), items_add=frozenset({'mineral water', 'frozen vegetables'}), confidence=0.19531250000000003, lift=5.4665636660447765), OrderedStatistic(items_base=frozenset({'mineral water', 'olive oil'}), items_add=frozenset({'milk', 'frozen vegetables'}), confidence=0.12077294685990338, lift=5.118180081334097), OrderedStatistic(items_base=frozensest({'milk', 'mineral water', 'frozen vegetables'}), items_add=frozenset({'olive oil'}), confidence=0.30120481927710846, lift=4.573557387444516), OrderedStatistic(items_base=frozenset({'mineral water', 'frozen vegetables', 'olive oil'}), items_add=frozenset({'milk'}), confidence=0.5102040816326531, lift=3.937284790459394), OrderedStatistic(items_base=frozenset({'milk', 'mineral water', 'olive oil'}), items_add=frozenset({'frozen vegetables'}), confidence=0.39062500000000006, lift=4.098011363636364)],

RelationRecord(items=frozenset({'milk', 'mineral water', 'soup', 'frozen vegetables'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'milk', 'mineral water', 'soup'}), confidence=0.03216783216783217, lift=3.77017045454553), OrderedStatistic(items_base=frozenset({'milk'}), items_add=frozenset({'mineral water', 'soup', 'frozen vegetables'}), confidence=0.02366255144032922, lift=4.67086311457656), OrderedStatistic(items_base=frozenset({'mineral water'}), items_add=frozenset({'milk', 'soup', 'frozen vegetables'}), confidence=0.012863534675615214, lift=3.2163124533929905), OrderedStatistic(items_base=frozenset({'soup'}), items_add=frozenset({'milk', 'mineral water', 'frozen vegetables'}), confidence=0.06068601583113457, lift=5.484407286136632), OrderedStatistic(items_base=frozenset({'milk', 'frozen vegetables'}), items_add=frozenset({'mineral water', 'soup'}), confidence=0.12994350282485875, lift=5.634139969302113), OrderedStatistic(items_base=frozenset({'mineral water', 'frozen vegetables'}), items_add=frozenset({'milk', 'soup'}), confidence=0.08582089552238806, lift=5.646864362398533), OrderedStatistic(items_base=frozenset({'soup', 'frozen vegetables'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.3833333333333333, lift=7.987175925925926), OrderedStatistic(items_base=frozenset({'milk', 'mineral water'}), items_add=frozenset({'soup', 'frozen vegetables'}), confidence=0.0638888888888889, lift=7.987175925925926), OrderedStatistic(items_base=frozenset({'milk', 'soup'}), items_add=frozenset({'mineral water', 'frozen vegetables'}), confidence=0.20175438596491227, lift=5.646864362398533), OrderedStatistic(items_base=frozenset({'mineral water', 'soup'}), items_add=frozenset({'milk', 'frozen vegetables'}), confidence=0.13294797687861273, lift=5.6341399693021135), OrderedStatistic(items_base=frozenset({'milk', 'mineral water', 'frozen vegetables'}), items_add=frozenset({'soup'}), confidence=0.27710843373493976, lift=5.484407286136631), OrderedStatistic(items_base=frozenset({'milk', 'soup', 'frozen vegetables'}), items_add=frozenset({'mineral water'}), confidence=0.766666666666, lift=3.21631245339299), OrderedStatistic(items_base=frozenset({'mineral water', 'soup', 'frozen vegetables'}), items_add=frozenset({'milk'}), confidence=0.6052631578947368, lift=4.670863114576565), OrderedStatistic(items_base=frozensest({'milk', 'mineral water', 'soup'}), items_add=frozenset({'frozen vegetables'}), confidence=0.3593750000000006, lift=3.77017045454553)],

RelationRecord(items=frozenset({'milk', 'spaghetti', 'mineral water', 'frozen vegetables'}), support=0.004532728969470737, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'milk', 'spaghetti'}), confidence=0.004532728969470737)])

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i', 'mineral water'})), confidence=0.04755244755244755, lift=3.0228043143297376), OrderedStatistic(items_base=frozenset({'milk', 'frozen vegetables'}), items_add=frozenset({'spaghetti', 'mineral water'})), confidence=0.19209039548022597, lift=3.216227804681194), OrderedStatistic(items_base=frozenset({'mineral water', 'frozen vegetables'}), items_add=frozenset({'milk', 'spaghetti'})), confidence=0.12686567164179102, lift=3.5775165525754677), OrderedStatistic(items_base=frozenset({'spaghetti', 'frozen vegetables'}), items_add=frozenset({'milk', 'mineral water'})), confidence=0.16267942583732056, lift=3.389606592238171), OrderedStatistic(items_base=frozenset({'milk', 'mineral water'}), items_add=frozenset({'spaghetti', 'frozen vegetables'})), confidence=0.09444444444444444, lift=3.389606592238171), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti'}), items_add=frozenset({'mineral water', 'frozen vegetables'})), confidence=0.12781954887218044, lift=3.577516552575468), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'milk', 'frozen vegetables'})), confidence=0.07589285714285714, lift=3.216227804681194), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti', 'mineral water'}), items_add=frozenset({'frozen vegetables'})), confidence=0.28813559322033894, lift=3.0228043143297376)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'frozen vegetables', 'shrimp'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'spaghetti', 'mineral water', 'shrimp'})), confidence=0.03496503496503497, lift=4.098011363636364), OrderedStatistic(items_base=frozenset({'shrimp'}), items_add=frozenset({'spaghetti', 'mineral water', 'frozen vegetables'})), confidence=0.046641791044776115, lift=3.8873341625207294), OrderedStatistic(items_base=frozenset({'mineral water', 'frozen vegetables'}), items_add=frozenset({'spaghetti', 'shrimp'})), confidence=0.09328358208955223, lift=4.400755655683844), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'shrimp'}), items_add=frozenset({'spaghetti', 'mineral water'})), confidence=0.2, lift=3.3486607142857148), OrderedStatistic(items_base=frozenset({'spaghetti', 'frozen vegetables'}), items_add=frozenset({'mineral water', 'shrimp'})), confidence=0.11961722488038279, lift=5.069202281512719), OrderedStatistic(items_base=frozenset({'mineral water', 'shrimp'}), items_add=frozenset({'spaghetti', 'frozen vegetables'})), confidence=0.14124293785310735, lift=5.069202281512719), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'frozen vegetables', 'shrimp'})), confidence=0.05580357142857143, lift=3.3486607142857143), OrderedStatistic(items_base=frozenset({'spaghetti', 'shrimp'}), items_add=frozenset({'mineral water', 'frozen vegetables'})), confidence=0.15723270440251574, lift=4.400755655683845), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water', 'frozen vegetables'}), items_add=frozenset({'shrimp'})), confidence=0.2777777777777778, lift=3.8873341625207294), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water', 'shrimp'}), items_add=frozenset({'frozen vegetables'})), confidence=0.3906250000000006, lift=4.0980113636364)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'tomatoes', 'frozen vegetables'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables'}), items_add=frozenset({'spaghetti', 'mineral water', 'tomatoes'})), confidence=0.03216783216783217, lift=3.4470129870129873), OrderedStatistic(items_base=frozenset({'spaghetti'}), items_add=frozenset({'mineral water', 'tomatoes', 'frozen vegetables'})), confidence=0.01761102603369066, lift=3.0022796881525826), OrderedStatistic(items_base=frozenset({'tomatoes'}), items_add=frozenset({'spaghetti', 'mineral water', 'frozen vegetables'})), confidence=0.04483430799220273, lift=3.736690491661252), OrderedStatistic(items_base=frozenset({'mineral water', 'frozen vegetables'}), items_add=frozenset({'spaghetti', 'tomatoes'})), confidence=0.08582089552238806, lift=4.1002709383021205), OrderedStatistic(items_base=frozenset({'spaghetti', 'frozen vegetables'}), items_add=frozenset({'mineral water', 'tomatoes'})), confidence=0.11004784688995216, lift=4.510759013778858), OrderedStatistic(items_base=frozenset({'tomatoes', 'frozen vegetables'}), items_add=frozenset({'spaghetti', 'mineral water'})), confidence=0.1900826446280992, lift=3.1826114226682414), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'tomatoes', 'frozen vegetables'})), confidence=0.05133928571428572, lift=3.1826114226682414), OrderedStatistic(items_base=frozenset({'mineral water', 'tomatoes'}), items_add=frozenset({'spaghetti', 'frozen vegetables'})), confidence=0.12568306010928962, lift=4.510759013778858), 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3021205), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water', 'frozen vegetables'}), items_add=frozenset({'tomatoes'}), confidence=0.2555555555555555
56, lift=3.7366904916612524), OrderedStatistic(items_base=frozenset({'mineral water', 'tomatoes', 'frozen vegetables'}), items_add=frozenset({'spaghetti'}), confidence=0.5227272727272727, lift=3.0022796881525826), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water', 'tomatoes'}), items_add=frozenset({'frozen vegetables'}), confidence=0.32857142857142857, lift=3.447012987012987)],

RelationRecord(items=frozenset({'milk', 'spaghetti', 'mineral water', 'ground beef'}), support=0.004399413411545127, ordered_statistics=[OrderedStatistic(items_base=frozenset({'milk', 'ground beef'}), items_add=frozenset({'spaghetti', 'mineral water'}), confidence=0.2, lift=3.3486607142857148), OrderedStatistic(items_base=frozenset({'mineral water', 'ground beef'}), items_add=frozenset({'milk', 'spaghetti'}), confidence=0.10749185667752444, lift=3.0311895373613185), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti'}), items_add=frozenset({'mineral water', 'ground beef'}), confidence=0.12406015037593984, lift=3.0311895373613185), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'milk', 'ground beef'}), confidence=0.07366071428571429, lift=3.3486607142857148]),

RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'ground beef', 'olive oil'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'spaghetti', 'mineral water', 'olive oil'}), confidence=0.03120759837177748, lift=3.040106433593544), OrderedStatistic(items_base=frozenset({'mineral water', 'ground beef'}), items_add=frozenset({'spaghetti', 'olive oil'}), confidence=0.0749185667752443, lift=3.267233542913416), OrderedStatistic(items_base=frozenset({'ground beef', 'olive oil'}), items_add=frozenset({'spaghetti', 'mineral water'}), confidence=0.2169811320754717, lift=3.63298096361186), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'ground beef', 'olive oil'}), confidence=0.05133928571428572, lift=3.63298096361186), OrderedStatistic(items_base=frozenset({'spaghetti', 'olive oil'}), items_add=frozenset({'mineral water', 'ground beef'}), confidence=0.13372093023255816, lift=3.267233542913416), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water', 'olive oil'}), items_add=frozenset({'ground beef'}), confidence=0.2987012987012987, lift=3.0401064335935435)],

RelationRecord(items=frozenset({'pancakes', 'spaghetti', 'mineral water', 'ground beef'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'pancakes', 'ground beef'}), items_add=frozenset({'spaghetti', 'mineral water'}), confidence=0.21100917431192662, lift=3.532990661861075), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'pancakes', 'ground beef'}), confidence=0.05133928571428572, lift=3.532990661861075)],

RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'ground beef', 'tomatoes'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef'}), items_add=frozenset({'spaghetti', 'mineral water', 'tomatoes'}), confidence=0.03120759837177748, lift=3.344117076952898), OrderedStatistic(items_base=frozenset({'spaghetti'}), items_add=frozenset({'tomatoes', 'mineral water', 'ground beef'}), confidence=0.01761102603369066, lift=3.221958689724723), OrderedStatistic(items_base=frozenset({'mineral water', 'ground beef'}), items_add=frozenset({'spaghetti', 'tomatoes'}), confidence=0.0749185667752443, lift=3.579389613892405), OrderedStatistic(items_base=frozenset({'spaghetti', 'ground beef'}), items_add=frozenset({'mineral water', 'tomatoes'}), confidence=0.0782312925170068, lift=3.2066280063938146), OrderedStatistic(items_base=frozenset({'tomatoes', 'ground beef'}), items_add=frozenset({'spaghetti', 'mineral water'}), confidence=0.26136363636363635, lift=4.3760907061688314), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'tomatoes', 'ground beef'}), confidence=0.05133928571428572, lift=4.3760907061688314), OrderedStatistic(items_base=frozenset({'mineral water', 'tomatoes'}), items_add=frozenset({'spaghetti', 'ground beef'}), confidence=0.12568306010928962, lift=3.206628006393814), OrderedStatistic(items_base=frozenset({'spaghetti', 'tomatoes'}), items_add=frozenset({'mineral water', 'ground beef'}), confidence=0.14649681528662423, lift=3.579389613892405), OrderedStatistic(items_base=frozenset({'tomatoes', 'mineral water', 'ground beef'}), items_add=frozenset({'spaghetti'}), confidence=0.5609756097560976, lift=3.221958689724723), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water', 'tomatoes'}), items_add=frozenset({'ground beef'}), confidence=0.32857142857142857, lift=3.344117076952898)])
]

```

```

RelationRecord(items=frozenset({'milk', 'spaghetti', 'mineral water', 'olive oil'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'olive oil'}), items_add=frozenset({'milk', 'spaghetti', 'mineral water'}), confidence=0.05060728744939272, lift=3.216993755575379), OrderedStatistic(items_base=frozenset({'milk', 'mineral water'}), items_add=frozenset({'spaghetti', 'olive oil'}), confidence=0.06944444444444445, lift=3.0285045219638245), OrderedStatistic(items_base=frozenset({'milk', 'olive oil'}), items_add=frozenset({'spaghetti', 'mineral water'}), confidence=0.19531250000000003, lift=3.2701764787946432), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti'}), items_add=frozenset({'mineral water', 'olive oil'}), confidence=0.09398496240601503, lift=3.4057062947223127), OrderedStatistic(items_base=frozenset({'mineral water', 'olive oil'}), items_add=frozenset({'milk', 'spaghetti'}), confidence=0.12077294685990338, lift=3.4057062947223127), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'milk', 'olive oil'}), confidence=0.05580357142857143, lift=3.2701764787946432), OrderedStatistic(items_base=frozenset({'spaghetti', 'olive oil'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.14534883720930233, lift=3.0285045219638245), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti', 'mineral water'}), items_add=frozenset({'olive oil'}), confidence=0.211864406779661, lift=3.216993755575379)]),
RelationRecord(items=frozenset({'milk', 'spaghetti', 'mineral water', 'shrimp'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'milk', 'mineral water'}), items_add=frozenset({'spaghetti', 'shrimp'}), confidence=0.0638888888888889, lift=3.014028651292803), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti'}), items_add=frozenset({'mineral water', 'shrimp'}), confidence=0.08646616541353383, lift=3.6643090777791936), OrderedStatistic(items_base=frozenset({'mineral water', 'shrimp'}), items_add=frozenset({'milk', 'spaghetti'}), confidence=0.12994350282485875, lift=3.6643090777791936), OrderedStatistic(items_base=frozenset({'spaghetti', 'shrimp'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.14465408805031446, lift=3.014028651292802)]),
RelationRecord(items=frozenset({'milk', 'spaghetti', 'mineral water', 'tomatoes'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'tomatoes'}), items_add=frozenset({'milk', 'spaghetti', 'mineral water'}), confidence=0.04873294346978558, lift=3.097845838702217), OrderedStatistic(items_base=frozenset({'milk', 'mineral water'}), items_add=frozenset({'spaghetti', 'tomatoes'}), confidence=0.06944444444444445, lift=3.3178520877565467), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti'}), items_add=frozenset({'mineral water', 'tomatoes'}), confidence=0.09398496240601503, lift=3.8523563005875343), OrderedStatistic(items_base=frozenset({'milk', 'tomatoes'}), items_add=frozenset({'spaghetti', 'mineral water'}), confidence=0.2380952380952381, lift=3.9865008503401365), OrderedStatistic(items_base=frozenset({'spaghetti', 'mineral water'}), items_add=frozenset({'milk', 'tomatoes'}), confidence=0.05580357142857143, lift=3.9865008503401365), OrderedStatistic(items_base=frozenset({'mineral water', 'tomatoes'}), items_add=frozenset({'milk', 'spaghetti'}), confidence=0.1366120218579235, lift=3.8523563005875348), OrderedStatistic(items_base=frozenset({'spaghetti', 'tomatoes'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.15923566878980894, lift=3.3178520877565467), OrderedStatistic(items_base=frozenset({'milk', 'spaghetti', 'mineral water'}), items_add=frozenset({'tomatoes'}), confidence=0.211864406779661, lift=3.0978458387022165)]])

```

In [68]: `#convert result in a dataframe for further operation...  
df_results = pd.DataFrame(Results)`

In [69]: `# as we see order statistics itself a List so need to be converted in proper format  
df_results.head()`

Out[69]:

|   | items                            | support  | ordered_statistics                                  |
|---|----------------------------------|----------|---|
| 0 | (cottage cheese, brownies)       | 0.003466 | [((brownies), (cottage cheese), 0.102766798418...]  |
| 1 | (chicken, light cream)           | 0.004533 | [((chicken), (light cream), 0.07555555555555555...] |
| 2 | (mushroom cream sauce, escalope) | 0.005733 | [((escalope), (mushroom cream sauce), 0.072268...]  |
| 3 | (pasta, escalope)                | 0.005866 | [((escalope), (pasta), 0.07394957983193277, 4....]  |
| 4 | (tomato juice, fresh bread)      | 0.004266 | [((fresh bread), (tomato juice), 0.09907120743...]  |

In [70]: 

```
#keep support in a separate data frame so we can use later..
support = df_results.support
```

In [71]: 

```
#all four empty list which will contain lhs, rhs, confidance and lift respectively

first_values = []
second_values = []
third_values = []
fourth_value = []

# Loop number of rows time and append 1 by 1 value in a separate list.. first and so on
for i in range(df_results.shape[0]):
    single_list = df_results['ordered_statistics'][i][0]
    first_values.append(list(single_list[0]))
    second_values.append(list(single_list[1]))
    third_values.append(single_list[2])
    fourth_value.append(single_list[3])
```

In [72]: 

```
#convert all four list into dataframe for further operation..
lhs = pd.DataFrame(first_values)
rhs= pd.DataFrame(second_values)
confidance=pd.DataFrame(third_values,columns=['Confidance'])
lift=pd.DataFrame(fourth_value,columns=['lift'])
```

In [73]: 

```
#concat all list together in a single dataframe
df_final = pd.concat([lhs,rhs,support,confidance,lift], axis=1)
df_final
```

|     | 0           | 1             | 0                    | 1             | 2             | support  | Confidance | lift     |
|-----|-------------|---------------|----------------------|---------------|---------------|----------|------------|----------|
| 0   | brownies    | None          | cottage cheese       | None          | None          | 0.003466 | 0.102767   | 3.225330 |
| 1   | chicken     | None          | light cream          | None          | None          | 0.004533 | 0.075556   | 4.843951 |
| 2   | escalope    | None          | mushroom cream sauce | None          | None          | 0.005733 | 0.072269   | 3.790833 |
| 3   | escalope    | None          | pasta                | None          | None          | 0.005866 | 0.073950   | 4.700812 |
| 4   | fresh bread | None          | tomato juice         | None          | None          | 0.004266 | 0.099071   | 3.259356 |
| ... | ...         | ...           | ...                  | ...           | ...           | ...      | ...        | ...      |
| 89  | pancakes    | ground beef   | spaghetti            | mineral water | None          | 0.003066 | 0.211009   | 3.532991 |
| 90  | ground beef | None          | spaghetti            | mineral water | tomatoes      | 0.003066 | 0.031208   | 3.344117 |
| 91  | olive oil   | None          | milk                 | spaghetti     | mineral water | 0.003333 | 0.050607   | 3.216994 |
| 92  | milk        | mineral water | spaghetti            | shrimp        | None          | 0.003066 | 0.063889   | 3.014029 |
| 93  | tomatoes    | None          | milk                 | spaghetti     | mineral water | 0.003333 | 0.048733   | 3.097846 |

94 rows × 8 columns

In [76]: `df_final.fillna(value=' ', inplace=True)`In [80]: `#set column name  
df_final.columns = ['lhs',1,'rhs',2,3,'support','confidance','lift']`In [82]: `#add all three column because those where the lhs itemset only  
df_final['lhs'] = df_final['lhs']+str(", ") + df_final[1]+str(", ") + df_final[2]+str(`In [83]: `df_final.drop(columns=[1,2,3],inplace=True)`In [84]: `#this is final output.. you can sort based on the support lift and confidance..  
df_final.head()`

|   | lhs               | rhs                  | support  | confidence | lift     |
|---|-------------------|----------------------|----------|------------|----------|
| 0 | brownies,.....    | cottage cheese       | 0.003466 | 0.102767   | 3.225330 |
| 1 | chicken,.....     | light cream          | 0.004533 | 0.075556   | 4.843951 |
| 2 | escalope,.....    | mushroom cream sauce | 0.005733 | 0.072269   | 3.790833 |
| 3 | escalope,.....    | pasta                | 0.005866 | 0.073950   | 4.700812 |
| 4 | fresh bread,..... | tomato juice         | 0.004266 | 0.099071   | 3.259356 |