Market Basket Analysis using Apriori Algorithm

```python
In [1]: import pandas as pd
        from apyori import apriori
        from operator import length_hint
```

```python
In [2]: df = pd.read_csv(r'.\Market_Basket - Optimisation.csv', header = None)
```

```python
In [3]: df.head(10)
```

Out[3]:

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	shrimp	almonds	avocado	vegetables mix	green grapes	whole weat flour	yams	cottage cheese	energy drink	tomato juice	low fat yogurt	green tea	honey	salad	mineral water	salmon	antioxy
1	burgers	meatballs	eggs	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
2	chutney	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
3	turkey	avocado	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
4	mineral water	milk	energy bar	whole wheat rice	green tea	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
5	low fat yogurt	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
6	whole wheat pasta	french fries	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
7	soup	light cream	shallot	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
8	frozen vegetables	spaghetti	green tea	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
9	french fries	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN

```python
In [4]: len(df)
```

Out[4]: 7501

Clean Nan-Values for Structural Analysis

```python
In [5]: df_trans = []
        for i in range (length_hint(df)):
            df_trans.append([str(df.values[i,j]) for j in range(20) if str(df.values[i,j]) != 'nan' ])
```

```python
In [6]: df_trans
```

Out[6]:
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 'tomato juice'],
['chocolate',
 'grated cheese',
 'herb & pepper',
 'mineral water',
 'soup',
 'olive oil'],
['burgers',
 'shrimp',
 'mineral water',
 'chicken',
 'fromage blanc',
 'salmon',
 'eggs',
 'cake',
 'frozen smoothie',
 'strawberries'],
['green tea'],
```

```
['cookies'],
['french fries', 'cookies'],
['milk', 'butter', 'eggs'],
['eggs', 'mushroom cream sauce', 'low fat yogurt'],
['eggs', 'green tea'],
['mineral water', 'whole wheat rice'],
['shrimp',
 'frozen vegetables',
 'parmesan cheese',
 'mineral water',
 'whole wheat rice',
 'cake'],
['whole wheat rice', 'pancakes'],
['frozen vegetables',
 'spaghetti',
 'olive oil',
 'butter',
 'salmon',
 'oil',
 'cooking oil',
 'frozen smoothie',
 'cauliflower'],
['green tea'],
['fresh tuna', 'eggs', 'escalope', 'strawberries'],
['spaghetti', 'soup', 'milk', 'carrots', 'chocolate'],
['burgers', 'mineral water', 'soup', 'meatballs', 'olive oil'],
['grated cheese',
 'mineral water',
 'cooking oil',
 'french fries',
 'cookies',
 'low fat yogurt'],
['shrimp', 'milk', 'olive oil', 'french fries'],
['frozen vegetables', 'mineral water', 'pancakes', 'cake', 'tomato juice'],
['spaghetti', 'milk', 'chicken'],
['grated cheese',
 'mineral water',
 'chicken',
 'french fries',
 'cottage cheese',
 'pancakes'],
['ground beef', 'mineral water', 'milk', 'eggs', 'mint'],
['shrimp', 'body spray', 'green tea'],
['frozen smoothie'],
['herb & pepper', 'frozen vegetables', 'mineral water', 'muffins', 'cereals'],
['turkey',
 'tomatoes',
 'spaghetti',
 'milk',
 'cider',
 'eggs',
 'honey',
 'cake',
 'green tea',
 'french fries',
 'brownies',
 'tomato juice'],
 ...]
```

Using Association Rules (with Support, Conf, and Lift)

```
In [7]:  rules = apriori(df_trans, min_support = 0.003, min_confidence = 0.35, min_lift = 3, min_length = 2)
```

```
In [8]:  list(rules)
```

```
Out[8]:  [RelationRecord(items=frozenset({'pasta', 'escalope'}), support=0.005865884548726837, ordered_statistics=[Order
         edStatistic(items_base=frozenset({'pasta'}), items_add=frozenset({'escalope'}), confidence=0.3728813559322034,
         lift=4.700811850163794)]),
          RelationRecord(items=frozenset({'ground beef', 'tomato sauce'}), support=0.005332622317024397, ordered_statist
         ics=[OrderedStatistic(items_base=frozenset({'tomato sauce'}), items_add=frozenset({'ground beef'}), confidence=
         0.3773584905660377, lift=3.840659481324083)]),
          RelationRecord(items=frozenset({'milk', 'avocado', 'spaghetti'}), support=0.003332888948140248, ordered_statis
         tics=[OrderedStatistic(items_base=frozenset({'avocado', 'spaghetti'}), items_add=frozenset({'milk'}), confidenc
         e=0.41666666666666663, lift=3.215449245541838)]),
          RelationRecord(items=frozenset({'frozen vegetables', 'cake', 'tomatoes'}), support=0.0030662578322890282, orde
         red_statistics=[OrderedStatistic(items_base=frozenset({'cake', 'tomatoes'}), items_add=frozenset({'frozen veget
         ables'}), confidence=0.36507936507936506, lift=3.8300144300144296)]),
          RelationRecord(items=frozenset({'ground beef', 'cereals', 'spaghetti'}), support=0.0030662578322890282, ordere
         d_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'cereals'}), items_add=frozenset({'spaghett
         i'}), confidence=0.6764705882352942, lift=3.8853031258445188), OrderedStatistic(items_base=frozenset({'cereals'
         , 'spaghetti'}), items_add=frozenset({'ground beef'}), confidence=0.45999999999999996, lift=4.681763907734057)]
         ),
          RelationRecord(items=frozenset({'ground beef', 'chicken', 'milk'}), support=0.0038661511798426876, ordered_sta
         tistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'chicken'}), items_add=frozenset({'milk'}), conf
         idence=0.40845070422535207, lift=3.152046020981858)]),
          RelationRecord(items=frozenset({'chicken', 'milk', 'olive oil'}), support=0.0035995200639914677, ordered_stati
         stics=[OrderedStatistic(items_base=frozenset({'chicken', 'olive oil'}), items_add=frozenset({'milk'}), confiden
```

ce=0.5, lift=3.858539094650206)]),
 RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'chocolate'}), support=0.003999466737768298, o
rdered_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper', 'chocolate'}), items_add=frozenset({
'ground beef'}), confidence=0.4411764705882354, lift=4.4901827759597746)]),
 RelationRecord(items=frozenset({'milk', 'chocolate', 'soup'}), support=0.003999466737768298, ordered_statistic
s=[OrderedStatistic(items_base=frozenset({'soup', 'chocolate'}), items_add=frozenset({'milk'}), confidence=0.39
47368421052632, lift=3.0462150747238472)]),
 RelationRecord(items=frozenset({'ground beef', 'cooking oil', 'spaghetti'}), support=0.004799360085321957, ord
ered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'cooking oil'}), items_add=frozenset({'s
paghetti'}), confidence=0.5714285714285714, lift=3.281951870487856)]),
 RelationRecord(items=frozenset({'eggs', 'red wine', 'spaghetti'}), support=0.0037328356219170776, ordered_stat
istics=[OrderedStatistic(items_base=frozenset({'eggs', 'red wine'}), items_add=frozenset({'spaghetti'}), confid
ence=0.5283018867924528, lift=3.0342974370828397)]),
 RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'french fries'}), support=0.003199573390214638
, ordered_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper', 'french fries'}), items_add=froze
nset({'ground beef'}), confidence=0.46153846153846156, lift=4.697421981004071)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'milk', 'olive oil'}), support=0.004799360085321957, orde
red_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'olive oil'}), items_add=frozenset(
{'milk'}), confidence=0.4235294117647058, lift=3.2684095860566447)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'milk', 'soup'}), support=0.003999466737768298, ordered_s
tatistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'soup'}), items_add=frozenset({'milk'}),
confidence=0.5, lift=3.858539094650206)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'shrimp', 'tomatoes'}), support=0.003999466737768298, ord
ered_statistics=[OrderedStatistic(items_base=frozenset({'tomatoes', 'shrimp'}), items_add=frozenset({'frozen ve
getables'}), confidence=0.35714285714285715, lift=3.7467532467532467)]),
 RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'milk'}), support=0.0035995200639914677, order
ed_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper', 'milk'}), items_add=frozenset({'ground b
eef'}), confidence=0.3913043478260869, lift=3.9825968969382335)]),
 RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'mineral water'}), support=0.00666577789628049
6, ordered_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper', 'mineral water'}), items_add=fro
zenset({'ground beef'}), confidence=0.39062500000000006, lift=3.975682666214383)]),
 RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'spaghetti'}), support=0.006399146780429276, o
rdered_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper', 'spaghetti'}), items_add=frozenset({
'ground beef'}), confidence=0.3934426229508197, lift=4.004359721511667)]),
 RelationRecord(items=frozenset({'ground beef', 'milk', 'soup'}), support=0.003999466737768298, ordered_statist
ics=[OrderedStatistic(items_base=frozenset({'ground beef', 'soup'}), items_add=frozenset({'milk'}), confidence=
0.4109589041095891, lift=3.1714019956029094)]),
 RelationRecord(items=frozenset({'ground beef', 'shrimp', 'spaghetti'}), 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({'ground beef', 'spaghetti', 'tomato sauce'}), support=0.0030662578322890282, o
rdered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'tomato sauce'}), items_add=frozenset(
{'spaghetti'}), confidence=0.5750000000000001, lift=3.3025076569678413), OrderedStatistic(items_base=frozenset(
{'spaghetti', 'tomato sauce'}), items_add=frozenset({'ground beef'}), confidence=0.4893617021276596, lift=4.980
599901844742)]),
 RelationRecord(items=frozenset({'milk', 'shrimp', 'olive oil'}), support=0.003199573390214638, ordered_statist
ics=[OrderedStatistic(items_base=frozenset({'shrimp', 'olive oil'}), items_add=frozenset({'milk'}), confidence=
0.3934426229508197, lift=3.0362274843149164)]),
 RelationRecord(items=frozenset({'milk', 'soup', 'olive oil'}), support=0.0035995200639914677, ordered_statisti
cs=[OrderedStatistic(items_base=frozenset({'soup', 'olive oil'}), items_add=frozenset({'milk'}), confidence=0.4
029850746268656, lift=3.1098673300165833)]),
 RelationRecord(items=frozenset({'tomatoes', 'milk', 'soup'}), support=0.0030662578322890282, ordered_statistic
s=[OrderedStatistic(items_base=frozenset({'tomatoes', 'soup'}), items_add=frozenset({'milk'}), confidence=0.442
30769230769235, lift=3.4133230452674903)]),
 RelationRecord(items=frozenset({'whole wheat pasta', 'milk', 'spaghetti'}), support=0.003999466737768298, orde
red_statistics=[OrderedStatistic(items_base=frozenset({'whole wheat pasta', 'spaghetti'}), items_add=frozenset(
{'milk'}), confidence=0.4545454545454546, lift=3.5077628133183696)]),
 RelationRecord(items=frozenset({'whole wheat pasta', 'mineral water', 'olive oil'}), support=0.003866151179842
6876, ordered_statistics=[OrderedStatistic(items_base=frozenset({'whole wheat pasta', 'mineral water'}), items_
add=frozenset({'olive oil'}), confidence=0.4027777777777778, lift=6.115862573099416)]),
 RelationRecord(items=frozenset({'tomatoes', 'spaghetti', 'olive oil'}), support=0.004399413411545127, ordered_
statistics=[OrderedStatistic(items_base=frozenset({'tomatoes', 'olive oil'}), items_add=frozenset({'spaghetti'}
), confidence=0.6111111111111112, lift=3.5099115194827295)]),
 RelationRecord(items=frozenset({'ground beef', 'frozen vegetables', 'chocolate', 'spaghetti'}), support=0.0030
662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'frozen vegetables',
'chocolate'}), items_add=frozenset({'spaghetti'}), confidence=0.5348837209302326, lift=3.0721001460165964), Ord
eredStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'spaghetti'}), items_add=frozenset({'grou
nd beef'}), confidence=0.3898305084745763, lift=3.967596531978015)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'milk', 'chocolate', 'mineral water'}), support=0.0039994
66737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'mine
ral water'}), items_add=frozenset({'milk'}), confidence=0.4109589041095891, lift=3.1714019956029094)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'milk', 'chocolate', 'spaghetti'}), support=0.00346620450
60658577, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'spaghet
ti'}), items_add=frozenset({'milk'}), confidence=0.44067796610169485, lift=3.4007463207086555)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'shrimp', 'chocolate', 'mineral water'}), support=0.00319
9573390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'shrimp', 'chocolate', 'mineral water
'}), items_add=frozenset({'frozen vegetables'}), confidence=0.4210526315789474, lift=4.417224880382776)]),
 RelationRecord(items=frozenset({'eggs', 'frozen vegetables', 'milk', 'mineral water'}), support=0.003732835621
9170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'eggs', 'frozen vegetables', 'mineral water
'}), items_add=frozenset({'milk'}), confidence=0.411764705882353, lift=3.177620430888405)]),
 RelationRecord(items=frozenset({'milk', 'mineral water', 'spaghetti', 'frozen smoothie'}), support=0.003199573
390214638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'mineral water', 'spaghetti', 'frozen smo
othie'}), items_add=frozenset({'milk'}), confidence=0.4705882352941177, lift=3.631566206729606)]),
 RelationRecord(items=frozenset({'ground beef', 'frozen vegetables', 'milk', 'mineral water'}), support=0.00373
28356219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'frozen vegetables',
'mineral water'}), items_add=frozenset({'milk'}), confidence=0.4057971014492753, lift=3.1315679608755294)]),
 RelationRecord(items=frozenset({'ground beef', 'frozen vegetables', 'milk', 'spaghetti'}), support=0.003066257
8322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'frozen vegetables', 'mil
k'}), items_add=frozenset({'spaghetti'}), confidence=0.5348837209302326, lift=3.0721001460165964), OrderedStati

```
stic(items_base=frozenset({'frozen vegetables', 'milk', 'spaghetti'}), items_add=frozenset({'ground beef'}), co
nfidence=0.3709677419354839, lift=3.7756160546242397)]),
 RelationRecord(items=frozenset({'ground beef', 'frozen vegetables', 'mineral water', 'spaghetti'}), support=0.
004399413411545127, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'mineral wa
ter', 'spaghetti'}), items_add=frozenset({'ground beef'}), confidence=0.3666666666666667, lift=3.73184079601990
07)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'milk', 'mineral water', 'olive oil'}), support=0.0033328
88948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'mineral water', '
olive oil'}), items_add=frozenset({'milk'}), confidence=0.5102040816326531, lift=3.937284790459394), OrderedSta
tistic(items_base=frozenset({'milk', 'mineral water', 'olive oil'}), items_add=frozenset({'frozen vegetables'})
, confidence=0.39062500000000006, lift=4.098011363636364)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'milk', 'soup', 'mineral water'}), support=0.003066257832
2890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'soup'}), items_add=fr
ozenset({'milk', 'mineral water'}), confidence=0.3833333333333333, lift=7.987175925925926), OrderedStatistic(it
ems_base=frozenset({'frozen vegetables', 'milk', 'soup'}), items_add=frozenset({'mineral water'}), confidence=0
.7666666666666666, lift=3.21631245339299), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'soup',
'mineral water'}), items_add=frozenset({'milk'}), confidence=0.6052631578947368, lift=4.670863114576565), Order
edStatistic(items_base=frozenset({'milk', 'soup', 'mineral water'}), items_add=frozenset({'frozen vegetables'})
, confidence=0.35937500000000006, lift=3.7701704545454553)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'shrimp', 'mineral water', 'spaghetti'}), support=0.00333
2888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'shrimp', 'mineral water', 'spaghetti
'}), items_add=frozenset({'frozen vegetables'}), confidence=0.39062500000000006, lift=4.098011363636364)]),
 RelationRecord(items=frozenset({'frozen vegetables', 'tomatoes', 'mineral water', 'spaghetti'}), support=0.003
06662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'mineral wate
r', 'tomatoes'}), items_add=frozenset({'spaghetti'}), confidence=0.5227272727272727, lift=3.0022796881525826)])
,
 RelationRecord(items=frozenset({'ground beef', 'tomatoes', 'mineral water', 'spaghetti'}), support=0.003066257
8322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'tomatoes', 'mineral wate
r'}), items_add=frozenset({'spaghetti'}), confidence=0.5609756097560976, lift=3.221958689724723)])]
```

Items which are sold-at Max

In [9]:
```python
D = df.values.ravel()
D
```

Out[9]:
```
array(['shrimp', 'almonds', 'avocado', ..., nan, nan, nan], dtype=object)
```

In [10]:
```python
import collections as cs
```

In [11]:
```python
values = cs.Counter(D)
values
```

Out[11]:
```
Counter({'shrimp': 536,
         'almonds': 153,
         'avocado': 250,
         'vegetables mix': 193,
         'green grapes': 68,
         'whole weat flour': 70,
         'yams': 86,
         'cottage cheese': 239,
         'energy drink': 200,
         'tomato juice': 228,
         'low fat yogurt': 574,
         'green tea': 991,
         'honey': 356,
         'salad': 37,
         'mineral water': 1788,
         'salmon': 319,
         'antioxydant juice': 67,
         'frozen smoothie': 475,
         'spinach': 53,
         'olive oil': 494,
         'burgers': 654,
         'meatballs': 157,
         'eggs': 1348,
         nan: 120657,
         'chutney': 31,
         'turkey': 469,
         'milk': 972,
         'energy bar': 203,
         'whole wheat rice': 439,
         'whole wheat pasta': 221,
         'french fries': 1282,
         'soup': 379,
         'light cream': 117,
         'shallot': 58,
         'frozen vegetables': 715,
         'spaghetti': 1306,
         'pet food': 49,
         'cookies': 603,
         'cooking oil': 383,
         'champagne': 351,
         'chocolate': 1230,
         'chicken': 450,
         'oil': 173,
         'fresh tuna': 167,
         'tomatoes': 513,
```

```
                'black tea': 107,
                'extra dark chocolate': 90,
                'protein bar': 139,
                'red wine': 211,
                'pasta': 118,
                'pepper': 199,
                'shampoo': 37,
                'rice': 141,
                'sparkling water': 47,
                'ham': 203,
                'body spray': 86,
                'pancakes': 713,
                'grated cheese': 393,
                'white wine': 124,
                'toothpaste': 61,
                'parmesan cheese': 149,
                'fresh bread': 323,
                'ground beef': 737,
                'escalope': 595,
                'herb & pepper': 371,
                'tomato sauce': 106,
                'magazines': 82,
                'strawberries': 160,
                'strong cheese': 58,
                'pickles': 45,
                'cake': 608,
                'hot dogs': 243,
                'brownies': 253,
                'cereals': 193,
                'clothes accessories': 63,
                'bug spray': 65,
                'muffins': 181,
                'light mayo': 204,
                'gums': 101,
                'soda': 47,
                'cider': 79,
                'corn': 36,
                'yogurt cake': 205,
                'mint': 131,
                'butter': 226,
                'asparagus': 35,
                'french wine': 169,
                'salt': 69,
                'tea': 29,
                'barbecue sauce': 81,
                'mayonnaise': 46,
                'zucchini': 71,
                'carrots': 115,
                'mushroom cream sauce': 143,
                'candy bars': 73,
                'chili': 46,
                'mashed potato': 31,
                'nonfat milk': 78,
                'water spray': 3,
                'chocolate bread': 32,
                'mint green tea': 42,
                'eggplant': 99,
                'blueberries': 69,
                'bacon': 65,
                'fromage blanc': 102,
                'gluten free bar': 52,
                'dessert wine': 33,
                'flax seed': 68,
                'hand protein bar': 39,
                'sandwich': 34,
                'babies food': 34,
                'melons': 90,
                'cauliflower': 36,
                'green beans': 65,
                'ketchup': 33,
                'bramble': 14,
                'burger sauce': 44,
                'oatmeal': 33,
                ' asparagus': 1,
                'cream': 7,
                'napkins': 5})
```

```python
In [12]: sort_values = sorted(values.items(), key=lambda x:x[1], reverse=True)
         print(sort_values[1:])
```

```
[('mineral water', 1788), ('eggs', 1348), ('spaghetti', 1306), ('french fries', 1282), ('chocolate', 1230), ('g
reen tea', 991), ('milk', 972), ('ground beef', 737), ('frozen vegetables', 715), ('pancakes', 713), ('burgers'
, 654), ('cake', 608), ('cookies', 603), ('escalope', 595), ('low fat yogurt', 574), ('shrimp', 536), ('tomatoe
s', 513), ('olive oil', 494), ('frozen smoothie', 475), ('turkey', 469), ('chicken', 450), ('whole wheat rice',
439), ('grated cheese', 393), ('cooking oil', 383), ('soup', 379), ('herb & pepper', 371), ('honey', 356), ('ch
ampagne', 351), ('fresh bread', 323), ('salmon', 319), ('brownies', 253), ('avocado', 250), ('hot dogs', 243),
('cottage cheese', 239), ('tomato juice', 228), ('butter', 226), ('whole wheat pasta', 221), ('red wine', 211),
('yogurt cake', 205), ('light mayo', 204), ('energy bar', 203), ('ham', 203), ('energy drink', 200), ('pepper',
199), ('vegetables mix', 193), ('cereals', 193), ('muffins', 181), ('oil', 173), ('french wine', 169), ('fresh
tuna', 167), ('strawberries', 160), ('meatballs', 157), ('almonds', 153), ('parmesan cheese', 149), ('mushroom
cream sauce', 143), ('rice', 141), ('protein bar', 139), ('mint', 131), ('white wine', 124), ('pasta', 118), ('
light cream', 117), ('carrots', 115), ('black tea', 107), ('tomato sauce', 106), ('fromage blanc', 102), ('gums
', 101), ('eggplant', 99), ('extra dark chocolate', 90), ('melons', 90), ('yams', 86), ('body spray', 86), ('ma
gazines', 82), ('barbecue sauce', 81), ('cider', 79), ('nonfat milk', 78), ('candy bars', 73), ('zucchini', 71)
, ('whole weat flour', 70), ('salt', 69), ('blueberries', 69), ('green grapes', 68), ('flax seed', 68), ('antio
xydant juice', 67), ('bug spray', 65), ('bacon', 65), ('green beans', 65), ('clothes accessories', 63), ('tooth
paste', 61), ('shallot', 58), ('strong cheese', 58), ('spinach', 53), ('gluten free bar', 52), ('pet food', 49)
, ('sparkling water', 47), ('soda', 47), ('mayonnaise', 46), ('chili', 46), ('pickles', 45), ('burger sauce', 4
4), ('mint green tea', 42), ('hand protein bar', 39), ('salad', 37), ('shampoo', 37), ('corn', 36), ('cauliflow
er', 36), ('asparagus', 35), ('sandwich', 34), ('babies food', 34), ('dessert wine', 33), ('ketchup', 33), ('oa
tmeal', 33), ('chocolate bread', 32), ('chutney', 31), ('mashed potato', 31), ('tea', 29), ('bramble', 14), ('c
ream', 7), ('napkins', 5), ('water spray', 3), (' asparagus', 1)]
```

In [13]:
```python
sort_values[0]
```

Out[13]:
```
(nan, 120657)
```

In [14]:
```python
df1 = pd.DataFrame(sort_values[1:])
```

In [15]:
```python
df1 = df1.rename(columns = {0:'ITEMS',1:'TOTAL_COUNT'})
```

In [16]:
```python
df1
```

Out[16]:

	ITEMS	TOTAL_COUNT
0	mineral water	1788
1	eggs	1348
2	spaghetti	1306
3	french fries	1282
4	chocolate	1230
...	...	...
115	bramble	14
116	cream	7
117	napkins	5
118	water spray	3
119	asparagus	1

120 rows × 2 columns

Mineral Water is the most sold item, where as Asparagus is the least sold

In [17]:
```python
df1.head(10)
```

Out[17]:

	ITEMS	TOTAL_COUNT
0	mineral water	1788
1	eggs	1348
2	spaghetti	1306
3	french fries	1282
4	chocolate	1230
5	green tea	991
6	milk	972
7	ground beef	737
8	frozen vegetables	715
9	pancakes	713

Arranging the rules in descending order of lift values

In [18]:
```python
rules = apriori(df_trans, min_support = 0.003, min_confidence = 0.35, min_lift = 3, min_length = 2)
association_results = list(rules)
print(type(rules))
```

```
print(type(association_results[0]))
print(type(association_results))
print(association_results)
```

<class 'generator'>
<class 'apyori.RelationRecord'>
<class 'list'>
[RelationRecord(items=frozenset({'pasta', 'escalope'}), support=0.005865884548726837, ordered_statistics=[Order
edStatistic(items_base=frozenset({'pasta'}), items_add=frozenset({'escalope'}), confidence=0.3728813559322034,
lift=4.700811850163794)]), RelationRecord(items=frozenset({'ground beef', 'tomato sauce'}), support=0.005332622
317024397, ordered_statistics=[OrderedStatistic(items_base=frozenset({'tomato sauce'}), items_add=frozenset({'g
round beef'}), confidence=0.3773584905660377, lift=3.840659481324083)]), RelationRecord(items=frozenset({'milk'
, 'avocado', 'spaghetti'}), support=0.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=froze
nset({'avocado', 'spaghetti'}), items_add=frozenset({'milk'}), confidence=0.41666666666666663, lift=3.215449245
541838)]), RelationRecord(items=frozenset({'frozen vegetables', 'cake', 'tomatoes'}), support=0.003066257832289
0282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'cake', 'tomatoes'}), items_add=frozenset({'fr
ozen vegetables'}), confidence=0.36507936507936506, lift=3.8300144300144296)]), RelationRecord(items=frozenset(
{'ground beef', 'cereals', 'spaghetti'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(i
tems_base=frozenset({'ground beef', 'cereals'}), items_add=frozenset({'spaghetti'}), confidence=0.6764705882352
942, lift=3.8853031258445188), OrderedStatistic(items_base=frozenset({'cereals', 'spaghetti'}), items_add=froze
nset({'ground beef'}), confidence=0.45999999999999996, lift=4.681763907734057)]), RelationRecord(items=frozense
t({'ground beef', 'chicken', 'milk'}), support=0.0038661511798426876, ordered_statistics=[OrderedStatistic(item
s_base=frozenset({'ground beef', 'chicken'}), items_add=frozenset({'milk'}), confidence=0.40845070422535207, li
ft=3.152046020981858)]), RelationRecord(items=frozenset({'chicken', 'milk', 'olive oil'}), support=0.0035995200
639914677, ordered_statistics=[OrderedStatistic(items_base=frozenset({'chicken', 'olive oil'}), items_add=froze
nset({'milk'}), confidence=0.5, lift=3.858539094650206)]), RelationRecord(items=frozenset({'ground beef', 'herb
& pepper', 'chocolate'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozens
et({'herb & pepper', 'chocolate'}), items_add=frozenset({'ground beef'}), confidence=0.4411764705882354, lift=4
.4901827759597746)]), RelationRecord(items=frozenset({'milk', 'chocolate', 'soup'}), support=0.0039994667377682
98, ordered_statistics=[OrderedStatistic(items_base=frozenset({'soup', 'chocolate'}), items_add=frozenset({'mil
k'}), confidence=0.3947368421052632, lift=3.0462150747238472)]), RelationRecord(items=frozenset({'ground beef',
'cooking oil', 'spaghetti'}), support=0.004799360085321957, ordered_statistics=[OrderedStatistic(items_base=fro
zenset({'ground beef', 'cooking oil'}), items_add=frozenset({'spaghetti'}), confidence=0.5714285714285714, lift
=3.2819951870487856)]), RelationRecord(items=frozenset({'eggs', 'red wine', 'spaghetti'}), support=0.0037328356
219170776, ordered_statistics=[OrderedStatistic(items_base=frozenset({'eggs', 'red wine'}), items_add=frozenset
({'spaghetti'}), confidence=0.5283018867924528, lift=3.0342974370828397)]), RelationRecord(items=frozenset({'gr
ound beef', 'herb & pepper', 'french fries'}), support=0.003199573390214638, ordered_statistics=[OrderedStatist
ic(items_base=frozenset({'herb & pepper', 'french fries'}), items_add=frozenset({'ground beef'}), confidence=0.
46153846153846156, lift=4.697421981004071)]), RelationRecord(items=frozenset({'frozen vegetables', 'milk', 'oli
ve oil'}), support=0.004799360085321957, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen veg
etables', 'olive oil'}), items_add=frozenset({'milk'}), confidence=0.4235294117647058, lift=3.2684095860566447)
]), RelationRecord(items=frozenset({'frozen vegetables', 'milk', 'soup'}), support=0.003999466737768298, ordere
d_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'soup'}), items_add=frozenset({'milk'
}), confidence=0.5, lift=3.858539094650206)]), RelationRecord(items=frozenset({'frozen vegetables', 'shrimp', '
tomatoes'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'tomatoes
', 'shrimp'}), items_add=frozenset({'frozen vegetables'}), confidence=0.35714285714285715, lift=3.7467532467532
467)]), RelationRecord(items=frozenset({'ground beef', 'herb & pepper', 'milk'}), support=0.0035995200639914677
, ordered_statistics=[OrderedStatistic(items_base=frozenset({'herb & pepper', 'milk'}), items_add=frozenset({'g
round beef'}), confidence=0.3913043478260869, lift=3.9825968969382335)]), RelationRecord(items=frozenset({'grou
nd beef', 'herb & pepper', 'mineral water'}), support=0.006665777896280496, ordered_statistics=[OrderedStatisti
c(items_base=frozenset({'herb & pepper', 'mineral water'}), items_add=frozenset({'ground beef'}), confidence=0.
39062500000000006, lift=3.975682666214383)]), RelationRecord(items=frozenset({'ground beef', 'herb & pepper', '
spaghetti'}), support=0.006399146780429276, ordered_statistics=[OrderedStatistic(items_base=frozenset({'herb &
pepper', 'spaghetti'}), items_add=frozenset({'ground beef'}), confidence=0.3934426229508197, lift=4.00435972151
1667)]), RelationRecord(items=frozenset({'ground beef', 'milk', 'soup'}), support=0.003999466737768298, ordered
_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'soup'}), items_add=frozenset({'milk'}), con
fidence=0.4109589041095891, lift=3.1714019956029094)]), RelationRecord(items=frozenset({'ground beef', 'shrimp'
, 'spaghetti'}), support=0.005999200106652446, ordered_statistics=[OrderedStatistic(items_base=frozenset({'grou
nd beef', 'shrimp'}), items_add=frozenset({'spaghetti'}), confidence=0.5232558139534884, lift=3.005315360233627
)]), RelationRecord(items=frozenset({'ground beef', 'spaghetti', 'tomato sauce'}), support=0.003066257832289028
2, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'tomato sauce'}), items_add=frozen
set({'spaghetti'}), confidence=0.5750000000000001, lift=3.3025076569678413), OrderedStatistic(items_base=frozen
set({'spaghetti', 'tomato sauce'}), items_add=frozenset({'ground beef'}), confidence=0.4893617021276596, lift=4
.980599901844742)]), RelationRecord(items=frozenset({'milk', 'shrimp', 'olive oil'}), support=0.003199573390214
638, ordered_statistics=[OrderedStatistic(items_base=frozenset({'shrimp', 'olive oil'}), items_add=frozenset({'
milk'}), confidence=0.3934426229508197, lift=3.0362274843149164)]), RelationRecord(items=frozenset({'milk', 'so
up', 'olive oil'}), support=0.0035995200639914677, ordered_statistics=[OrderedStatistic(items_base=frozenset({'
soup', 'olive oil'}), items_add=frozenset({'milk'}), confidence=0.4029850746268656, lift=3.1098673300165833)]),
RelationRecord(items=frozenset({'tomatoes', 'milk', 'soup'}), support=0.0030662578322890282, ordered_statistics
=[OrderedStatistic(items_base=frozenset({'tomatoes', 'soup'}), items_add=frozenset({'milk'}), confidence=0.4423
0769230769235, lift=3.4133230452674903)]), RelationRecord(items=frozenset({'whole wheat pasta', 'milk', 'spaghe
tti'}), support=0.003999466737768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'whole wheat p
asta', 'spaghetti'}), items_add=frozenset({'milk'}), confidence=0.4545454545454546, lift=3.5077628133183696)]),
RelationRecord(items=frozenset({'whole wheat pasta', 'mineral water', 'olive oil'}), support=0.0038661511798426
876, ordered_statistics=[OrderedStatistic(items_base=frozenset({'whole wheat pasta', 'mineral water'}), items_a
dd=frozenset({'olive oil'}), confidence=0.4027777777777778, lift=6.115862573099416)]), RelationRecord(items=fro
zenset({'tomatoes', 'spaghetti', 'olive oil'}), support=0.004399413411545127, ordered_statistics=[OrderedStatis
tic(items_base=frozenset({'tomatoes', 'olive oil'}), items_add=frozenset({'spaghetti'}), confidence=0.611111111
1111112, lift=3.5099115194827295)]), RelationRecord(items=frozenset({'ground beef', 'frozen vegetables', 'choco
late', 'spaghetti'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset(
{'ground beef', 'frozen vegetables', 'chocolate'}), items_add=frozenset({'spaghetti'}), confidence=0.5348837209
302326, lift=3.0721001460165964), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'spa
ghetti'}), items_add=frozenset({'ground beef'}), confidence=0.3898305084745763, lift=3.967596531978015)]), Rela
tionRecord(items=frozenset({'frozen vegetables', 'milk', 'chocolate', 'mineral water'}), support=0.003999466737
768298, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'mineral w
ater'}), items_add=frozenset({'milk'}), confidence=0.4109589041095891, lift=3.1714019956029094)]), RelationReco
rd(items=frozenset({'frozen vegetables', 'milk', 'chocolate', 'spaghetti'}), support=0.0034662045060658577, ord
ered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'chocolate', 'spaghetti'}), items_
add=frozenset({'milk'}), confidence=0.44067796610169485, lift=3.4007463207086555)]), RelationRecord(items=froze
```

```
nset({'frozen vegetables', 'shrimp', 'chocolate', 'mineral water'}), support=0.003199573390214638, ordered_stat
istics=[OrderedStatistic(items_base=frozenset({'shrimp', 'chocolate', 'mineral water'}), items_add=frozenset({'
frozen vegetables'}), confidence=0.4210526315789474, lift=4.417224880382776)]), RelationRecord(items=frozenset(
{'eggs', 'frozen vegetables', 'milk', 'mineral water'}), support=0.0037328356219170776, ordered_statistics=[Ord
eredStatistic(items_base=frozenset({'eggs', 'frozen vegetables', 'mineral water'}), items_add=frozenset({'milk'
}), confidence=0.411764705882353, lift=3.177620430888405)]), RelationRecord(items=frozenset({'milk', 'mineral w
ater', 'spaghetti', 'frozen smoothie'}), support=0.003199573390214638, ordered_statistics=[OrderedStatistic(ite
ms_base=frozenset({'mineral water', 'spaghetti', 'frozen smoothie'}), items_add=frozenset({'milk'}), confidence
=0.4705882352941177, lift=3.631566206729606)]), RelationRecord(items=frozenset({'ground beef', 'frozen vegetabl
es', 'milk', 'mineral water'}), support=0.0037328356219170776, ordered_statistics=[OrderedStatistic(items_base=
frozenset({'ground beef', 'frozen vegetables', 'mineral water'}), items_add=frozenset({'milk'}), confidence=0.4
0579710144927533, lift=3.1315679608755294)]), RelationRecord(items=frozenset({'ground beef', 'frozen vegetables
', 'milk', 'spaghetti'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozen
set({'ground beef', 'frozen vegetables', 'milk'}), items_add=frozenset({'spaghetti'}), confidence=0.53488372093
02326, lift=3.0721001460165964), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'milk', 'spaghetti
'}), items_add=frozenset({'ground beef'}), confidence=0.3709677419354839, lift=3.7756160546242397)]), RelationR
ecord(items=frozenset({'ground beef', 'frozen vegetables', 'mineral water', 'spaghetti'}), support=0.0043994134
11545127, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'mineral water', 'spa
ghetti'}), items_add=frozenset({'ground beef'}), confidence=0.3666666666666667, lift=3.7318407960199007)]), Rel
ationRecord(items=frozenset({'frozen vegetables', 'milk', 'mineral water', 'olive oil'}), support=0.00333288894
8140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'mineral water', 'oliv
e oil'}), items_add=frozenset({'milk'}), confidence=0.5102040816326531, lift=3.937284790459394), OrderedStatist
ic(items_base=frozenset({'milk', 'mineral water', 'olive oil'}), items_add=frozenset({'frozen vegetables'}), co
nfidence=0.39062500000000006, lift=4.098011363636364)]), RelationRecord(items=frozenset({'frozen vegetables', '
milk', 'soup', 'mineral water'}), support=0.0030662578322890282, ordered_statistics=[OrderedStatistic(items_bas
e=frozenset({'frozen vegetables', 'soup'}), items_add=frozenset({'milk', 'mineral water'}), confidence=0.383333
3333333333, lift=7.987175925925926), OrderedStatistic(items_base=frozenset({'frozen vegetables', 'milk', 'soup'
}), items_add=frozenset({'mineral water'}), confidence=0.7666666666666666, lift=3.21631245339299), OrderedStati
stic(items_base=frozenset({'frozen vegetables', 'soup', 'mineral water'}), items_add=frozenset({'milk'}), confi
dence=0.6052631578947368, lift=4.670863114576565), OrderedStatistic(items_base=frozenset({'milk', 'soup', 'mine
ral water'}), items_add=frozenset({'frozen vegetables'}), confidence=0.35937500000000006, lift=3.77017045454545
53)]), RelationRecord(items=frozenset({'frozen vegetables', 'shrimp', 'mineral water', 'spaghetti'}), support=0
.003332888948140248, ordered_statistics=[OrderedStatistic(items_base=frozenset({'shrimp', 'mineral water', 'spa
ghetti'}), items_add=frozenset({'frozen vegetables'}), confidence=0.39062500000000006, lift=4.098011363636364)]
), RelationRecord(items=frozenset({'frozen vegetables', 'tomatoes', 'mineral water', 'spaghetti'}), support=0.0
030662578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'frozen vegetables', 'mineral wa
ter', 'tomatoes'}), items_add=frozenset({'spaghetti'}), confidence=0.5227272727272727, lift=3.0022796881525826)
]), RelationRecord(items=frozenset({'ground beef', 'tomatoes', 'mineral water', 'spaghetti'}), support=0.003066
2578322890282, ordered_statistics=[OrderedStatistic(items_base=frozenset({'ground beef', 'tomatoes', 'mineral w
ater'}), items_add=frozenset({'spaghetti'}), confidence=0.5609756097560976, lift=3.221958689724723)])]
```

In [19]: `print(association_results[0])`

```
RelationRecord(items=frozenset({'pasta', 'escalope'}), support=0.005865884548726837, ordered_statistics=[Ordere
dStatistic(items_base=frozenset({'pasta'}), items_add=frozenset({'escalope'}), confidence=0.3728813559322034, l
ift=4.700811850163794)])
```

In [20]: `len(association_results)`

Out[20]: 41

In [21]:
```python
store_data = pd.DataFrame(columns=('items','item1','item2','support','confidence','lift'))

support =[]
confidence = []
lift = []
items = []
item1 = []
item2=[]

for x in association_results:
    for stat in x.ordered_statistics:
        support.append(x.support)
        items.append(x.items)
        item1.append(stat.items_base)
        item2.append(stat.items_add)
        confidence.append(stat.confidence)
        lift.append(stat.lift)

store_data['items'] = list(map(set, items))
store_data['item1'] = list(map(set, item1))
store_data['item2'] = list(map(set, item2))
store_data['support'] = support
store_data['confidence'] = confidence
store_data['lift']= lift
sortd=store_data.sort_values(by='lift',ascending=False)
```

In [22]: `sortd.reset_index(inplace=True)`

In [23]:
```python
sortd.drop('index',axis=1,inplace=True)
sortd
```

Out[23]:

	items	item1	item2	support	confidence	lift
0	{frozen vegetables, milk, soup, mineral water}	{frozen vegetables, soup}	{milk, mineral water}	0.003066	0.383333	7.987176
1	{whole wheat pasta, mineral water, olive oil}	{whole wheat pasta, mineral water}	{olive oil}	0.003866	0.402778	6.115863

2	{ground beef, spaghetti, tomato sauce}	{spaghetti, tomato sauce}	{ground beef}	0.003066	0.489362	4.980600
3	{pasta, escalope}	{pasta}	{escalope}	0.005866	0.372881	4.700812
4	{ground beef, herb & pepper, french fries}	{herb & pepper, french fries}	{ground beef}	0.003200	0.461538	4.697422
5	{ground beef, cereals, spaghetti}	{cereals, spaghetti}	{ground beef}	0.003066	0.460000	4.681764
6	{frozen vegetables, milk, soup, mineral water}	{frozen vegetables, soup, mineral water}	{milk}	0.003066	0.605263	4.670863
7	{ground beef, herb & pepper, chocolate}	{herb & pepper, chocolate}	{ground beef}	0.003999	0.441176	4.490183
8	{frozen vegetables, shrimp, chocolate, mineral...	{shrimp, chocolate, mineral water}	{frozen vegetables}	0.003200	0.421053	4.417225
9	{frozen vegetables, shrimp, mineral water, spa...	{shrimp, mineral water, spaghetti}	{frozen vegetables}	0.003333	0.390625	4.098011
10	{frozen vegetables, milk, mineral water, olive...	{milk, mineral water, olive oil}	{frozen vegetables}	0.003333	0.390625	4.098011
11	{ground beef, herb & pepper, spaghetti}	{herb & pepper, spaghetti}	{ground beef}	0.006399	0.393443	4.004360
12	{ground beef, herb & pepper, milk}	{herb & pepper, milk}	{ground beef}	0.003600	0.391304	3.982597
13	{ground beef, herb & pepper, mineral water}	{herb & pepper, mineral water}	{ground beef}	0.006666	0.390625	3.975683
14	{ground beef, frozen vegetables, chocolate, sp...	{frozen vegetables, chocolate, spaghetti}	{ground beef}	0.003066	0.389831	3.967597
15	{frozen vegetables, milk, mineral water, olive...	{frozen vegetables, mineral water, olive oil}	{milk}	0.003333	0.510204	3.937285
16	{ground beef, cereals, spaghetti}	{ground beef, cereals}	{spaghetti}	0.003066	0.676471	3.885303
17	{chicken, milk, olive oil}	{chicken, olive oil}	{milk}	0.003600	0.500000	3.858539
18	{frozen vegetables, milk, soup}	{frozen vegetables, soup}	{milk}	0.003999	0.500000	3.858539
19	{ground beef, tomato sauce}	{tomato sauce}	{ground beef}	0.005333	0.377358	3.840659
20	{frozen vegetables, cake, tomatoes}	{cake, tomatoes}	{frozen vegetables}	0.003066	0.365079	3.830014
21	{ground beef, frozen vegetables, milk, spaghetti}	{frozen vegetables, milk, spaghetti}	{ground beef}	0.003066	0.370968	3.775616
22	{frozen vegetables, milk, soup, mineral water}	{milk, soup, mineral water}	{frozen vegetables}	0.003066	0.359375	3.770170
23	{frozen vegetables, shrimp, tomatoes}	{tomatoes, shrimp}	{frozen vegetables}	0.003999	0.357143	3.746753
24	{ground beef, frozen vegetables, mineral water...	{frozen vegetables, mineral water, spaghetti}	{ground beef}	0.004399	0.366667	3.731841
25	{milk, mineral water, spaghetti, frozen smoothie}	{mineral water, spaghetti, frozen smoothie}	{milk}	0.003200	0.470588	3.631566
26	{tomatoes, spaghetti, olive oil}	{tomatoes, olive oil}	{spaghetti}	0.004399	0.611111	3.509912
27	{whole wheat pasta, milk, spaghetti}	{whole wheat pasta, spaghetti}	{milk}	0.003999	0.454545	3.507763
28	{tomatoes, milk, soup}	{tomatoes, soup}	{milk}	0.003066	0.442308	3.413323
29	{frozen vegetables, milk, chocolate, spaghetti}	{frozen vegetables, chocolate, spaghetti}	{milk}	0.003466	0.440678	3.400746
30	{ground beef, spaghetti, tomato sauce}	{ground beef, tomato sauce}	{spaghetti}	0.003066	0.575000	3.302508
31	{ground beef, cooking oil, spaghetti}	{ground beef, cooking oil}	{spaghetti}	0.004799	0.571429	3.281995
32	{frozen vegetables, milk, olive oil}	{frozen vegetables, olive oil}	{milk}	0.004799	0.423529	3.268410
33	{ground beef, tomatoes, mineral water, spaghetti}	{ground beef, tomatoes, mineral water}	{spaghetti}	0.003066	0.560976	3.221959
34	{frozen vegetables, milk, soup, mineral water}	{frozen vegetables, milk, soup}	{mineral water}	0.003066	0.766667	3.216312
35	{milk, avocado, spaghetti}	{avocado, spaghetti}	{milk}	0.003333	0.416667	3.215449
36	{eggs, frozen vegetables, milk, mineral water}	{eggs, frozen vegetables, mineral water}	{milk}	0.003733	0.411765	3.177620
37	{frozen vegetables, milk, chocolate, mineral w...	{frozen vegetables, chocolate, mineral water}	{milk}	0.003999	0.410959	3.171402
38	{ground beef, milk, soup}	{ground beef, soup}	{milk}	0.003999	0.410959	3.171402
39	{ground beef, chicken, milk}	{ground beef, chicken}	{milk}	0.003866	0.408451	3.152046
40	{ground beef, frozen vegetables, milk, mineral...	{ground beef, frozen vegetables, mineral water}	{milk}	0.003733	0.405797	3.131568
41	{milk, soup, olive oil}	{soup, olive oil}	{milk}	0.003600	0.402985	3.109867
42	{ground beef, frozen vegetables, milk, spaghetti}	{ground beef, frozen vegetables, milk}	{spaghetti}	0.003066	0.534884	3.072100
43	{ground beef, frozen vegetables, chocolate, sp...	{ground beef, frozen vegetables, chocolate}	{spaghetti}	0.003066	0.534884	3.072100
44	{milk, chocolate, soup}	{soup, chocolate}	{milk}	0.003999	0.394737	3.046215
45	{milk, shrimp, olive oil}	{shrimp, olive oil}	{milk}	0.003200	0.393443	3.036227
46	{eggs, red wine, spaghetti}	{eggs, red wine}	{spaghetti}	0.003733	0.528302	3.034297
47	{ground beef, shrimp, spaghetti}	{ground beef, shrimp}	{spaghetti}	0.005999	0.523256	3.005315
48	{frozen vegetables, tomatoes, mineral water, s...	{frozen vegetables, mineral water, tomatoes}	{spaghetti}	0.003066	0.522727	3.002280

In [ ]: