

Apriori Algorithm on Market Basket Analysis

March 2, 2024

1 Market Basket Analysis

2 Importing the libraries

```
[1]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

3 Installing the apyori to perform the Apriori algorithm

```
[2]: !pip install apyori
```

```
Collecting apyori
  Downloading apyori-1.1.2.tar.gz (8.6 kB)
  Preparing metadata (setup.py): started
  Preparing metadata (setup.py): finished with status 'done'
Building wheels for collected packages: apyori
  Building wheel for apyori (setup.py): started
  Building wheel for apyori (setup.py): finished with status 'done'
  Created wheel for apyori: filename=apyori-1.1.2-py3-none-any.whl size=5955
sha256=48015eb3940ad147ce121dc022745f2cf5463984be2596e05d8cdca82c02c6f1
  Stored in directory: c:\users\धारिनी\appdata\local\pip\cache\wheels\1b\02\6c\
a45230be8603bd95c0a51cd2b289aefdd860c1a100eab73661
Successfully built apyori
Installing collected packages: apyori
Successfully installed apyori-1.1.2
```

```
[notice] A new release of pip is available: 23.2.1 -> 24.0
```

```
[notice] To update, run: python.exe -m pip install --upgrade pip
```

```
[3]: from apyori import apriori
```

4 Importing the dataset

```
[4]: df = pd.read_csv("C:/Users/Dharini/Downloads/Groceries_dataset.csv/  
↳Groceries_dataset.csv")
```

5 Data Analysis

```
[5]: df.head()
```

```
[5]:
```

	Member_number	Date	itemDescription
0	1808	21-07-2015	tropical fruit
1	2552	05-01-2015	whole milk
2	2300	19-09-2015	pip fruit
3	1187	12-12-2015	other vegetables
4	3037	01-02-2015	whole milk

```
[6]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>  
RangeIndex: 38765 entries, 0 to 38764  
Data columns (total 3 columns):  
#   Column                Non-Null Count  Dtype  
---  ---  
0   Member_number         38765 non-null  int64  
1   Date                  38765 non-null  object  
2   itemDescription       38765 non-null  object  
dtypes: int64(1), object(2)  
memory usage: 908.7+ KB
```

```
[7]: df.shape
```

```
[7]: (38765, 3)
```

```
[8]: df.size
```

```
[8]: 116295
```

```
[9]: df.ndim
```

```
[9]: 2
```

```
[10]: df.isna().sum()
```

```
[10]: Member_number    0  
Date                0  
itemDescription     0  
dtype: int64
```

```
[11]: df.head()
```

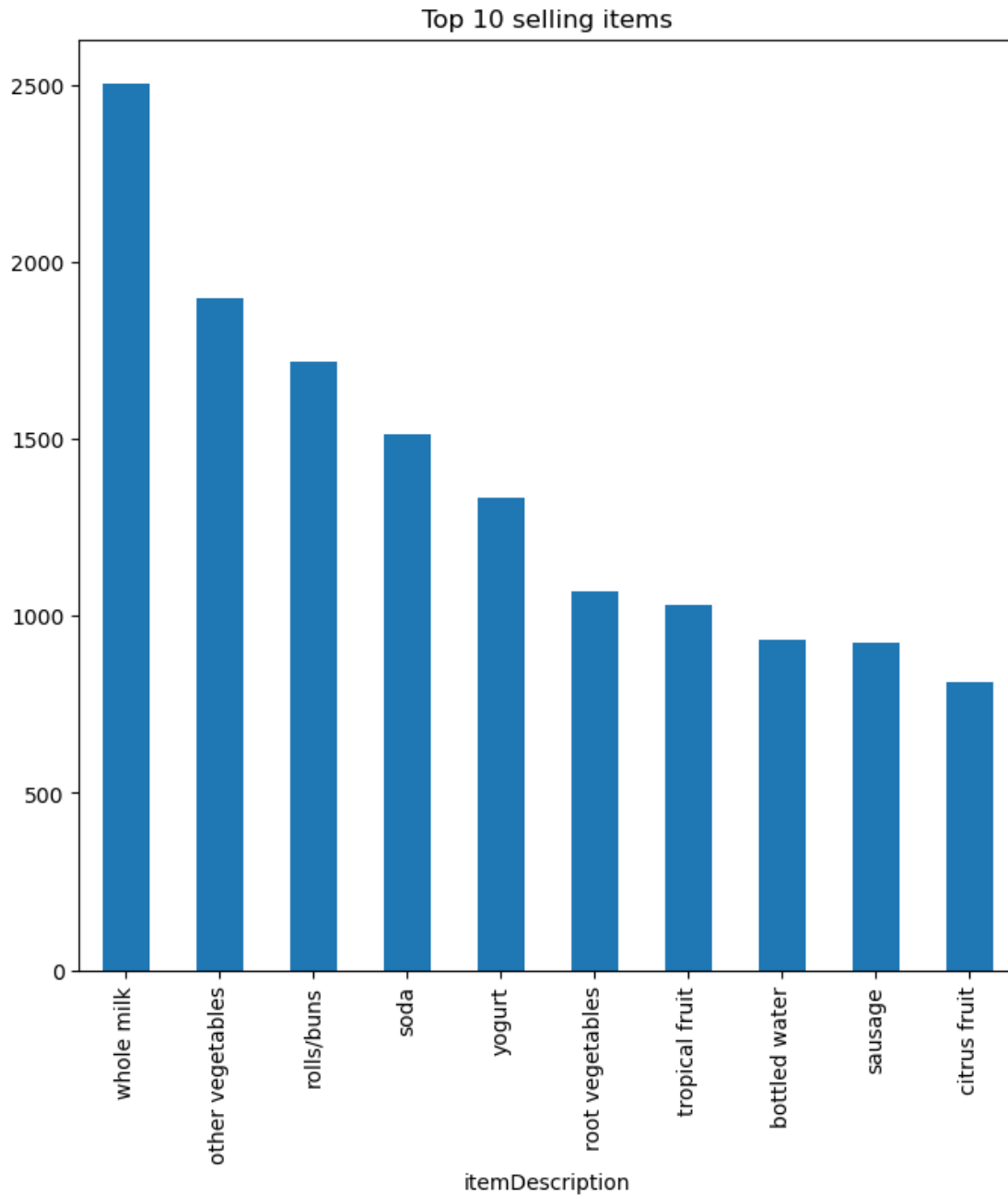
```
[11]:   Member_number      Date itemDescription
0          1808  21-07-2015    tropical fruit
1          2552  05-01-2015         whole milk
2          2300  19-09-2015         pip fruit
3          1187  12-12-2015    other vegetables
4          3037  01-02-2015         whole milk
```

```
[12]: # Q1. Which of the items are the top 10 selling item?
df.itemDescription.value_counts().head(10)
```

```
[12]: itemDescription
whole milk          2502
other vegetables    1898
rolls/buns          1716
soda                1514
yogurt              1334
root vegetables     1071
tropical fruit      1032
bottled water        933
sausage             924
citrus fruit         812
Name: count, dtype: int64
```

```
[13]: plt.figure(figsize=(8,8))
df.itemDescription.value_counts().head(10).plot.bar()
plt.title('Top 10 selling items')
```

```
[13]: Text(0.5, 1.0, 'Top 10 selling items')
```



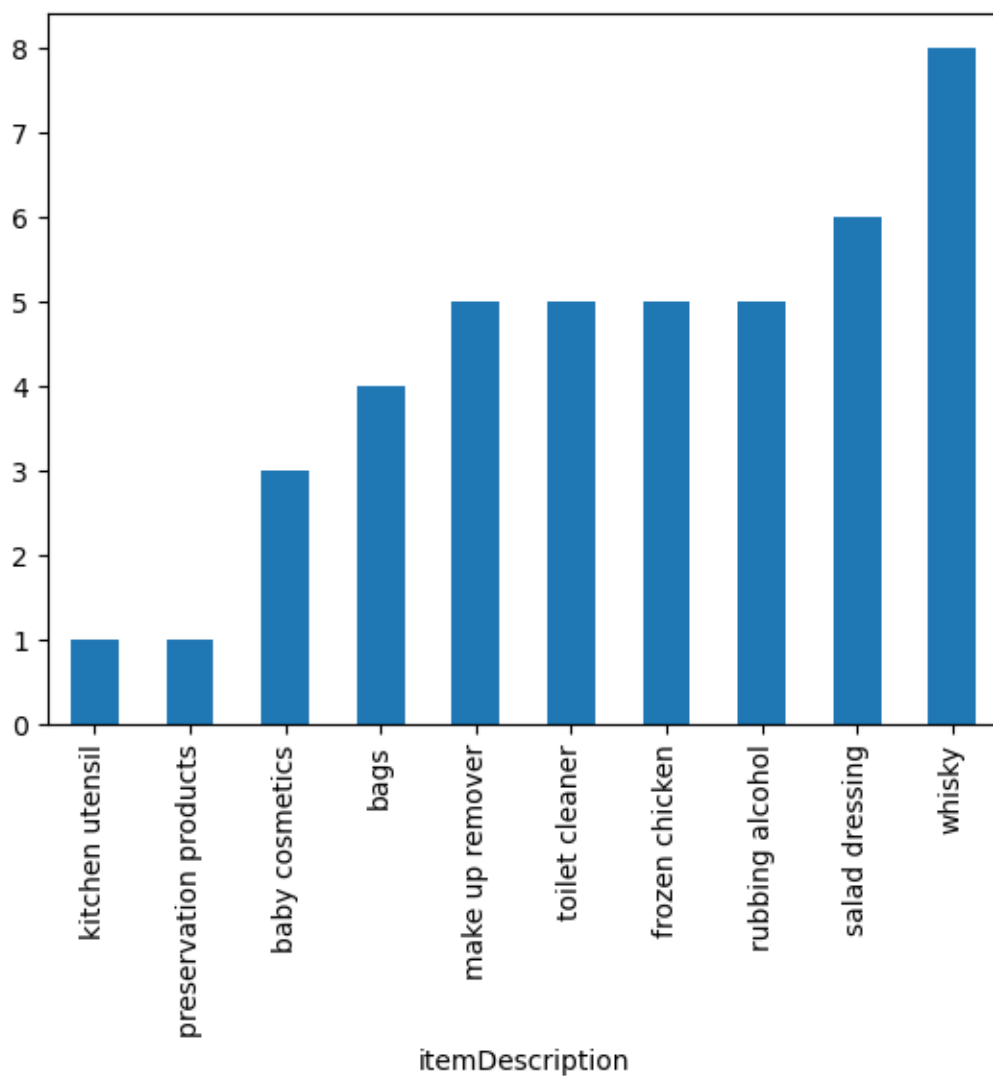
```
[14]: # Q2. Which of the item is the least 10 selling item?  
df.itemDescription.value_counts().tail(10).sort_values()
```

```
[14]: itemDescription  
      kitchen utensil      1  
      preservation products  1  
      baby cosmetics      3
```

```
bags 4
make up remover 5
toilet cleaner 5
frozen chicken 5
rubbing alcohol 5
salad dressing 6
whisky 8
Name: count, dtype: int64
```

```
[15]: df.itemDescription.value_counts().tail(10).sort_values().plot.bar()
```

```
[15]: <AxesSubplot: xlabel='itemDescription'>
```



```
[16]: df.head()
```

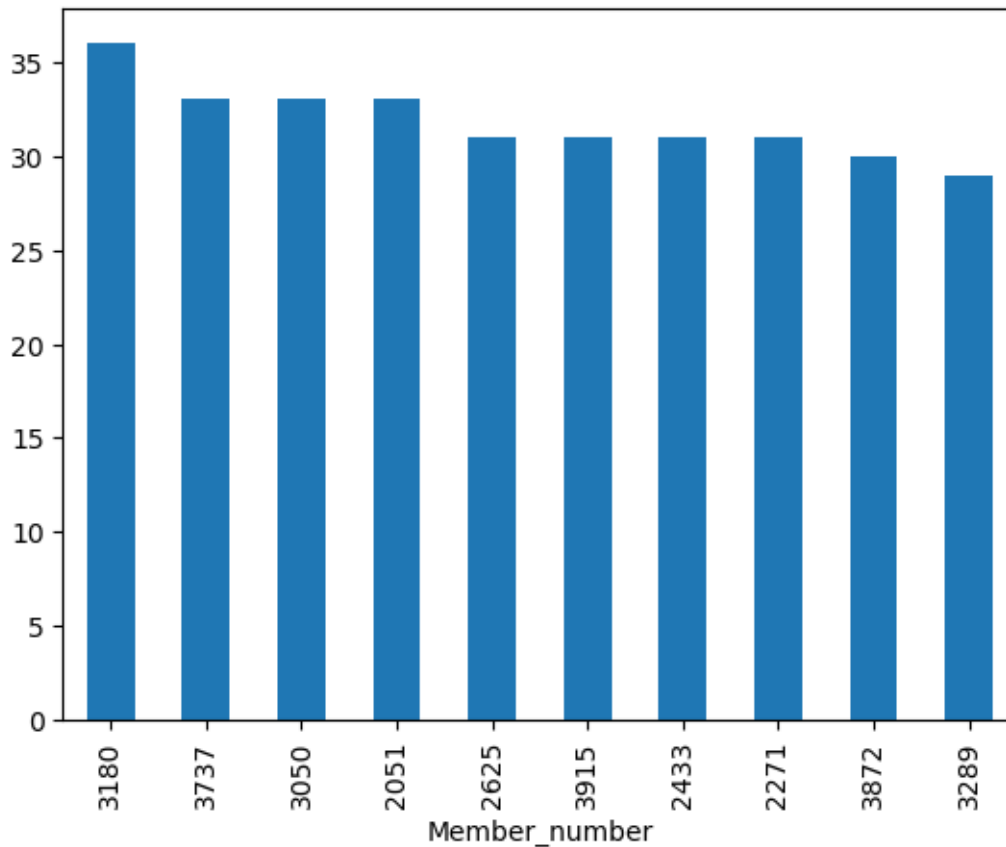
```
[16]:   Member_number      Date itemDescription
0          1808  21-07-2015    tropical fruit
1          2552  05-01-2015         whole milk
2          2300  19-09-2015         pip fruit
3          1187  12-12-2015    other vegetables
4          3037  01-02-2015         whole milk
```

```
[17]: # Q3. Top 10 customers
df.Member_number.value_counts().head(10)
```

```
[17]: Member_number
3180      36
3737      33
3050      33
2051      33
2625      31
3915      31
2433      31
2271      31
3872      30
3289      29
Name: count, dtype: int64
```

```
[18]: df.Member_number.value_counts().head(10).plot.bar()
```

```
[18]: <AxesSubplot: xlabel='Member_number'>
```



```
[19]: df.head(2)
```

```
[19]:   Member_number      Date itemDescription
0          1808  21-07-2015  tropical fruit
1          2552  05-01-2015      whole milk
```

```
[20]: df['Year'] = pd.DatetimeIndex(df['Date']).year
df['Month'] = pd.DatetimeIndex(df['Date']).month
df['Day'] = pd.DatetimeIndex(df['Date']).day
```

```
[21]: df.head(2)
```

```
[21]:   Member_number      Date itemDescription  Year  Month  Day
0          1808  21-07-2015  tropical fruit  2015     7   21
1          2552  05-01-2015      whole milk  2015     5    1
```

```
[22]: # Q4. In which year, the majority of the transactions has happened?
df.Year.value_counts()
```

```
[22]: Year
      2015    20488
      2014    18277
      Name: count, dtype: int64
```

```
[23]: df.Month.value_counts()
```

```
[23]: Month
      8    3498
      5    3335
      1    3333
      6    3316
      3    3283
     11    3273
      7    3268
     10    3218
      4    3172
     12    3074
      2    3032
      9    2963
      Name: count, dtype: int64
```

```
[24]: df.Day.value_counts()
```

```
[24]: Day
     28    1375
     21    1354
     26    1351
      8    1349
     14    1341
     13    1341
     27    1327
      4    1308
     10    1308
     11    1297
      5    1290
     24    1290
     18    1285
      7    1277
     23    1277
     22    1272
     19    1272
      9    1271
      2    1252
      1    1250
     15    1245
      3    1243
```



```

6      1232
25     1229
20     1214
30     1201
17     1181
12     1179
16     1158
29     1124
31      672
Name: count, dtype: int64

```

```
[25]: df[df['Year']==2015]['Month'].value_counts()
```

```

[25]: Month
8      1963
1      1829
3      1792
6      1791
11     1777
5      1710
4      1666
10     1663
7      1645
9      1613
12     1554
2      1485
Name: count, dtype: int64

```

```

[56]: df['Date'] = pd.to_datetime(df['Date'], format='%d-%m-%Y')
df['Year'] = df['Date'].dt.year
transaction_counts = df['Year'].value_counts()
most_transactions_year = transaction_counts.idxmax()
print("The majority of transactions occurred in the year:",
      most_transactions_year)

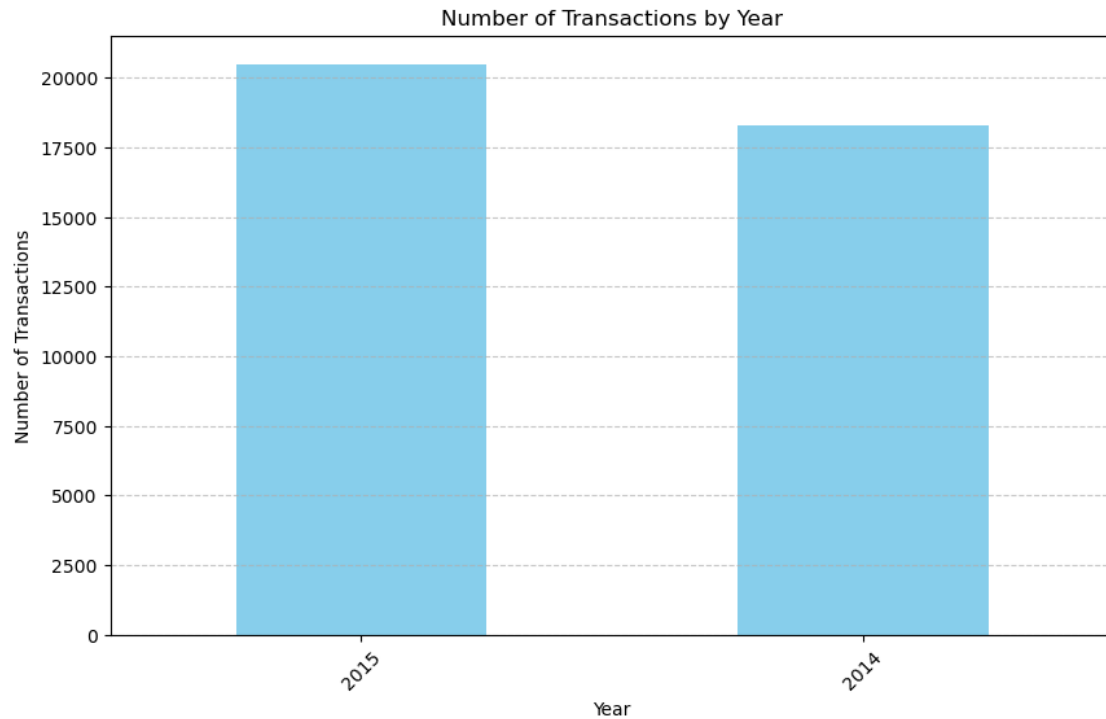
```

The majority of transactions occurred in the year: 2015

```

[57]: # Plotting
plt.figure(figsize=(10, 6))
transaction_counts.plot(kind='bar', color='skyblue')
plt.title('Number of Transactions by Year')
plt.xlabel('Year')
plt.ylabel('Number of Transactions')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()

```



6 Aprori Implementation

```
[27]: df.head(2)
```

```
[27]:   Member_number      Date itemDescription  Year  Month  Day
0          1808  21-07-2015  tropical fruit  2015     7    21
1          2552  05-01-2015    whole milk  2015     5     1
```

```
[28]: data = df.copy()
      data1 = data.copy()
```

```
[29]: data = pd.get_dummies(data['itemDescription'])
```

```
[30]: data.head(2)
```

```
[30]:   Instant food products  UHT-milk  abrasive cleaner  artif. sweetener \
0                False      False                False                False
1                False      False                False                False

      baby cosmetics   bags  baking powder  bathroom cleaner  beef  berries \
0                False  False            False            False  False  False
1                False  False            False            False  False  False
```

	...	turkey	vinegar	waffles	whipped/sour cream	whisky	white bread	\
0	...	False	False	False	False	False	False	
1	...	False	False	False	False	False	False	

	white wine	whole milk	yogurt	zwieback
0	False	False	False	False
1	False	True	False	False

[2 rows x 167 columns]

```
[31]: data1.drop(['itemDescription'], axis=1, inplace=True)
```

```
[32]: data1 = data1.join(data)
```

```
[33]: data1.head()
```

```
[33]:
```

	Member_number	Date	Year	Month	Day	Instant food products	\
0	1808	21-07-2015	2015	7	21	False	
1	2552	05-01-2015	2015	5	1	False	
2	2300	19-09-2015	2015	9	19	False	
3	1187	12-12-2015	2015	12	12	False	
4	3037	01-02-2015	2015	1	2	False	

	UHT-milk	abrasive cleaner	artif. sweetener	baby cosmetics	...	turkey	\
0	False	False	False	False	False	...	False
1	False	False	False	False	False	...	False
2	False	False	False	False	False	...	False
3	False	False	False	False	False	...	False
4	False	False	False	False	False	...	False

	vinegar	waffles	whipped/sour cream	whisky	white bread	white wine	\
0	False	False	False	False	False	False	
1	False	False	False	False	False	False	
2	False	False	False	False	False	False	
3	False	False	False	False	False	False	
4	False	False	False	False	False	False	

	whole milk	yogurt	zwieback
0	False	False	False
1	True	False	False
2	False	False	False
3	False	False	False
4	True	False	False

[5 rows x 172 columns]

```
[34]: products = df['itemDescription'].unique()
```

```
[35]: products
```

```
[35]: array(['tropical fruit', 'whole milk', 'pip fruit', 'other vegetables',
'rolls/buns', 'pot plants', 'citrus fruit', 'beef', 'frankfurter',
'chicken', 'butter', 'fruit/vegetable juice',
'packaged fruit/vegetables', 'chocolate', 'specialty bar',
'butter milk', 'bottled water', 'yogurt', 'sausage', 'brown bread',
'hamburger meat', 'root vegetables', 'pork', 'pastry',
'canned beer', 'berries', 'coffee', 'misc. beverages', 'ham',
'turkey', 'curd cheese', 'red/blush wine',
'frozen potato products', 'flour', 'sugar', 'frozen meals',
'herbs', 'soda', 'detergent', 'grapes', 'processed cheese', 'fish',
'sparkling wine', 'newspapers', 'curd', 'pasta', 'popcorn',
'finished products', 'beverages', 'bottled beer', 'dessert',
'dog food', 'specialty chocolate', 'condensed milk', 'cleaner',
'white wine', 'meat', 'ice cream', 'hard cheese', 'cream cheese ',
'liquor', 'pickled vegetables', 'liquor (appetizer)', 'UHT-milk',
'candy', 'onions', 'hair spray', 'photo/film', 'domestic eggs',
'margarine', 'shopping bags', 'salt', 'oil', 'whipped/sour cream',
'frozen vegetables', 'sliced cheese', 'dish cleaner',
'baking powder', 'specialty cheese', 'salty snack',
'Instant food products', 'pet care', 'white bread',
'female sanitary products', 'cling film/bags', 'soap',
'frozen chicken', 'house keeping products', 'spread cheese',
'decalCIFIER', 'frozen dessert', 'vinegar', 'nuts/prunes',
'potato products', 'frozen fish', 'hygiene articles',
'artif. sweetener', 'light bulbs', 'canned vegetables',
'chewing gum', 'canned fish', 'cookware', 'semi-finished bread',
'cat food', 'bathroom cleaner', 'prosecco', 'liver loaf',
'zwieback', 'canned fruit', 'frozen fruits', 'brandy',
'baby cosmetics', 'spices', 'napkins', 'waffles', 'sauces', 'rum',
'chocolate marshmallow', 'long life bakery product', 'bags',
'sweet spreads', 'soups', 'mustard', 'specialty fat',
'instant coffee', 'snack products', 'organic sausage',
'soft cheese', 'mayonnaise', 'dental care', 'roll products ',
'kitchen towels', 'flower soil/fertilizer', 'cereals',
'meat spreads', 'dishes', 'male cosmetics', 'candles', 'whisky',
'tidbits', 'cooking chocolate', 'seasonal products', 'liqueur',
'abrasive cleaner', 'syrup', 'ketchup', 'cream', 'skin care',
'rubbing alcohol', 'nut snack', 'cocoa drinks', 'softener',
'organic products', 'cake bar', 'honey', 'jam', 'kitchen utensil',
'flower (seeds)', 'rice', 'tea', 'salad dressing',
'specialty vegetables', 'pudding powder', 'ready soups',
'make up remover', 'toilet cleaner', 'preservation products'],
dtype=object)
```

```
[36]: data2 = data1.groupby(['Member_number', 'Date'])[products[:]].sum()
```

```
[37]: data1.groupby(['Member_number', 'Date'])[products[:]].sum()
```

```
[37]:
```

		tropical fruit	whole milk	pip fruit	\
Member_number	Date				
1000	15-03-2015	0	1	0	
	24-06-2014	0	1	0	
	24-07-2015	0	0	0	
	25-11-2015	0	0	0	
	27-05-2015	0	0	0	
...		
4999	24-01-2015	1	0	0	
	26-12-2015	0	0	0	
5000	09-03-2014	0	0	0	
	10-02-2015	0	0	0	
	16-11-2014	0	0	0	

		other vegetables	rolls/buns	pot plants	\
Member_number	Date				
1000	15-03-2015	0	0	0	
	24-06-2014	0	0	0	
	24-07-2015	0	0	0	
	25-11-2015	0	0	0	
	27-05-2015	0	0	0	
...		
4999	24-01-2015	1	0	0	
	26-12-2015	0	0	0	
5000	09-03-2014	0	0	0	
	10-02-2015	0	0	0	
	16-11-2014	1	0	0	

		citrus fruit	beef	frankfurter	chicken	...	\
Member_number	Date						
1000	15-03-2015	0	0	0	0	...	
	24-06-2014	0	0	0	0	...	
	24-07-2015	0	0	0	0	...	
	25-11-2015	0	0	0	0	...	
	27-05-2015	0	0	0	0	...	
...		
4999	24-01-2015	0	0	0	0	...	
	26-12-2015	0	0	0	0	...	
5000	09-03-2014	0	0	0	0	...	
	10-02-2015	0	0	0	0	...	
	16-11-2014	0	0	0	0	...	

		flower (seeds)	rice	tea	salad dressing	\
Member_number	Date					
1000	15-03-2015	0	0	0	0	

	24-06-2014	0	0	0	0
	24-07-2015	0	0	0	0
	25-11-2015	0	0	0	0
	27-05-2015	0	0	0	0
...	
4999	24-01-2015	0	0	0	0
	26-12-2015	0	0	0	0
5000	09-03-2014	0	0	0	0
	10-02-2015	0	0	0	0
	16-11-2014	0	0	0	0

Member_number	Date	specialty vegetables	pudding powder	ready soups	\
1000	15-03-2015	0	0	0	
	24-06-2014	0	0	0	
	24-07-2015	0	0	0	
	25-11-2015	0	0	0	
	27-05-2015	0	0	0	
...		
4999	24-01-2015	0	0	0	
	26-12-2015	0	0	0	
5000	09-03-2014	0	0	0	
	10-02-2015	0	0	0	
	16-11-2014	0	0	0	

Member_number	Date	make up remover	toilet cleaner	\
1000	15-03-2015	0	0	
	24-06-2014	0	0	
	24-07-2015	0	0	
	25-11-2015	0	0	
	27-05-2015	0	0	
...		
4999	24-01-2015	0	0	
	26-12-2015	0	0	
5000	09-03-2014	0	0	
	10-02-2015	0	0	
	16-11-2014	0	0	

Member_number	Date	preservation products
1000	15-03-2015	0
	24-06-2014	0
	24-07-2015	0
	25-11-2015	0
	27-05-2015	0
...		...

4999	24-01-2015	0
	26-12-2015	0
5000	09-03-2014	0
	10-02-2015	0
	16-11-2014	0

[14963 rows x 167 columns]

```
[38]: data2.head()
```

```
[38]:
```

Member_number	Date	tropical fruit	whole milk	pip fruit	\
1000	15-03-2015	0	1	0	
	24-06-2014	0	1	0	
	24-07-2015	0	0	0	
	25-11-2015	0	0	0	
	27-05-2015	0	0	0	

Member_number	Date	other vegetables	rolls/buns	pot plants	\
1000	15-03-2015	0	0	0	
	24-06-2014	0	0	0	
	24-07-2015	0	0	0	
	25-11-2015	0	0	0	
	27-05-2015	0	0	0	

Member_number	Date	citrus fruit	beef	frankfurter	chicken	...	\
1000	15-03-2015	0	0	0	0	...	
	24-06-2014	0	0	0	0	...	
	24-07-2015	0	0	0	0	...	
	25-11-2015	0	0	0	0	...	
	27-05-2015	0	0	0	0	...	

Member_number	Date	flower (seeds)	rice	tea	salad dressing	\
1000	15-03-2015	0	0	0	0	
	24-06-2014	0	0	0	0	
	24-07-2015	0	0	0	0	
	25-11-2015	0	0	0	0	
	27-05-2015	0	0	0	0	

Member_number	Date	specialty vegetables	pudding powder	ready soups	\
1000	15-03-2015	0	0	0	
	24-06-2014	0	0	0	
	24-07-2015	0	0	0	

25-11-2015	0	0	0
27-05-2015	0	0	0

		make up remover	toilet cleaner	\
Member_number	Date			
1000	15-03-2015	0	0	
	24-06-2014	0	0	
	24-07-2015	0	0	
	25-11-2015	0	0	
	27-05-2015	0	0	

Member_number	Date		
1000	15-03-2015	0	
	24-06-2014	0	
	24-07-2015	0	
	25-11-2015	0	
	27-05-2015	0	

[5 rows x 167 columns]

```
[39]: data2 = data2.reset_index()[products]
```

```
[40]: data2
```

	tropical fruit	whole milk	pip fruit	other vegetables	rolls/buns	\
0	0	1	0	0	0	
1	0	1	0	0	0	
2	0	0	0	0	0	
3	0	0	0	0	0	
4	0	0	0	0	0	
...	
14958	1	0	0	1	0	
14959	0	0	0	0	0	
14960	0	0	0	0	0	
14961	0	0	0	0	0	
14962	0	0	0	1	0	

	pot plants	citrus fruit	beef	frankfurter	chicken	...	\
0	0	0	0	0	0	...	
1	0	0	0	0	0	...	
2	0	0	0	0	0	...	
3	0	0	0	0	0	...	
4	0	0	0	0	0	...	
...	
14958	0	0	0	0	0	...	
14959	0	0	0	0	0	...	

14960	0	0	0	0	0	...
14961	0	0	0	0	0	...
14962	0	0	0	0	0	...

	flower (seeds)	rice	tea	salad dressing	specialty vegetables	\
0	0	0	0	0		0
1	0	0	0	0		0
2	0	0	0	0		0
3	0	0	0	0		0
4	0	0	0	0		0
...	
14958	0	0	0	0		0
14959	0	0	0	0		0
14960	0	0	0	0		0
14961	0	0	0	0		0
14962	0	0	0	0		0

	pudding powder	ready soups	make up remover	toilet cleaner	\
0	0	0	0	0	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
...	
14958	0	0	0	0	
14959	0	0	0	0	
14960	0	0	0	0	
14961	0	0	0	0	
14962	0	0	0	0	

	preservation products
0	0
1	0
2	0
3	0
4	0
...	...
14958	0
14959	0
14960	0
14961	0
14962	0

[14963 rows x 167 columns]

[41]: data2.values

```
[41]: array([[0, 1, 0, ..., 0, 0, 0],
          [0, 1, 0, ..., 0, 0, 0],
          [0, 0, 0, ..., 0, 0, 0],
          ...,
          [0, 0, 0, ..., 0, 0, 0],
          [0, 0, 0, ..., 0, 0, 0],
          [0, 0, 0, ..., 0, 0, 0]], dtype=int64)
```

```
[42]: data2['tropical fruit']
```

```
[42]: 0      0
      1      0
      2      0
      3      0
      4      0
      ..
14958    1
14959    0
14960    0
14961    0
14962    0
Name: tropical fruit, Length: 14963, dtype: int64
```

```
[43]: def func(data):
      for i in products:
          if data[i] > 0:
              data[i] = i
      return data
```

```
[44]: data2 = data2.apply(func,axis=1)
```

```
[45]: data2.head()
```

```
[45]: tropical fruit  whole milk pip fruit other vegetables rolls/buns pot plants \
0      0      0 whole milk      0      0      0      0
1      0      0 whole milk      0      0      0      0
2      0      0      0      0      0      0      0
3      0      0      0      0      0      0      0
4      0      0      0      0      0      0      0

      citrus fruit beef frankfurter chicken ... flower (seeds) rice tea \
0      0      0      0      0 ...      0      0      0
1      0      0      0      0 ...      0      0      0
2      0      0      0      0 ...      0      0      0
3      0      0      0      0 ...      0      0      0
4      0      0      0      0 ...      0      0      0
```

	salad dressing	specialty vegetables	pudding powder	ready soups	\
0	0	0	0	0	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	

	make up remover	toilet cleaner	preservation products
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0

[5 rows x 167 columns]

```
[46]: newdata = data2.values
```

```
[47]: newdata
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```
[47]: array([[0, 'whole milk', 0, ..., 0, 0, 0],
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          [0, 0, 0, ..., 0, 0, 0]], dtype=object)
```

```
[48]: newdata.ndim
```

```
[48]: 2
```

```
[49]: newdata = [i[i!=0].tolist() for i in newdata if i[i!=0].tolist()]
```

```
[50]: newdata[:10]
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```

```
[58]: newdata
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```

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```

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 'dessert',
 'photo/film',
 'white bread'],
...]

```

7 Apriori Implementation

```

[51]: association = apriori(newdata,
                           min_support=0.0003,
                           min_confidence=0.05,
                           min_lift=3,
                           max_length=2)

result = list(association)

```

```

[52]: result[5]

```

```

[52]: RelationRecord(items=frozenset({'seasonal products', 'soups'}),
support=0.0003341575887188398,
ordered_statistics=[OrderedStatistic(items_base=frozenset({'soups'}),
items_add=frozenset({'seasonal products'}), confidence=0.10416666666666667,
lift=14.704205974842768)])

```

```
[53]: for i in result[5]:  
       print(i)
```

```
frozenset({'seasonal products', 'soups'})  
0.0003341575887188398  
[OrderedStatistic(items_base=frozenset({'soups'}),  
items_add=frozenset({'seasonal products'}), confidence=0.10416666666666667,  
lift=14.704205974842768)]
```

- Items: soups -> seasonal products
- Support: 0.0003341575887188398 (indicating the proportion of transactions that contain both soups and seasonal products)
- Confidence: 0.10416666666666667 (indicating the probability of purchasing seasonal products given that soups are purchased)
- Lift: 14.704205974842768 (indicating how much more likely seasonal products are purchased when soups are purchased, compared to when they are purchased independently)

```
[54]: type(result[5])
```

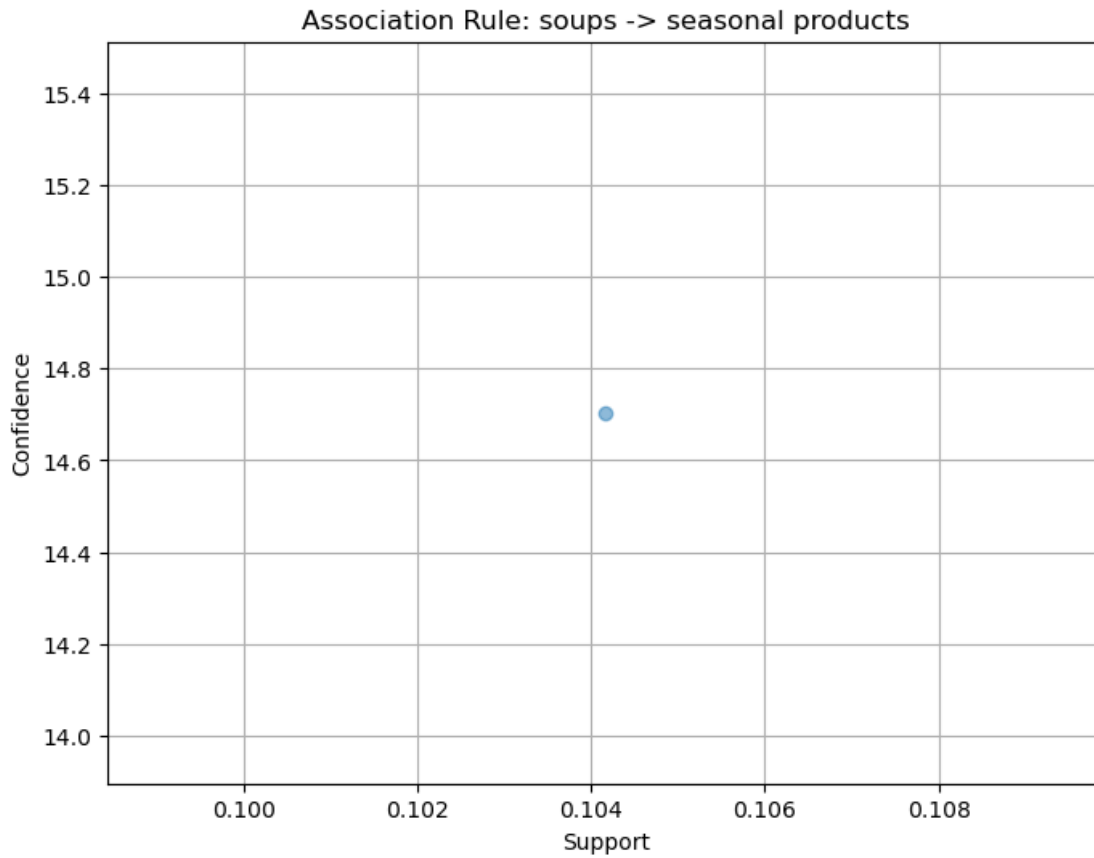
```
[54]: apyori.RelationRecord
```

```
[61]: import matplotlib.pyplot as plt  
  
# Sample association rule  
association_rule = [('soups', 'seasonal products', 0.10416666666666667, 14.  
↪704205974842768)]
```

```
# Extracting support and confidence values  
items = [(rule[0], rule[1]) for rule in association_rule]  
support = [rule[2] for rule in association_rule]  
confidence = [rule[3] for rule in association_rule]
```

```
print(items)  
print(support)  
print(confidence)  
# Plotting  
plt.figure(figsize=(8, 6))  
plt.scatter(support, confidence, alpha=0.5)  
plt.xlabel('Support')  
plt.ylabel('Confidence')  
plt.title('Association Rule: soups -> seasonal products')  
plt.grid(True)  
plt.show()
```

```
[('soups', 'seasonal products')]  
[0.10416666666666667]  
[14.704205974842768]
```



- The conclusion from this association rule is that there is a strong positive association between purchasing soups and purchasing seasonal products.
- Specifically, when customers buy soups, they are 10.42% likely to also purchase seasonal products, and this likelihood is 14.70 times higher than what would be expected if the purchase of soups and seasonal products were independent of each other.

```
[63]: import matplotlib.pyplot as plt

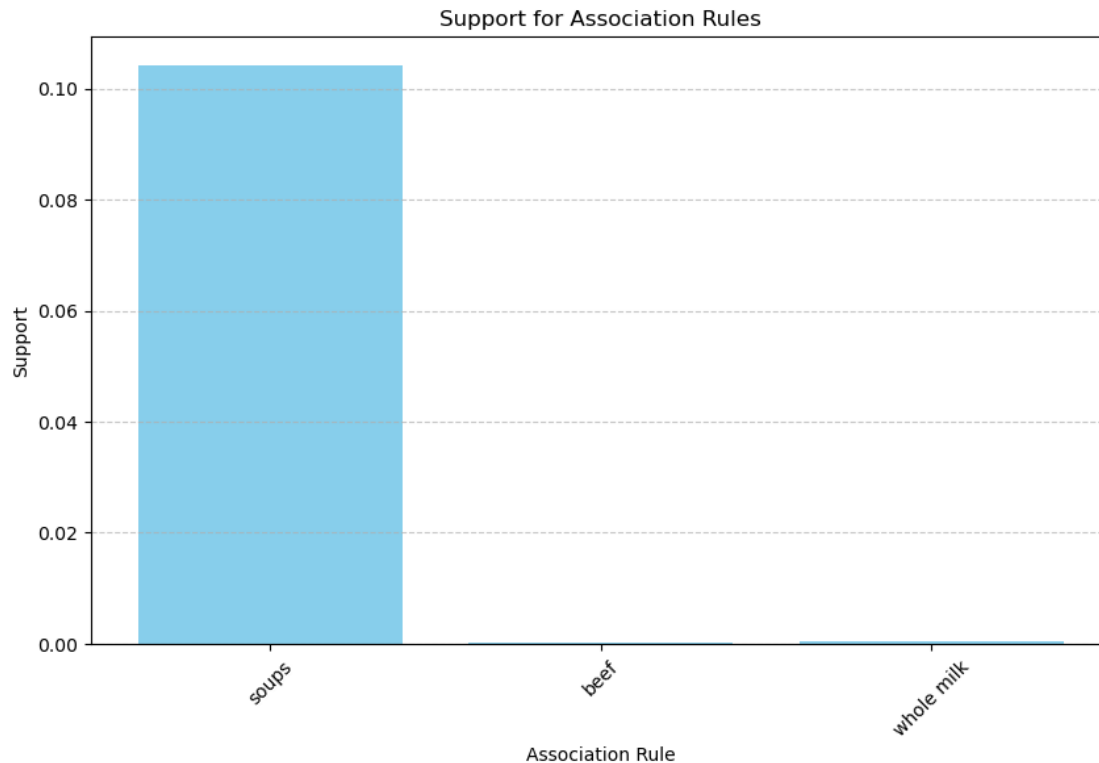
# Sample association rules
association_rules = [
    ('soups -> seasonal products', 0.10416666666666667),
    ('beef -> napkins', 0.00027392739273927394),
    ('whole milk -> yogurt', 0.00041967871485943775)
]

# Extracting items and support values
items = [rule.split(' -> ')[0] for rule, _ in association_rules]
support = [support for _, support in association_rules]
```

```

# Plotting
plt.figure(figsize=(10, 6))
plt.bar(items, support, color='skyblue')
plt.xlabel('Association Rule')
plt.ylabel('Support')
plt.title('Support for Association Rules')
plt.xticks(rotation=45)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()

```



```

[64]: association_rules = [
    ('whole milk -> yogurt', 0.00041967871485943775, 0.10416666666666667, 3.
    ↳12741967871486),
    ('beef -> napkins', 0.00027392739273927394, 0.08333333333333333, 3.
    ↳255767443611353),
    ('pip fruit -> rolls/buns', 0.00017523407028288558, 0.13888888888888889, 4.
    ↳177667079906591)
]

for rule in association_rules:
    items, support, confidence, lift = rule
    print(f"Association Rule: {items}")

```



```

print(f"Support: {support}")
print(f"Confidence: {confidence}")
print(f"Lift: {lift}")
print("\n")

```

Association Rule: whole milk -> yogurt
Support: 0.00041967871485943775
Confidence: 0.10416666666666667
Lift: 3.12741967871486

Association Rule: beef -> napkins
Support: 0.0002739273927392739
Confidence: 0.08333333333333333
Lift: 3.255767443611353

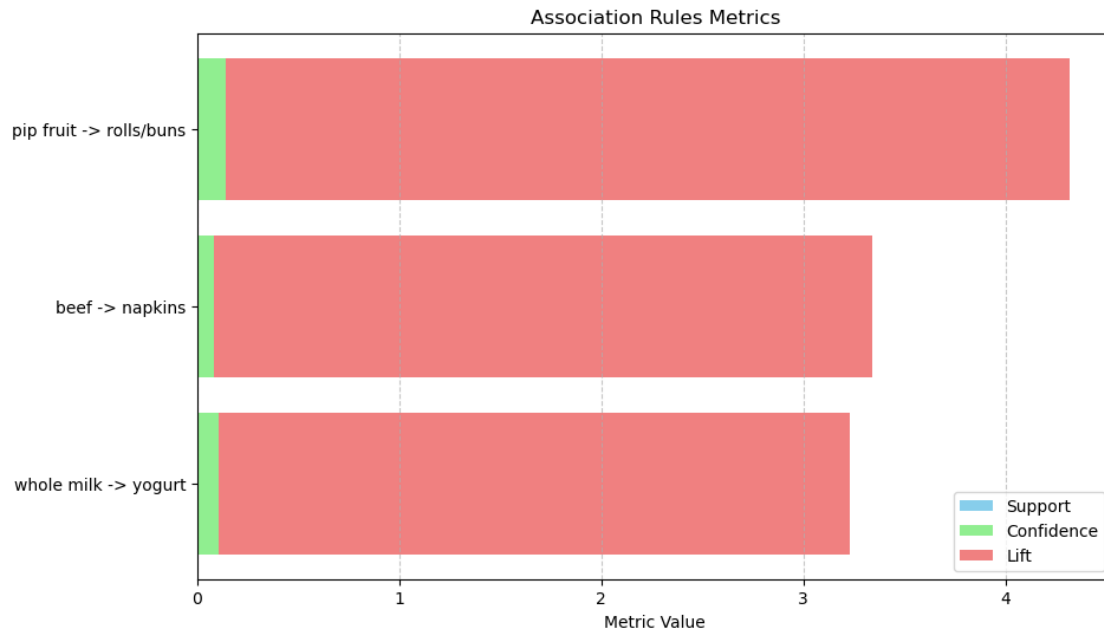
Association Rule: pip fruit -> rolls/buns
Support: 0.00017523407028288557
Confidence: 0.13888888888888889
Lift: 4.177667079906591

```

[65]: # Association rules
rules = ['whole milk -> yogurt', 'beef -> napkins', 'pip fruit -> rolls/buns']
support = [0.00041967871485943775, 0.0002739273927392739, 0.
↳ 00017523407028288557]
confidence = [0.10416666666666667, 0.08333333333333333, 0.13888888888888889]
lift = [3.12741967871486, 3.255767443611353, 4.177667079906591]

# Plotting
plt.figure(figsize=(10, 6))
plt.barh(rules, support, color='skyblue', label='Support')
plt.barh(rules, confidence, color='lightgreen', left=support,
↳ label='Confidence')
plt.barh(rules, lift, color='lightcoral', left=[sup + conf for sup, conf in
↳ zip(support, confidence)], label='Lift')
plt.xlabel('Metric Value')
plt.title('Association Rules Metrics')
plt.legend()
plt.grid(axis='x', linestyle='--', alpha=0.7)
plt.show()

```



- Customers who purchase whole milk are 10.42% likely to also purchase yogurt, with a lift of 3.13. This indicates a moderate positive association between whole milk and yogurt purchases.
- Customers who purchase beef are 8.33% likely to also purchase napkins, with a lift of 3.26. This suggests a moderate positive association between beef and napkins purchases.
- Customers who purchase pip fruit are 13.89% likely to also purchase rolls/buns, with a lift of 4.18. This indicates a strong positive association between pip fruit and rolls/buns purchases.

[]: