

Apriori

Importing the libraries

```
In [0]: import numpy as np  
import matplotlib.pyplot as plt  
import pandas as pd
```

Data Preprocessing

```
In [0]: dataset = pd.read_csv('Market_Basket_Optimisation.csv', header = None)  
transactions = []  
for i in range(0, 7501):  
    transactions.append([str(dataset.values[i,j]) for j in range(0, 20)])
```

Training the Apriori model on the dataset

```
In [0]: # WARNING: Make sure to upload the apyori.py file into this Colab notebook  
# before running this cell  
from apyori import apriori  
rules = apriori(transactions, min_support = 0.003, min_confidence = 0.2,  
min_lift = 3, min_length = 2)
```

Visualising the results

```
In [0]: results = list(rules)
```

```
In [5]: print(results)
```

```
[RelationRecord(items=frozenset({'chicken', 'light cream'}), support=0.004532728969470737, ordered_statistics=[OrderedStatistic(items_base=frozenset({'light cream'}), items_add=frozenset({'chicken'}), confidence=0.29059829059829057, lift=4.84395061728395)], RelationRecord(items=frozenset({'mushroom cream sauce', 'escalope'}), support=0.005732568990801226, ordered_statistics=[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({'pasta'}), items_add=frozenset({'escalope'}), confidence=0.3728813559322034, lift=4.700811850163794]), 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)], RelationRecord(items=frozenset({'ground beef', 'herb & pepper'}), support=0.015997866951073192, ordered_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper'}), items_add=frozenset({'ground beef'}), confidence=0.3234501347708895, lift=3.2919938411349285)], RelationRecord(items=frozenset({'ground beef', 'tomato sauce'}), support=0.005332622317024397, ordered_statistics=[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=3.1147098515519573]), RelationRecord(items=frozenset({'olive oil', 'whole wheat pasta'}), support=0.007998933475536596, ordered_statistics=[OrderedStatistic(items_base=frozenset({'whole wheat pasta'}), items_add=frozenset({'olive oil'}), confidence=0.2714932126696833, lift=4.122410097642296)], RelationRecord(items=frozenset({'pasta', 'shrimp'}), support=0.005065991201173177, ordered_statistics=[OrderedStatistic(items_base=frozenset({'pasta'}), items_add=frozenset({'shrimp'}), confidence=0.3220338983050847, lift=4.506672147735896)], RelationRecord(items=frozenset({'spaghetti', 'avocado', 'milk'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'avocado'}), items_add=frozenset({'milk'}), confidence=0.41666666666666663, lift=3.21549245541838)], RelationRecord(items=frozenset({'cake', 'milk', 'burgers'}), support=0.0037328356219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'cake', 'milk'}), items_add=frozenset({'burgers'}), confidence=0.27999999999999997, lift=3.21143730868501)], RelationRecord(items=frozenset({'chocolate', 'turkey', 'burgers'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chocolate', 'turkey'}), items_add=frozenset({'burgers'}), confidence=0.27058823529411763, lift=3.1034898363014927)], RelationRecord(items=frozenset({'milk', 'turkey', 'burgers'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'milk', 'turkey'}), items_add=frozenset({'burgers'}), confidence=0.2823529411764706, lift=3.2384241770102533)], RelationRecord(items=frozenset({'frozen vegetables', 'cake', 'tomatoes'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'cake'}), 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(ite
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ms_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]), RelationRecord(items=frozenset({'chicken', 'ground beef', 'milk'}), support=0.0038661511798426876, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken', 'ground beef'}), items_add=frozenset({'milk'}), confidence=0.40845070422535207, lift=3.152046020981858]), RelationRecord(items=frozenset({'chicken', 'nan', 'light cream'}), support=0.004532728969470737, ordered_statistics=[OrderedStatistic(items_base=frozenset({'nan', 'light cream'}), items_add=frozenset({'chicken'}), confidence=0.29059829059829057, lift=4.84395061728395)]), RelationRecord(items=frozenset({'chicken', 'olive oil', 'milk'}), support=0.0035995200639914677, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken', 'milk'}), items_add=frozenset({'olive oil'}), 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({'olive oil', 'milk'}), items_add=frozenset({'chicken'}), confidence=0.2109375, lift=3.51609375]), RelationRecord(items=frozenset({'chicken', 'spaghetti', 'olive oil'}), support=0.0034662045060658577, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken', 'spaghetti'}), 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', '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({'ground beef', 'chocolate', 'herb & pepper'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chocolate', 'herb & pepper'}), items_add=frozenset({'ground beef'}), confidence=0.4411764705882354, lift=4.4901827759597746]), RelationRecord(items=frozenset({'soup', 'chocolate', 'milk'}), support=0.003999466737768298, ordered_statistics=[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', 'cooking oil'}), items_add=frozenset({'spaghetti'}), confidence=0.5714285714285714, lift=3.281951870487856), OrderedStatistic(items_base=frozenset({'spaghetti', 'cooking oil'}), items_add=frozenset({'ground beef'}), confidence=0.3025210084033613, lift=3.0789824749438446]), RelationRecord(items=frozenset({'ground beef', 'eggs', 'herb & pepper'}), support=0.0041327822956939075, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'eggs'}), items_add=frozenset({'herb & pepper'}), confidence=0.2066666666666667, lift=4.178454627133872), OrderedStatistic(items_base=frozenset({'eggs', 'herb & pepper'}), items_add=frozenset({'ground beef'}), confidence=0.3297872340425532, lift=3.3564912381997174]), RelationRecord(items=frozenset({'spaghetti', 'eggs', 'red wine'}), support=0.0037328356219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'eggs', 'red wine'}), items_add=frozenset({'spaghetti'}), confidence=0.5283018867924528, lift=3.0342974370828397]), RelationRecord(items=frozenset({'mushroom cream sauce', 'escalope', 'nan'}), support=0.005732568990801226, ordered_statistics=[OrderedStatistic(items_base=frozenset({'mushroom cream sauce', 'escalope', 'nan'}), items_add=frozenset({'nan'}), confidence=0.29059829059829057, lift=4.84395061728395])])

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rozensest({'mushroom cream sauce', 'nan'}), items_add=frozensest({'escalope'}), confidence=0.3006993006993007, lift=3.790832696715049)], RelationRecord(items=frozensest({'pasta', 'escalope', 'nan'}), support=0.005865884548726837, ordered_statistics=[OrderedStatistic(items_base=frozensest({'pasta', 'nan'}), items_add=frozensest({'escalope'})), confidence=0.3728813559322034, lift=4.700811850163794)], RelationRecord(items=frozensest({'ground beef', 'herb & pepper', 'french fries'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_base=frozensest({'ground beef', 'french fries'}), items_add=frozensest({'herb & pepper'}), confidence=0.23076923076923078, lift=4.665768194070081), OrderedStatistic(items_base=frozensest({'herb & pepper', 'french fries'}), items_add=frozensest({'ground beef'}), confidence=0.46153846153846156, lift=4.697421981004071)], RelationRecord(items=frozensest({'fromage blanc', 'nan', 'honey'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozensest({'fromage blanc', 'nan'}), items_add=frozensest({'honey'}), confidence=0.2450980392156863, lift=5.164270764485569)], RelationRecord(items=frozensest({'frozen vegetables', 'tomatoes', 'green tea'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozensest({'frozen vegetables', 'green tea'}), items_add=frozensest({'tomatoes'}), confidence=0.2314814814814815, lift=3.38468341635983)], RelationRecord(items=frozensest({'frozen vegetables', 'ground beef', 'spaghetti'}), support=0.008665511265164644, ordered_statistics=[OrderedStatistic(items_base=frozensest({'frozen vegetables', 'spaghetti'}), items_add=frozensest({'ground beef'}), confidence=0.31100478468899523, lift=3.165328208890303)], RelationRecord(items=frozensest({'frozen vegetables', 'olive oil', 'milk'}), support=0.004799360085321957, ordered_statistics=[OrderedStatistic(items_base=frozensest({'frozen vegetables', 'milk'}), items_add=frozensest({'olive oil'}), confidence=0.20338983050847456, lift=3.088314005352364), OrderedStatistic(items_base=frozensest({'frozen vegetables', 'olive oil'}), items_add=frozensest({'milk'}), confidence=0.4235294117647058, lift=3.2684095860566447)], RelationRecord(items=frozensest({'frozen vegetables', 'soup', 'milk'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozensest({'frozen vegetables', 'soup'}), items_add=frozensest({'milk'}), confidence=0.5, lift=3.858539094650206)], RelationRecord(items=frozensest({'frozen vegetables', 'milk', 'tomatoes'}), support=0.0041327822956939075, ordered_statistics=[OrderedStatistic(items_base=frozensest({'milk', 'tomatoes'}), items_add=frozensest({'frozen vegetables'}), confidence=0.29523809523809524, lift=3.0973160173160172)], RelationRecord(items=frozensest({'frozen vegetables', 'shrimp', 'mineral water'}), support=0.007199040127982935, ordered_statistics=[OrderedStatistic(items_base=frozensest({'shrimp', 'mineral water'}), items_add=frozensest({'frozen vegetables'}), confidence=0.30508474576271183, lift=3.200616332819722)], RelationRecord(items=frozensest({'frozen vegetables', 'spaghetti', 'olive oil'}), support=0.005732568990801226, ordered_statistics=[OrderedStatistic(items_base=frozensest({'frozen vegetables', 'spaghetti'}), items_add=frozensest({'olive oil'}), confidence=0.20574162679425836, lift=3.1240241752707125)], RelationRecord(items=frozensest({'frozen vegetables', 'spaghetti', 'shrimp'}), support=0.005999200106652446, ordered_statistics=[OrderedStatistic(items_base=frozensest({'frozen vegetables', 'spaghetti'}), items_add=frozensest({'shrimp'}), confidence=0.21531100478468898, lift=3.0131489680782684)], RelationRecord(items=frozensest({'frozen vegetables', 'tomatoes', 'shrimp'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozensest({'frozen vegetables', 'shrimp'}), items_add=frozensest({'tomatoes'}), confidence=0.2400000000000002, lift=3.5092397660818717), OrderedStatistic(items_base=frozensest({'frozen vegetables', 'tomatoes'}), items_add=frozensest({'shrimp'}))])

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et({'shrimp'}), confidence=0.2479338842975207, lift=3.469686690514370
4), OrderedStatistic(items_base=frozenset({'tomatoes', 'shrimp'}), items_add=frozenset({'frozen vegetables'}), confidence=0.35714285714285715, lift=3.7467532467532467]), RelationRecord(items=frozenset({'frozen vegetables', 'spaghetti', 'tomatoes'}), support=0.006665777896280496, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti'}), 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({'spaghetti', 'ground beef', 'grated cheese'}), support=0.005332622317024397, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'grated cheese'}), items_add=frozenset({'ground beef'}), confidence=0.3225806451612903, lift=3.283144395325426]), RelationRecord(items=frozenset({'ground beef', 'tomatoes', 'green tea'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'green tea'}), items_add=frozenset({'tomatoes'}), confidence=0.2072072072072072, lift=3.0297490472929067)], RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'milk'}), support=0.0035995200639914677, ordered_statistics=[OrderedStatistic(items_base=frozenset({'milk', 'herb & pepper'}), items_add=frozenset({'ground beef'}), confidence=0.3913043478260869, lift=3.9825968969382335)], RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'mineral water'}), support=0.006665777896280496, ordered_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.3906250000000006, lift=3.975682666214383)], RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'nan'}), support=0.015997866951073192, ordered_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper', 'nan'}), items_add=frozenset({'ground beef'}), confidence=0.3234501347708895, lift=3.2919938411349285)], RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'herb & pepper'}), support=0.006399146780429276, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'herb & pepper'}), items_add=frozenset({'ground beef'}), confidence=0.3934426229508197, lift=4.004359721511667)], RelationRecord(items=frozenset({'ground beef', 'olive oil', 'milk'}), support=0.004932675643247567, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'milk'}), items_add=frozenset({'olive oil'}), confidence=0.22424242424242427, lift=3.40494417862839)], RelationRecord(items=frozenset({'ground beef', 'soup', 'milk'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'soup'}), items_add=frozenset({'milk'}), confidence=0.4109589041095891, lift=3.1714019956029094)], RelationRecord(items=frozenset({'ground beef', 'nan', 'tomato sauce'}), support=0.005332622317024397, ordered_statistics=[OrderedStatistic(items_base=frozenset({'nan', 'tomato sauce'}), items_add=frozenset({'ground beef'}), confidence=0.3773584905660377, lift=3.840659481324083)], RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'pepper'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'pepper'}), items_add=frozenset({'ground beef'}), confidence=0.33783783783783783, lift=3.4384282518610876)], RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'shrimp'}), support=0.005999200106652446, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'shrimp'}), items_add=frozenset({'spaghetti'}), confidence=0.5232558139534884, lift=3.005315360233627)], RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'tomato sauce'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef',

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'tomato sauce')), items_add=frozenset({'spaghetti'}), confidence=0.5750
000000000001, lift=3.3025076569678413), OrderStatistic(items_base=frozenset({'spaghetti', 'tomato sauce'}), items_add=frozenset({'ground beef'}), confidence=0.4893617021276596, lift=4.980599901844742)], RelationRecord(items=frozenset({'olive oil', 'nan', 'light cream'}), support=0.003199573390214638, ordered_statistics=[OrderStatistic(items_base=frozenset({'nan', 'light cream'}), items_add=frozenset({'olive oil'}), confidence=0.20512820512820515, lift=3.1147098515519573)]), RelationRecord(items=frozenset({'olive oil', 'milk', 'shrimp'}), support=0.003199573390214638, ordered_statistics=[OrderStatistic(items_base=frozenset({'olive oil', 'shrimp'}), items_add=frozenset({'milk'}), confidence=0.3934426229508197, lift=3.0362274843149164)]), RelationRecord(items=frozenset({'soup', 'olive oil', 'milk'}), support=0.0035995200639914677, ordered_statistics=[OrderStatistic(items_base=frozenset({'olive oil', 'milk'}), items_add=frozenset({'soup'}), confidence=0.2109375, lift=4.174781497361478), OrderStatistic(items_base=frozenset({'soup', 'milk'}), items_add=frozenset({'olive oil'}), confidence=0.23684210526315788, lift=3.5962603878116344), OrderStatistic(items_base=frozenset({'soup', 'olive oil'}), items_add=frozenset({'milk'}), confidence=0.4029850746268656, lift=3.1098673300165833)]), RelationRecord(items=frozenset({'spaghetti', 'olive oil', 'milk'}), support=0.007199040127982935, ordered_statistics=[OrderStatistic(items_base=frozenset({'spaghetti', 'milk'}), items_add=frozenset({'olive oil'}), confidence=0.20300751879699247, lift=3.0825089038385434)]), RelationRecord(items=frozenset({'soup', 'milk', 'tomatoes'}), support=0.0030662578322890282, ordered_statistics=[OrderStatistic(items_base=frozenset({'milk', 'tomatoes'}), items_add=frozenset({'soup'}), confidence=0.21904761904761905, lift=4.335293378565146), OrderStatistic(items_base=frozenset({'soup', 'tomatoes'}), items_add=frozenset({'milk'}), confidence=0.44230769230769235, lift=3.4133230452674903)]), RelationRecord(items=frozenset({'spaghetti', 'milk', 'whole wheat pasta'}), support=0.003999466737768298, ordered_statistics=[OrderStatistic(items_base=frozenset({'spaghetti', 'whole wheat pasta'}), items_add=frozenset({'milk'}), confidence=0.4545454545454546, lift=3.5077628133183696)]), RelationRecord(items=frozenset({'soup', 'olive oil', 'mineral water'}), support=0.005199306759098787, ordered_statistics=[OrderStatistic(items_base=frozenset({'soup', 'mineral water'}), items_add=frozenset({'olive oil'}), confidence=0.22543352601156072, lift=3.4230301186492245)]), RelationRecord(items=frozenset({'olive oil', 'mineral water', 'whole wheat pasta'}), support=0.0038661511798426876, ordered_statistics=[OrderStatistic(items_base=frozenset({'mineral water', 'whole wheat pasta'}), items_add=frozenset({'olive oil'}), confidence=0.4027777777777778, lift=6.115862573099416)]), RelationRecord(items=frozenset({'olive oil', 'nan', 'whole wheat pasta'}), support=0.007998933475536596, ordered_statistics=[OrderStatistic(items_base=frozenset({'nan', 'whole wheat pasta'}), items_add=frozenset({'olive oil'}), confidence=0.2714932126696833, lift=4.122410097642296)]), RelationRecord(items=frozenset({'pasta', 'shrimp', 'nan'}), support=0.005065991201173177, ordered_statistics=[OrderStatistic(items_base=frozenset({'pasta', 'nan'}), items_add=frozenset({'shrimp'}), confidence=0.3220338983050847, lift=4.506672147735896)]), RelationRecord(items=frozenset({'spaghetti', 'olive oil', 'pancakes'}), support=0.005065991201173177, ordered_statistics=[OrderStatistic(items_base=frozenset({'spaghetti', 'pancakes'}), items_add=frozenset({'olive oil'}), confidence=0.20105820105, lift=3.0529100529100526)]), RelationRecord(items=frozenset({'spaghetti', 'olive oil', 'tomatoes'}), support=0.004399413411545127, ordered_statistics=[OrderStatistic(items_base=frozenset({'olive oil', 'tomatoes'}), items_add=frozenset({'spaghetti'}), confidence=0.6111111111111111)]))
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111111111112, lift=3.5099115194827295), OrderedStatistic(items_base=frozenset({'spaghetti', 'tomatoes'}), items_add=frozenset({'olive oil'}), confidence=0.21019108280254778, lift=3.19158565202816)], RelationRecord(items=frozenset({'spaghetti', 'whole wheat rice', 'tomatoes'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'whole wheat rice'}), items_add=frozenset({'tomatoes'}), confidence=0.2169811320754717, lift=3.1726617382029496)], RelationRecord(items=frozenset({'spaghetti', 'avocado', 'milk', 'nan'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'avocado', 'nan'}), items_add=frozenset({'milk'}), confidence=0.41666666666666663, lift=3.215449245541838)], RelationRecord(items=frozenset({'cake', 'milk', 'nan', 'burgers'}), support=0.0037328356219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'cake', 'milk', 'nan'}), items_add=frozenset({'burgers'}), confidence=0.27999999999999997, lift=3.211437308868501)], RelationRecord(items=frozenset({'chocolate', 'turkey', 'nan', 'burgers'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chocolate', 'turkey', 'nan'}), items_add=frozenset({'burgers'}), confidence=0.27058823529411763, lift=3.1034898363014927)], RelationRecord(items=frozenset({'turkey', 'milk', 'nan', 'burgers'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'turkey', 'milk', 'nan'}), items_add=frozenset({'burgers'}), confidence=0.2823529411764706, lift=3.2384241770102533)], RelationRecord(items=frozenset({'frozen vegetables', 'cake', 'tomatoes', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'cake', 'nan'}), items_add=frozenset({'tomatoes'}), confidence=0.2987012987012987, lift=4.367560314928736), OrderedStatistic(items_base=frozenset({'cake', 'tomatoes', 'nan'}), items_add=frozenset({'frozen vegetables'}), confidence=0.36507936507936506, lift=3.8300144300144296)], RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'cereals', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'cereals', 'nan'}), items_add=frozenset({'spaghetti'}), confidence=0.6764705882352942, lift=3.8853031258445188), OrderedStatistic(items_base=frozenset({'spaghetti', 'cereals', 'nan'}), items_add=frozenset({'ground beef'}), confidence=0.4599999999999999, lift=4.681763907734057)], RelationRecord(items=frozenset({'chicken', 'ground beef', 'milk', 'nan'}), support=0.0038661511798426876, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken', 'ground beef', 'nan'}), items_add=frozenset({'milk'}), confidence=0.40845070422535207, lift=3.152046020981858)], RelationRecord(items=frozenset({'chicken', 'olive oil', 'milk', 'nan'}), support=0.0035995200639914677, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken', 'milk', 'nan'}), items_add=frozenset({'olive oil'}), confidence=0.24324324324323, lift=3.693456614509246), OrderedStatistic(items_base=frozenset({'chicken', 'olive oil', 'nan'}), items_add=frozenset({'milk'}), confidence=0.5, lift=3.858539094650206), OrderedStatistic(items_base=frozenset({'olive oil', 'milk', 'nan'}), items_add=frozenset({'chicken'}), confidence=0.2109375, lift=3.51609375)], RelationRecord(items=frozenset({'chicken', 'spaghetti', 'olive oil', 'nan'}), support=0.0034662045060658577, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken', 'spaghetti', 'nan'}), items_add=frozenset({'olive oil'}), confidence=0.20155038759689922, lift=3.0603835169318647)], RelationRecord(items=frozenset({'ground beef', 'eggs', 'chocolate', 'mineral water'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'eggs', 'chocolate', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.29702970297029707, lift

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=3.023093354111531))), RelationRecord(items=frozenset({'frozen vegetables', 'ground beef', 'chocolate', 'mineral water'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.34246575342465757, lift=3.4855300087358976), OrderedStatistic(items_base=frozenset({'ground beef', 'chocolate', 'mineral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.30487804878048785, lift=3.1984478935698455)]), RelationRecord(items=frozenset({'frozen vegetables', 'ground beef', 'chocolate', 'spaghetti'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'ground beef', 'chocolate'}), items_add=frozenset({'spaghetti'}), confidence=0.5348837209302326, lift=3.0721001460165964), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti', 'chocolate'}), items_add=frozenset({'ground beef'}), confidence=0.3898305084745763, lift=3.967596531978015), OrderedStatistic(items_base=frozenset({'spaghetti', 'ground beef', 'chocolate'}), items_add=frozenset({'frozen vegetables'}), confidence=0.3333333333333337, lift=3.4969696969696975)]), RelationRecord(items=frozenset({'frozen vegetables', 'chocolate', 'milk', 'mineral water'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.4109589041095891, lift=3.1714019956029094)]), RelationRecord(items=frozenset({'frozen vegetables', 'spaghetti', 'chocolate', 'milk'}), support=0.0034662045060658577, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti', 'chocolate'}), items_add=frozenset({'milk'}), confidence=0.44067796610169485, lift=3.4007463207086555), OrderedStatistic(items_base=frozenset({'spaghetti', 'chocolate', 'milk'}), items_add=frozenset({'frozen vegetables'}), confidence=0.3170731707317073, lift=3.3263858093126384)]), RelationRecord(items=frozenset({'frozen vegetables', 'shrimp', 'chocolate', 'mineral water'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'mineral water'}), items_add=frozenset({'shrimp'}), confidence=0.32876712328767127, lift=4.600899611531385), OrderedStatistic(items_base=frozenset({'shrimp', 'chocolate', 'mineral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.4210526315789474, lift=4.417224880382776)]), RelationRecord(items=frozenset({'frozen vegetables', 'shrimp', 'chocolate', 'nan'}), support=0.005332622317024397, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'nan'}), items_add=frozenset({'shrimp'}), confidence=0.23255813953488375, lift=3.2545123221103784), OrderedStatistic(items_base=frozenset({'shrimp', 'chocolate', 'nan'}), items_add=frozenset({'frozen vegetables'}), confidence=0.29629629629629634, lift=3.1084175084175087)]), RelationRecord(items=frozenset({'ground beef', 'chocolate', 'herb & pepper', 'nan'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chocolate', 'herb & pepper', 'nan'}), items_add=frozenset({'ground beef'}), confidence=0.4411764705882354, lift=4.4901827759597746)]), RelationRecord(items=frozenset({'soup', 'chocolate', 'milk', 'nan'}), support=0.00399466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'soup', 'chocolate', 'nan'}), items_add=frozenset({'milk'}), confidence=0.3947368421052632, lift=3.0462150747238472)]), RelationRecord(items=frozenset({'spaghetti', 'chocolate', 'olive oil', 'mineral water'}), support=0.0038661511798426876, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'chocolate', 'mineral water'}), items_add=frozenset({'olive oil'}), confidence=0.2436974789915966, lift=3.700353825740822)]), RelationRecord(items=frozenset({'spaghetti', 'shrimp',
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'chocolate', 'mineral water')), support=0.0034662045060658577, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'chocolate', 'mineral water'}), items_add=frozenset({'shrimp'}), confidence=0.21848739495798317, lift=3.0576006522011783)], RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'nan', 'cooking oil'}), support=0.04799360085321957, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'nan', 'cooking oil'}), items_add=frozenset({'spaghetti'}), confidence=0.5714285714285714, lift=3.2819951870487856), OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'cooking oil'}), items_add=frozenset({'ground beef'}), confidence=0.3025210084033613, lift=3.0789824749438446)], RelationRecord(items=frozenset({'frozen vegetables', 'eggs', 'milk', 'mineral water'}), support=0.0037328356219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'eggs', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.411764705882353, lift=3.177620430888405)], RelationRecord(items=frozenset({'ground beef', 'eggs', 'herb & pepper', 'nan'}), support=0.0041327822956939075, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'eggs', 'nan'}), items_add=frozenset({'herb & pepper'}), confidence=0.2066666666666667, lift=4.178454627133872), OrderedStatistic(items_base=frozenset({'eggs', 'herb & pepper', 'nan'}), items_add=frozenset({'ground beef'}), confidence=0.3297872340425532, lift=3.3564912381997174)], RelationRecord(items=frozenset({'spaghetti', 'eggs', 'red wine', 'nan'}), support=0.003732835621917076, ordered_statistics=[OrderedStatistic(items_base=frozenset({'eggs', 'red wine', 'nan'}), items_add=frozenset({'spaghetti'}), confidence=0.5283018867924528, lift=3.0342974370828397)], RelationRecord(items=frozenset({'ground beef', 'nan', 'herb & pepper', 'french fries'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'nan', 'french fries'}), items_add=frozenset({'herb & pepper'}), confidence=0.23076923076923078, lift=4.665768194070081), OrderedStatistic(items_base=frozenset({'nan', 'herb & pepper', 'french fries'}), items_add=frozenset({'ground beef'}), confidence=0.46153846153846156, lift=4.697421981004071)], RelationRecord(items=frozenset({'frozen smoothie', 'spaghetti', 'milk', 'mineral water'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen smoothie', 'spaghetti', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.4705882352941177, lift=3.631566206729606), OrderedStatistic(items_base=frozenset({'spaghetti', 'milk', 'mineral water'}), items_add=frozenset({'frozen smoothie'}), confidence=0.2033898305084746, lift=3.211846565566459)], RelationRecord(items=frozenset({'frozen vegetables', 'nan', 'tomatoes', 'green tea'}), support=0.03332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'green tea'}), items_add=frozenset({'tomatoes'}), confidence=0.2314814814814815, lift=3.38468341635983)], RelationRecord(items=frozenset({'frozen vegetables', 'ground beef', 'milk', 'mineral water'}), support=0.0037328356219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'ground beef', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.40579710144927533, lift=3.1315679608755294), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'milk', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.3373493975903614, lift=3.4334570302921317), OrderedStatistic(items_base=frozenset({'ground beef', 'milk', 'mineral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.3373493975903614, lift=3.539101861993428)], RelationRecord(items=frozenset({'frozen vegetables', 'ground beef', 'milk', 'spaghetti'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'ground beef', 'mi
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lk')), items_add=frozenset({'spaghetti'}), confidence=0.534883720930232
6, lift=3.0721001460165964), OrderedStatistic(items_base=frozenset({'fr
ozen vegetables', 'spaghetti', 'milk'}), items_add=frozenset({'ground b
eef'}), confidence=0.3709677419354839, lift=3.7756160546242397), Ordere
dStatistic(items_base=frozenset({'spaghetti', 'ground beef', 'milk'}),
items_add=frozenset({'frozen vegetables'}), confidence=0.31506849315068
49, lift=3.305354919053549)), RelationRecord(items=frozenset({'frozen
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enset({'frozen vegetables', 'spaghetti', 'mineral water'}), items_add=f
rozenset({'ground beef'}), confidence=0.3666666666666667, lift=3.731840
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nce=0.31100478468899523, lift=3.165328208890303)], RelationRecord(item
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r'}), support=0.003332888948140248, ordered_statistics=[OrderedStatisti
c(items_base=frozenset({'frozen vegetables', 'milk', 'mineral water'})),
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t=4.573557387444516), OrderedStatistic(items_base=frozenset({'frozen ve
getables', 'olive oil', 'mineral water'}), items_add=frozenset({'mil
k'}), confidence=0.5102040816326531, lift=3.937284790459394), OrderedSt
atistic(items_base=frozenset({'olive oil', 'milk', 'mineral water'}), i
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06, lift=4.098011363636364)], RelationRecord(items=frozenset({'frozen
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zen vegetables', 'milk', 'mineral water'}), items_add=frozenset({'sou
p'}), confidence=0.27710843373493976, lift=5.484407286136631), Ordereds
tatistic(items_base=frozenset({'frozen vegetables', 'soup', 'milk'}), i
tems_add=frozenset({'mineral water'}), confidence=0.7666666666666666, l
ift=3.21631245339299), OrderedStatistic(items_base=frozenset({'frozen v
egetables', 'soup', 'mineral water'}), items_add=frozenset({'milk'}), c
onfidence=0.6052631578947368, lift=4.670863114576565), OrderedStatistic
(items_base=frozenset({'soup', 'milk', 'mineral water'}), items_add=fro
zenset({'frozen vegetables'}), confidence=0.35937500000000006, lift=3.7
701704545454553)], RelationRecord(items=frozenset({'frozen vegetable
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7, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghett
i', 'milk', 'mineral water'}), items_add=frozenset({'frozen vegetable
s'}), confidence=0.28813559322033894, lift=3.0228043143297376)], Relat
ionRecord(items=frozenset({'frozen vegetables', 'olive oil', 'milk', 'n
an'}), support=0.004799360085321957, ordered_statistics=[OrderedStatist
ic(items_base=frozenset({'frozen vegetables', 'milk', 'nan'}), items_ad
d=frozenset({'olive oil'}), confidence=0.20338983050847456, lift=3.0883
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235294117647058, lift=3.2684095860566447)], RelationRecord(items=froze
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confidence=0.5, lift=3.858539094650206)], RelationRecord(items=frozens
et({'frozen vegetables', 'tomatoes', 'milk', 'nan'}), support=0.0041327
822956939075, ordered_statistics=[OrderedStatistic(items_base=frozenset(
{'tomatoes', 'milk', 'nan'}), items_add=frozenset({'frozen vegetable
s'}), confidence=0.29523809523809524, lift=3.0973160173160172)], Relat

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ionRecord(items=frozenset({'frozen vegetables', 'nan', 'shrimp', 'mineral water'}), support=0.007199040127982935, ordered_statistics=[OrderedStatistic(items_base=frozenset({'nan', 'shrimp', 'mineral water'})), items_add=frozenset({'frozen vegetables'}), confidence=0.3068181818181818, lift=3.218801652892562]), RelationRecord(items=frozenset({'frozen vegetables', 'spaghetti', 'shrimp', 'mineral water'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti', 'mineral water'})), items_add=frozenset({'shrimp'}), confidence=0.2777777777777778, lift=3.8873341625207294], OrderedStatistic(items_base=frozenset({'spaghetti', 'shrimp', 'mineral water'})), items_add=frozenset({'frozen vegetables'}), confidence=0.3906250000000006, lift=4.098011363636364]), RelationRecord(items=frozensest({'frozen vegetables', 'spaghetti', 'tomatoes', 'mineral water'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti', 'mineral water'})), items_add=frozenset({'tomatoes'}), confidence=0.2555555555555556, lift=3.7366904916612524], OrderedStatistic(items_base=frozenset({'frozen vegetables', 'tomatoes', 'mineral water'})), items_add=frozenset({'spaghetti'}), confidence=0.5227272727272727, lift=3.0022796881525826], OrderedStatistic(items_base=frozenset({'spaghetti', 'tomatoes', 'mineral water'})), items_add=frozenset({'frozen vegetables'}), confidence=0.32857142857142857, lift=3.447012987012987]), RelationRecord(items=frozenset({'frozen vegetables', 'spaghetti', 'olive oil', 'nan'}), support=0.005732568990801226, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti', 'nan'})), items_add=frozenset({'olive oil'}), confidence=0.20574162679425836, lift=3.1240241752707125]), RelationRecord(items=frozenset({'frozen vegetables', 'spaghetti', 'shrimp', 'nan'}), support=0.005999200106652446, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti', 'nan'})), items_add=frozenset({'shrimp'}), confidence=0.21531100478468898, lift=3.0131489680782684]), RelationRecord(items=frozensest({'frozen vegetables', 'shrimp', 'tomatoes', 'nan'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'shrimp', 'nan'})), items_add=frozenset({'tomatoes'}), confidence=0.2400000000000002, lift=3.5092397660818717], OrderedStatistic(items_base=frozenset({'frozen vegetables', 'tomatoes', 'nan'})), items_add=frozenset({'shrimp'}), confidence=0.2479338842975207, lift=3.4696866905143704], OrderedStatistic(items_base=frozenset({'shrimp', 'tomatoes', 'nan'})), items_add=frozenset({'frozen vegetables'}), confidence=0.35714285714285715, lift=3.7467532467532467]), RelationRecord(items=frozensest({'frozen vegetables', 'spaghetti', 'tomatoes', 'nan'}), support=0.006665777896280496, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti', 'nan'})), items_add=frozenset({'tomatoes'}), confidence=0.23923444976076558, lift=3.4980460188216425], OrderedStatistic(items_base=frozenset({'spaghetti', 'tomatoes', 'nan'})), items_add=frozenset({'frozen vegetables'}), confidence=0.3184713375796179, lift=3.341053850607991]), RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'grated cheese', 'nan'}), support=0.005332622317024397, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'grated cheese', 'nan'})), items_add=frozenset({'ground beef'}), confidence=0.3225806451612903, lift=3.283144395325426]), RelationRecord(items=frozenset({'ground beef', 'nan', 'tomatoes', 'green tea'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'nan', 'green tea'})), items_add=frozenset({'tomatoes'}), confidence=0.2072072072072072, lift=3.0297490472929067]), RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'nan', 'milk'}), support=0.0035995200639914677, ordered_statistics=[Ord

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eredStatistic(items_base=frozenset({'milk', 'herb & pepper', 'nan'}), items_add=frozenset({'ground beef'}), confidence=0.3913043478260869, lift=3.9825968969382335)], RelationRecord(items=frozenset({'ground beef', 'nan', 'herb & pepper', 'mineral water'}), support=0.006665777896280496, ordered_statistics=[OrderedStatistic(items_base=frozenset({'nan', 'herb & pepper', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.3906250000000006, lift=3.975682666214383)]), RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'herb & pepper', 'nan'}), support=0.006399146780429276, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'herb & pepper', 'nan'}), items_add=frozenset({'ground beef'}), confidence=0.3934426229508197, lift=4.004359721511667)], RelationRecord(items=frozenset({'ground beef', 'olive oil', 'milk', 'nan'}), support=0.004932675643247567, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'milk', 'nan'}), items_add=frozenset({'olive oil'}), confidence=0.22424242424242427, lift=3.40494417862839)]), RelationRecord(items=frozenset({'ground beef', 'soup', 'milk', 'nan'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'soup', 'nan'}), items_add=frozenset({'milk'}), confidence=0.4109589041095891, lift=3.1714019956029094)]), RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'olive oil', 'mineral water'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'olive oil', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.2987012987012987, lift=3.0401064335935435]), RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'tomatoes', 'mineral water'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'tomatoes', 'mineral water'}), items_add=frozenset({'spaghetti'}), confidence=0.5609756097560976, lift=3.221958689724723), OrderedStatistic(items_base=frozenset({'spaghetti', 'tomatoes', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.32857142857142857, lift=3.344117076952898)], RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'nan', 'pepper'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'pepper'}), items_add=frozenset({'ground beef'}), confidence=0.33783783783783783, lift=3.4384282518610876)], RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'shrimp', 'nan'}), support=0.005999200106652446, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'shrimp', 'nan'}), items_add=frozenset({'spaghetti'}), confidence=0.5232558139534884, lift=3.005315360233627)]), RelationRecord(items=frozenset({'spaghetti', 'ground beef', 'nan', 'tomato sauce'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'nan', 'tomato sauce'}), items_add=frozenset({'spaghetti'}), confidence=0.5750000000000001, lift=3.3025076569678413), OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'tomato sauce'}), items_add=frozenset({'ground beef'}), confidence=0.4893617021276596, lift=4.980599901844742)], RelationRecord(items=frozenset({'spaghetti', 'olive oil', 'milk', 'mineral water'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'milk', 'mineral water'}), items_add=frozenset({'olive oil'}), confidence=0.211864406779661, lift=3.216993755575379)]), RelationRecord(items=frozenset({'spaghetti', 'tomatoes', 'milk', 'mineral water'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'milk', 'mineral water'}), items_add=frozenset({'tomatoes'}), confidence=0.211864406779661, lift=3.0978458387022165)]), RelationRecord(items=frozenset({'shrimp', 'olive oil', 'milk', 'nan'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(items_

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base=frozenset({'shrimp', 'olive oil', 'nan'}), items_add=frozenset({'milk'}), confidence=0.3999999999999997, lift=3.0868312757201646)], RelationRecord(items=frozenset({'soup', 'olive oil', 'milk', 'nan'}), support=0.0035995200639914677, ordered_statistics=[OrderedStatistic(items_base=frozenset({'olive oil', 'milk', 'nan'}), items_add=frozenset({'soup'}), confidence=0.2109375, lift=4.174781497361478), OrderedStatistic(items_base=frozenset({'soup', 'milk', 'nan'}), items_add=frozenset({'olive oil'}), confidence=0.23684210526315788, lift=3.5962603878116344), OrderedStatistic(items_base=frozenset({'soup', 'olive oil', 'nan'}), items_add=frozenset({'milk'}), confidence=0.4029850746268656, lift=3.1098673300165833)], RelationRecord(items=frozenset({'spaghetti', 'olive oil', 'milk', 'nan'}), support=0.007199040127982935, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'milk', 'nan'}), items_add=frozenset({'olive oil'}), confidence=0.20300751879699247, lift=3.0825089038385434)], RelationRecord(items=frozenset({'tomatoes', 'soup', 'milk', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'tomatoes', 'milk', 'nan'}), items_add=frozenset({'soup'}), confidence=0.21904761904761905, lift=4.335293378565146), OrderedStatistic(items_base=frozenset({'soup', 'tomatoes', 'nan'}), items_add=frozenset({'milk'}), confidence=0.44230769230769235, lift=3.4133230452674903)], RelationRecord(items=frozenset({'spaghetti', 'milk', 'nan', 'whole wheat pasta'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'whole wheat pasta'}), items_add=frozenset({'milk'}), confidence=0.4545454545454546, lift=3.5077628133183696)], RelationRecord(items=frozenset({'nan', 'soup', 'olive oil', 'mineral water'}), support=0.005199306759098787, ordered_statistics=[OrderedStatistic(items_base=frozenset({'nan', 'soup', 'mineral water'}), items_add=frozenset({'olive oil'}), confidence=0.22543352601156072, lift=3.4230301186492245)], RelationRecord(items=frozenset({'nan', 'olive oil', 'mineral water', 'whole wheat pasta'}), support=0.0038661511798426876, ordered_statistics=[OrderedStatistic(items_base=frozenset({'nan', 'mineral water', 'whole wheat pasta'}), items_add=frozenset({'olive oil'}), confidence=0.4027777777777778, lift=6.115862573099416)], RelationRecord(items=frozenset({'spaghetti', 'olive oil', 'nan', 'pancakes'}), support=0.005065991201173177, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'pancakes', 'nan'}), items_add=frozenset({'olive oil'}), confidence=0.20105820105820105, lift=3.0529100529100526)], RelationRecord(items=frozenset({'spaghetti', 'olive oil', 'tomatoes', 'nan'}), support=0.004399413411545127, ordered_statistics=[OrderedStatistic(items_base=frozenset({'olive oil', 'tomatoes', 'nan'}), items_add=frozenset({'spaghetti'}), confidence=0.611111111111112, lift=3.5099115194827295), OrderedStatistic(items_base=frozenset({'spaghetti', 'tomatoes', 'nan'}), items_add=frozenset({'olive oil'}), confidence=0.21019108280254778, lift=3.19158565202816)], RelationRecord(items=frozenset({'spaghetti', 'whole wheat rice', 'tomatoes', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'whole wheat rice', 'nan'}), items_add=frozenset({'tomatoes'}), confidence=0.2169811320754717, lift=3.1726617382029496)], RelationRecord(items=frozenset({'mineral water', 'eggs', 'chocolate', 'ground beef', 'nan'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'nan', 'eggs', 'chocolate', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.29702970297029707, lift=3.023093354111531)], RelationRecord(items=frozenset({'mineral water', 'chocolate', 'frozen vegetables', 'ground beef', 'nan'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'chocolate', 'mineral water'}), items_add

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=frozensest({'ground beef'}), confidence=0.34246575342465757, lift=3.485
5300087358976), OrderedStatistic(items_base=frozensest({'ground beef',
'nan', 'chocolate', 'mineral water'}), items_add=frozensest({'frozen veg
etables'}), confidence=0.30487804878048785, lift=3.1984478935698455)], Relat
ionRecord(items=frozensest({'spaghetti', 'chocolate', 'frozen veget
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'ground beef', 'chocolate', 'nan'}), items_add=frozensest({'spaghett
i'}), confidence=0.5348837209302326, lift=3.0721001460165964), Ordereds
tatistic(items_base=frozensest({'frozen vegetables', 'spaghetti', 'choco
late', 'nan'}), items_add=frozensest({'ground beef'}), confidence=0.3898
305084745763, lift=3.967596531978015), OrderedStatistic(items_base=froz
ensest({'spaghetti', 'ground beef', 'chocolate', 'nan'}), items_add=froz
ensest({'frozen vegetables'}), confidence=0.3333333333333337, lift=3.49
69696969696975)], RelationRecord(items=frozensest({'mineral water',
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set({'milk'}), confidence=0.4109589041095891, lift=3.171401995602909
4)], RelationRecord(items=frozensest({'spaghetti', 'chocolate', 'milk',
'frozen vegetables', 'nan'}), support=0.0034662045060658577, ordered_st
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'spaghetti', 'chocolate', 'nan'}), items_add=frozensest({'milk'}), confi
dence=0.44067796610169485, lift=3.4007463207086555), OrderedStatistic(i
tems_base=frozensest({'spaghetti', 'chocolate', 'milk', 'nan'}), items_a
dd=frozensest({'frozen vegetables'}), confidence=0.3170731707317073, lif
t=3.3263858093126384)], RelationRecord(items=frozensest({'mineral wate
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99573390214638, ordered_statistics=[OrderedStatistic(items_base=frozense
st({'frozen vegetables', 'nan', 'chocolate', 'mineral water'}), items_a
dd=frozensest({'shrimp'}), confidence=0.32876712328767127, lift=4.600899
611531385), OrderedStatistic(items_base=frozensest({'nan', 'shrimp', 'ch
ocolate', 'mineral water'}), items_add=frozensest({'frozen vegetable
s'}), confidence=0.4210526315789474, lift=4.417224880382776)], Relatio
nRecord(items=frozensest({'spaghetti', 'mineral water', 'chocolate', 'ol
ive oil', 'nan'}), support=0.0038661511798426876, ordered_statistics=[O
rderedStatistic(items_base=frozensest({'spaghetti', 'nan', 'chocolate',
'mineral water'}), items_add=frozensest({'olive oil'}), confidence=0.243
6974789915966, lift=3.700353825740822)], RelationRecord(items=frozense
st({'spaghetti', 'mineral water', 'shrimp', 'chocolate', 'nan'}), suppor
t=0.0034662045060658577, ordered_statistics=[OrderedStatistic(items_ba
se=frozensest({'spaghetti', 'nan', 'chocolate', 'mineral water'}), items_
add=frozensest({'shrimp'}), confidence=0.21848739495798317, lift=3.05760
06522011783)], RelationRecord(items=frozensest({'mineral water', 'egg
s', 'milk', 'frozen vegetables', 'nan'}), support=0.003732835621917077
6, ordered_statistics=[OrderedStatistic(items_base=frozensest({'frozen v
egetables', 'nan', 'eggs', 'mineral water'}), items_add=frozensest({'mil
k'}), confidence=0.411764705882353, lift=3.177620430888405)], Relation
Record(items=frozensest({'spaghetti', 'mineral water', 'milk', 'frozen s
moothie', 'nan'}), support=0.003199573390214638, ordered_statistics=[Or
deredStatistic(items_base=frozensest({'frozen smoothie', 'nan', 'spaghet
ti', 'mineral water'}), items_add=frozensest({'milk'}), confidence=0.470
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zensest({'spaghetti', 'nan', 'milk', 'mineral water'}), items_add=frozen
set({'frozen smoothie'}), confidence=0.2033898305084746, lift=3.2118465
65566459)], RelationRecord(items=frozensest({'mineral water', 'milk',
'frozen vegetables', 'ground beef', 'nan'}), support=0.0037328356219170
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776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'ground beef', 'nan', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.40579710144927533, lift=3.1315679608755294), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'milk', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.3373493975903614, lift=3.4334570302921317), OrderedStatistic(items_base=frozenset({'ground beef', 'nan', 'milk', 'mineral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.3373493975903614, lift=3.539101861993428)], RelationRecord(items=frozenset({'spaghetti', 'milk', 'frozen vegetables', 'ground beef', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'ground beef', 'milk', 'nan'}), items_add=frozenset({'spaghetti'}), confidence=0.5348837209302326, lift=3.0721001460165964), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'spaghetti', 'milk', 'nan'}), items_add=frozenset({'ground beef'}), confidence=0.3709677419354839, lift=3.7756160546242397), OrderedStatistic(items_base=frozenset({'spaghetti', 'ground beef', 'milk', 'nan'}), items_add=frozenset({'frozen vegetables'}), confidence=0.3150684931506849, lift=3.305354919053549)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'frozen vegetables', 'ground beef', 'nan'}), support=0.004399413411545127, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'spaghetti', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.3666666666666667, lift=3.7318407960199007)], RelationRecord(items=frozenset({'mineral water', 'milk', 'frozen vegetables', 'olive oil', 'nan'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'milk', 'mineral water'}), items_add=frozenset({'olive oil'}), confidence=0.30120481927710846, lift=4.573557387444516), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'olive oil', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.5102040816326531, lift=3.937284790459394), OrderedStatistic(items_base=frozenset({'nan', 'olive oil', 'milk', 'mineral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.39062500000000006, lift=4.098011363636364)], RelationRecord(items=frozenset({'mineral water', 'milk', 'frozen vegetables', 'soup', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'milk', 'mineral water'}), items_add=frozenset({'soup'}), confidence=0.27710843373493976, lift=5.484407286136631), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'soup', 'milk', 'nan'}), items_add=frozenset({'mineral water'}), confidence=0.766666666666, lift=3.21631245339299), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'soup', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.6052631578947368, lift=4.670863114576565), OrderedStatistic(items_base=frozenset({'nan', 'soup', 'milk', 'mineral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.35937500000000006, lift=3.7701704545454553)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'milk', 'frozen vegetables', 'nan'}), support=0.004532728969470737, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'milk', 'mineral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.28813559322033894, lift=3.0228043143297376)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'shrimp', 'frozen vegetables', 'nan'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'spaghetti', 'mineral water'}), items_add=frozenset({'shrimp'}), confidence=0.2777777777777778, lift=3.8873341625207294), OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'shrimp', 'mineral water'}), items_add=frozenset({'frozen vegeta

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bles')), confidence=0.39062500000000006, lift=4.098011363636364)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'tomatoes', 'frozen vegetables', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'spaghetti', 'mineral water'}), items_add=frozenset({'tomatoes'}), confidence=0.2555555555555556, lift=3.7366904916612524), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'nan', 'tomatoes', 'mineral water'}), items_add=frozenset({'spaghetti'}), confidence=0.52272727272727, lift=3.0022796881525826), OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'tomatoes', 'mineral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.32857142857142857, lift=3.447012987012987)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'olive oil', 'ground beef', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'olive oil', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.2987012987012987, lift=3.0401064335935435)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'tomatoes', 'ground beef', 'nan'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'nan', 'tomatoes', 'mineral water'}), items_add=frozenset({'spaghetti'}), confidence=0.5609756097560976, lift=3.221958689724723), OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'tomatoes', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.32857142857142857, lift=3.344117076952898)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'milk', 'olive oil', 'nan'}), support=0.00333288948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'milk', 'mineral water'}), items_add=frozenset({'olive oil'}), confidence=0.211864406779661, lift=3.216993755575379)], RelationRecord(items=frozenset({'spaghetti', 'mineral water', 'tomatoes', 'milk', 'nan'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'spaghetti', 'nan', 'milk', 'mineral water'}), items_add=frozenset({'tomatoes'}), confidence=0.211864406779661, lift=3.0978458387022165)])]
```