Association Analysis

Frequent Itemset Mining using Apriori Algorithm

```
import pandas as pd
from mlxtend.preprocessing import TransactionEncoder
from mlxtend.frequent patterns import apriori, association rules
import matplotlib.pyplot as plt
%matplotlib inline
from google.colab import drive
drive.mount('/content/drive')
     Go to this URL in a browser: <a href="https://accounts.google.com/o/oauth2/auth?client_id=9473189">https://accounts.google.com/o/oauth2/auth?client_id=9473189</a>
     Enter your authorization code:
     Mounted at /content/drive
from google.colab import files
import io
import pandas as pd
pd.set option('display.max columns', None)
uploaded = files.upload()
       Choose Files Online Retail.xlsx
        Online Retail.xlsx(application/vnd.openxmlformats-
     officedocument.spreadsheetml.sheet) - 23715344 bytes, last modified: 9/21/2019 - 100%
     done
Convert csv = pd.read excel('Online Retail.xlsx', index col=None)
Convert_csv.to_csv('csvfile.csv', encoding='utf-8')
```

▼ Loading the Data

```
df = pd.read_csv('csvfile.csv', sep=',')
df.head(10)
 С→
```

	Unnamed: 0	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	Custon
0	0	536365	85123A	WHITE HANGING HEART T- LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17
1	1	536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17
2	2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	2010-12-01 08:26:00	2.75	17
3	3	536365	84029G	KNITTED UNION FLAG HOT	6	2010-12-01 08:26:00	3.39	17

```
a = df.filter(like='StockCode').values.T.ravel()
b = df.filter(like='Country').values.T.ravel()
c = df.filter(like='Quantity').values.T.ravel()
df1 = pd.DataFrame({'StockCode':a, 'Country':b , 'Quantity':c}, columns=['StockCode','Country df2=df1.drop_duplicates()
print (df2)
```

С⇒		StockCode		Country	Quantity
	0	85123A	United	Kingdom	6
	1	71053	United	Kingdom	6
	2	84406B	United	Kingdom	8
	3	84029G	United	Kingdom	6
	4	84029E	United	Kingdom	6
				• • •	
	541781	22549		Germany	24
	541786	22622		Germany	6
	541798	22081		Germany	10
	541814	23350	United	Kingdom	25
	541868	85038	United	Kingdom	48

[67427 rows x 3 columns]

df3=df2.head(20000)
print (df3)

 \Box

	StockCode		Country	Quantity
0	85123A	United	Kingdom	6
1	71053	United	Kingdom	6
2	84406B	United	Kingdom	8
3	84029G	United	Kingdom	6
4	84029E	United	Kingdom	6
70593	22967	United	Kingdom	3
70594	22021	United	Kingdom	4
70595	85206A	United	Kingdom	4
70601	21626	United	Kingdom	10
70607	21472	United	Kingdom	12

[20000 rows x 3 columns]

```
df4=df2.sort_values(by=['Country'])
df9=df4.Country.value_counts()
print (df9)
```



United Kingdom	42929
EIRE	3697
Germany	3339
France	2959
Spain	1655
Switzerland	1444
Netherlands	1396
Australia	1049
Portugal	1040
Belgium	1011
Norway	764
Italy	602
Cyprus	566
Finland	548
Channel Islands	537
Unspecified	409
Sweden	359
Austria	334
Denmark	324
Japan	311
Israel	286
USA	283
Poland	256
Hong Kong	253
Singapore	199
Canada	148
Greece	140
Iceland	126
Malta	113
United Arab Emirates	68
RSA	58
European Community	56
Lebanon	45
Lithuania	34
Brazil	32
Czech Republic	28
Bahrain .	19
Saudi Arabia	10
Name: Country, dtype:	int64

df5=df4.sort_values(by=['Quantity'], ascending=False)
print (df5)



	Charlicada		Carration	0
540421	StockCode 23843	Uni+od	Country	Quantity 80995
61619	23043	United United	Kingdom Kingdom	74215
	84826	United	Kingdom	
502122				12540
74614	37413	United	Kingdom	5568
421632	84077	United	Kingdom	4800
206121	22197	United	Kingdom	4300
220843	85123A	United	Kingdom	4000
97432	22053	United	Kingdom	3906
270885	18007	United	Kingdom	3186
52711	21108	United	Kingdom	3114
263885	23343	United	Kingdom	3100
433788	16014	United	Kingdom	3000
115807	84988	United	Kingdom	3000
291249	84879	United	Kingdom	2880
4945	84077	United	Kingdom	2880
201149	21977	United	Kingdom	2700
80742	84077	United	Kingdom	2592
74615	79063D	United	Kingdom	2560
91772	18007	United	Kingdom	2400
32671	22693	United	Kingdom	2400
421601	23084		nerlands	2400
125282	21967	United	Kingdom	2160
437480	21915	United	Kingdom	2100
511421	23084		Japan	2040
52710	21175	United	Kingdom	2000
177702	16014	United	Kingdom	2000
424310	22197	United	Kingdom	1992
348317	23288	United	Kingdom	1944
348318	23285	United	Kingdom	1944
52709	85123A	United	Kingdom	1930
229728	23113	United	Kingdom	-1440
151033	21620	United	Kingdom	-1479
472841	16008		Kingdom	-1510
174654	79164		Kingdom	-1512
224419	22920	United	Kingdom	-1515
445127	85036C	United	Kingdom	-1560
431376	79323B	United	Kingdom	-1671
242906	22618	United	Kingdom	-1681
323469	21829	United	Kingdom	-1897
160143	85123A	United	Kingdom	-1930
160144	21175	United	Kingdom	-2000
431379	79323P	United	Kingdom	-2003
185113	23059	United	Kingdom	-2376
131399	72732	United	Kingdom	-2472
50849	22617	United	Kingdom	-2600
431378	79323LP	United	Kingdom	-2618
270886	18007	United	Kingdom	-2834
375429	23270	United	Kingdom	-2880
113580	84598	United	Kingdom	-3000
263884	20713	United	Kingdom	-3100
160145	21108	United	Kingdom	-3114
323458	16259	United	Kingdom	-3167
341601	16045	United	Kingdom	-3667
431381	79323W	United	Kingdom	-4830
115818	72140F	United	Kingdom	-5368
			•	

```
      225528
      23003
      United Kingdom
      -9058

      4287
      84347
      United Kingdom
      -9360

      225529
      23005
      United Kingdom
      -9600

      61624
      23166
      United Kingdom
      -74215

      540422
      23843
      United Kingdom
      -80995
```

[67427 rows x 3 columns]

```
df6=df5.loc[df['Country'] == 'United Kingdom']
print (df6)
```



	Charlicada		Carratian	0
540421	StockCode	United	Country	Quantity 80995
61619	23843 23166	United United	Kingdom Kingdom	74215
		United	Kingdom	
502122	84826			12540
74614	37413	United	Kingdom	5568
421632	84077	United	Kingdom	4800
206121	22197	United	Kingdom	4300
220843	85123A	United	Kingdom	4000
97432	22053	United	Kingdom	3906
270885	18007	United	Kingdom	3186
52711	21108	United	Kingdom	3114
263885	23343	United	Kingdom	3100
433788	16014	United	Kingdom	3000
115807	84988	United	Kingdom	3000
291249	84879	United	Kingdom	2880
4945	84077	United	Kingdom	2880
201149	21977	United	Kingdom	2700
80742	84077	United	Kingdom	2592
74615	79063D	United	Kingdom	2560
91772	18007	United	Kingdom	2400
32671	22693	United	Kingdom	2400
125282	21967	United	Kingdom	2160
437480	21915	United	Kingdom	2100
52710	21175	United	Kingdom	2000
177702	16014	United	Kingdom	2000
424310	22197	United	Kingdom	1992
348317	23288	United	Kingdom	1944
348318	23285	United	Kingdom	1944
52709	85123A	United	Kingdom	1930
291247	22197	United	Kingdom	1900
348316	23286	United	Kingdom	1878
229728	23113	United	Kingdom	-1440
151033	21620	United	Kingdom	-1479
472841	16008		Kingdom	-1510
174654	79164		Kingdom	-1512
224419	22920	United	Kingdom	-1515
445127	85036C	United	Kingdom	-1560
431376	79323B	United	Kingdom	-1671
242906	22618	United	Kingdom	-1681
323469	21829	United	Kingdom	-1897
160143	85123A	United	Kingdom	-1930
160144	21175	United	Kingdom	-2000
431379	79323P	United	Kingdom	-2003
185113	23059	United	Kingdom	-2376
131399	72732	United	Kingdom	-2472
50849	22617	United	Kingdom	-2600
431378	79323LP	United	Kingdom	-2618
270886	18007	United	Kingdom	-2834
375429	23270	United	Kingdom	-2880
113580	84598	United	Kingdom	-3000
263884	20713	United	Kingdom	-3100
160145	21108	United	Kingdom	-3114
323458	16259	United	Kingdom	-3167
341601	16045	United	Kingdom	-3667
431381	79323W	United	Kingdom	-4830
115818	72140F	United	Kingdom	-5368
			•	

```
225528
          23003 United Kingdom
                                    -9058
4287
          84347 United Kingdom
                                    -9360
          23005 United Kingdom
225529
                                    -9600
          23166 United Kingdom
61624
                                   -74215
540422
          23843 United Kingdom
                                   -80995
[42929 rows x 3 columns]
```

Each row of the dataset represents items that were purchased together on the same day at same sto.

The dataset is a **sparse dataset** as relatively high percentage of data is NA or NAN or equivalent.

Let's see all the unique items in the dataset.



Dagarintian	4 DUDDLE ELOCK DINNER	CANDLEC	FOLC CURTCIMAC CITY	
Description	4 PURPLE FLOCK DINNER	CANDLES	50'S CHRISTMAS GIFT	BAG LAKGE
InvoiceNo		0.0		0.0
536365		0.0		0.0
536366		0.0		0.0
536367		0.0		0.0
536368		0.0		0.0
536369		0.0		0.0
536371		0.0		0.0
536372		0.0		0.0
536373		0.0		0.0
536374		0.0		0.0
536375		0.0		0.0
536376		0.0		0.0
536377		0.0		0.0
536378		0.0		0.0
536380		0.0		0.0
536381		0.0		0.0
536382		0.0		0.0
536384		0.0		0.0
536385		0.0		0.0
536386		0.0		0.0
536387		0.0		0.0
536388		0.0		0.0
536390		0.0		0.0
536392		0.0		0.0
536393		0.0		0.0
536394		0.0		0.0
536395		0.0		0.0
536396		0.0		0.0
536397		0.0		0.0
536398		0.0		0.0
536399		0.0		0.0
• • •		• • •		
C581012		0.0		0.0
C581100		0.0		0.0
C581106		0.0		0.0
C581117		0.0		0.0
C581121		0.0		0.0
C581124		0.0		0.0
C581145		0.0		0.0
C581162		0.0		0.0
C581178		0.0		0.0
C581228		0.0		0.0
C581235		0.0		0.0
C581305		0.0		0.0
C581322		0.0		0.0
C581330		0.0		0.0
C581384		0.0		0.0
C581390		0.0		0.0
C581393		0.0		0.0
C581460		0.0		0.0
C581462		0.0		0.0
C581462		0.0		0.0
C581464		0.0		0.0
C581464 C581465		0.0		0.0
C581466		0.0		0.0
C581468				
C301400		0.0		0.0

	, ,,	•
C581470	0.0	0.0
C581484	0.0	0.0
C581490	0.0	0.0
C581499	0.0	0.0
C581568	0.0	0.0
C581569	0.0	0.0

C581568 C581569					0.0 0.0			
Description	DOLLY GIRL	BEAKER	Ι	LOVE	LONDON	MINI	BACKPACK	,
InvoiceNo								
536365		0.0					0.0	
536366		0.0					0.0	
536367		0.0					0.0	
536368		0.0					0.0	
536369		0.0					0.0	
536371		0.0					0.0	
536372		0.0					0.0	
536373		0.0					0.0	
536374		0.0					0.0	
536375		0.0					0.0	
536376		0.0					0.0	
536377		0.0					0.0	
536378		0.0 0.0					0.0	
536380 536381		0.0					0.0 0.0	
536382		0.0					0.0	
536384		0.0					0.0	
536385		0.0					0.0	
536386		0.0					0.0	
536387		0.0					0.0	
536388		0.0					0.0	
536390		0.0					0.0	
536392		0.0					0.0	
536393		0.0					0.0	
536394		0.0					0.0	
536395		0.0					0.0	
536396		0.0					0.0	
536397		0.0					0.0	
536398		0.0					0.0	
536399		0.0					0.0	
• • •		• • •					• • •	
C581012		0.0					0.0	
C581100		0.0					0.0	
C581106		0.0					0.0	
C581117		0.0					0.0	
C581121		0.0					0.0	
C581124 C581145		0.0 0.0					0.0 0.0	
C581145		0.0					0.0	
C581102		0.0					0.0	
C581228		0.0					0.0	
C581235		0.0					0.0	
C581305		0.0					0.0	
C581322		0.0					0.0	
C581330		0.0					0.0	
C581384		0.0					0.0	
C581390		0.0					0.0	
C581393		0.0					0.0	
C581460		0.0					0.0	

	Bonus_Associa	ation_Analysis.ipyrib - Colaboratory
C581462	0.0	0.0
C581463	0.0	0.0
C581464	0.0	0.0
C581465	0.0	0.0
C581466	0.0	0.0
C581468	0.0	0.0
C581470	0.0	0.0
C581484		0.0
	0.0	0.0
C581490	0.0	
C581499	0.0	0.0
C581568	0.0	0.0
C581569	0.0	0.0
Docenintion	NINE DRAWER OFFICE TIDY	OVAL WALL MIRROR DIAMANTE
Description	NINE DRAWER OFFICE TIDY	OVAL WALL MIRROR DIAMANTE
InvoiceNo	0.0	2.0
536365	0.0	0.0
536366	0.0	0.0
536367	0.0	0.0
536368	0.0	0.0
536369	0.0	0.0
536371	0.0	0.0
536372	0.0	0.0
536373	0.0	0.0
536374	0.0	0.0
536375	0.0	0.0
536376	0.0	0.0
536377	0.0	0.0
536378	0.0	0.0
536380	0.0	0.0
536381	0.0	0.0
536382	0.0	0.0
536384	0.0	0.0
536385	0.0	0.0
536386	0.0	0.0
536387	0.0	0.0
536388	0.0	0.0
536390	0.0	0.0
536392	0.0	0.0
536393	0.0	0.0
536394	0.0	0.0
536395	0.0	0.0
536396	0.0	0.0
536397	0.0	0.0
536398	0.0	0.0
536399	0.0	0.0
 CE01012		
C581012	0.0	0.0
C581100	0.0	0.0
C581106	0.0	0.0
C581117	0.0	0.0
C581121	0.0	0.0
C581124	0.0	0.0
C581145	0.0	0.0
C581162	0.0	0.0
C581178	0.0	0.0
C581228	0.0 0.0	0.0
C581235	0.0 a a	0.0 a a
		и и У7n0.l#scrollTo=PHvh2kKKYx35&printMode=tru

	Bonds_/1000010	ation_7 that you supplied to to about tory
CACTOCA	٥.٥	0.0
C581322	0.0	0.0
C581330	0.0	0.0
C581384	0.0	0.0
C581390	0.0	0.0
C581393	0.0	0.0
C581460	0.0	0.0
C581462	0.0	0.0
C581463	0.0	0.0
C581464	0.0	0.0
C581465	0.0	0.0
C581466	0.0	0.0
C581468	0.0	0.0
C581470	0.0	0.0
C581484	0.0	0.0
C581490	0.0	0.0
C581499	0.0	0.0
C581568	0.0	0.0
C581569	0.0	0.0
Description	RED SPOT GIFT BAG LARGE	SET 2 TEA TOWELS I LOVE LONDON
·	NED SFOT GITT DAG LANGE	SET 2 TEA TOWELS I LOVE LONDON
InvoiceNo		• •
536365	0.0	0.0
536366	0.0	0.0
536367	0.0	0.0
536368	0.0	0.0
536369	0.0	0.0
536371	0.0	0.0
536372	0.0	0.0
536373	0.0	0.0
536374	0.0	0.0
536375	0.0	0.0
536376	0.0	0.0
536377	0.0	0.0
536378	0.0	0.0
536380	0.0	0.0
536381	0.0	0.0
536382	0.0	0.0
536384	0.0	0.0
536385	0.0	0.0
536386	0.0	0.0
536387	0.0	0.0
536388	0.0	0.0
536390	0.0	0.0
536392	0.0	0.0
536393	0.0	0.0
536394	0.0	0.0
536395	0.0	0.0
536396	0.0	0.0
536397	0.0	0.0
536398	0.0	0.0
536399	0.0	0.0
	•••	•••
C581012	0.0	0.0
C581012 C581100	0.0	0.0
C581106	0.0	0.0
C581117	0.0	0.0
C581121	0.0	0.0

	Borius_Association_Arialysis.ipyrib - Colaboratory	
C581124	0.0	0.0
C581145	0.0	0.0
C581162	0.0	0.0
C581178	0.0	0.0
C581228	0.0	0.0
C581235	0.0	0.0
C581305	0.0	0.0
C581322	0.0	0.0
C581330	0.0	0.0
C581384	0.0	0.0
C581390	0.0	0.0
C581393	0.0	0.0
C581460	0.0	0.0
C581462	0.0	0.0
C581463	0.0	0.0
C581464	0.0	0.0
C581465	0.0	0.0
C581466	0.0	0.0
C581468	0.0	0.0
C581408	0.0	0.0
	0.0	
C581484		0.0
C581490	0.0	0.0
C581499	0.0	0.0
C581568	0.0	0.0
C581569	0.0	0.0
Doccointion	SPACEBOY BABY GIFT SET TOADSTOOL BEDSIDE LIGHT	\
Description InvoiceNo	SPACEBUY BABY GIFT SET TOADSTOOL BEDSIDE LIGHT	\
	0.0	• • •
536365	0.0 0.0 0.0	• • •
536366		• • •
536367 536368	0.0 0.0 0.0	• • •
		• • •
536369 536371	0.0 0.0 0.0	• • •
		• • •
536372	0.0	• • •
536373 536374	0.0 0.0 0.0	• • •
		• • •
536375	0.0	• • •
536376	0.0	• • •
536377	0.0	• • •
536378	0.0	• • •
536380	0.0	• • •
536381	0.0	• • •
536382	0.0	• • •
536384	0.0	• • •
536385	0.0	• • •
536386	0.0	• • •
536387	0.0	• • •
536388	0.0	• • •
536390	0.0	• • •
536392	0.0	• • •
536393	0.0	• • •
536394	0.0	• • •
536395	0.0	• • •
536396	0.0	• • •
536397	0.0	• • •
536398	0.0	• • •
536399	0.0	• • •

• • •		• • •	• • • • • •
C581012		0.0	0.0
C581100		0.0	0.0
C581106		0.0	0.0
C581117		0.0	0.0
C581121		0.0	0.0
C581124		0.0	0 0
C581124		0.0	0 0
C581162		0.0	0.0
C581178		0.0	0.0
C581228		0.0	0.0
C581235		0.0	0.0
C581305		0.0	0.0
C581322		0.0	0.0
C581330		0.0	0.0
C581384		0.0	0.0
C581390		0.0	0.0
C581393		0.0	0.0
C581460		0.0	0.0
C581462		0.0	0.0
C581463		0.0	0.0
C581464		0.0	0.0
C581465		0.0	0.0
C581466		0.0	0.0
C581468		0.0	0 0
C581470		0.0	0 0
C581484		0.0	0.0
C581490		0.0	0.0
C581499		0.0	0.0
		0 0	
C581568		0.0	0.0
C581568 C581569		0.0 0.0	
C581569		0.0	0.0 0.0
C581569 Description			0.0 0.0
C581569 Description InvoiceNo	wrongly coded 20713	0.0 wrongly coded 23343	0.0 0.0 wrongly coded-23343 \
C581569 Description InvoiceNo 536365	wrongly coded 20713	0.0 wrongly coded 23343 0.0	0.0 0.0 wrongly coded-23343 \
C581569 Description InvoiceNo 536365 536366	wrongly coded 20713 0.0 0.0	0.0 wrongly coded 23343 0.0 0.0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0
C581569 Description InvoiceNo 536365 536366 536367	wrongly coded 20713 0.0 0.0 0.0	0.0 wrongly coded 23343 0.0 0.0 0.0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0
C581569 Description InvoiceNo 536365 536366 536367 536368	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0	0.0 wrongly coded 23343 0.0 0.0 0.0 0.0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0	0.0 wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0	0.0 wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.0 wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	<pre>wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0</pre>	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536377 536377	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	 wrongly coded 23343 0.0 0.0<td>0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.</td>	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	<pre>wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0</pre>	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	<pre>wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0</pre>	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	<pre>wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0</pre>	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385 536386	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385 536387 536388	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385 536386 536387 536388 536388	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385 536387 536388	wrongly coded 20713 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	wrongly coded 23343 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	0.0 0.0 wrongly coded-23343 \ 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0

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		Bonus_Association	n_Analysis.ipy	nb - Colaborat
536385	0.0		0.0	
536386	0.0		0.0	
536387	0.0		0.0	
536388	0.0		0.0	
536390	0.0		0.0	
536392	0.0		0.0	
536393	0.0		0.0	
536394	0.0		0.0	
536395	0.0		0.0	
536396	0.0		0.0	
536397	0.0		0.0	
536398	0.0		0.0	
536399	0.0		0.0	
 CE01013				
C581012	0.0		0.0	
C581100	0.0		0.0	
C581106	0.0		0.0	
C581117	0.0		0.0	
C581121	0.0		0.0	
C581124	0.0		0.0	
C581145	0.0		0.0	
C581162	0.0		0.0	
C581178	0.0		0.0	
C581228 C581235	0.0 0.0		0.0 0.0	
C581235	0.0		0.0	
C581303	0.0		0.0	
C581322 C581330	0.0		0.0	
C581336	0.0		0.0	
C581384 C581390	0.0		0.0	
C581390	0.0		0.0	
C581393	0.0		0.0	
C581462	0.0		0.0	
C581463	0.0		0.0	
C581464	0.0		0.0	
C581465	0.0		0.0	
C581466	0.0		0.0	
C581468	0.0		0.0	
C581470	0.0		0.0	
C581484	0.0		0.0	
C581490	0.0		0.0	
C581499	0.0		0.0	
C581568	0.0		0.0	
C581569	0.0		0.0	
-5	0.0		3.0	
Description	wrongly marked	carton 22804	wrongly	marked.

Description	wrongly marked	carton 22804	wrongly marked.	23343 in box
InvoiceNo				
536365		0.0		0.0
536366		0.0		0.0
536367		0.0		0.0
536368		0.0		0.0
536369		0.0		0.0
536371		0.0		0.0
536372		0.0		0.0
536373		0.0		0.0
536374		0.0		0.0
536375		0.0		0.0
536376		0.0		0.0

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536377				0.0						0.0
536378				0.0						0.0
536380				0.0						0.0
536381				0.0						0.0
536382				0.0						0.0
536384				0.0						0.0
536385				0.0						0.0
536386				0.0						0.0
536387				0.0						0.0
536388				0.0						0.0
536390				0.0						0.0
536392				0.0						0.0
536393				0.0						0.0
										0.0
536394				0.0						
536395				0.0						0.0
536396				0.0						0.0
536397				0.0						0.0
536398				0.0						0.0
536399				0.0						0.0
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C581012				0.0						0.0
C581100				0.0						0.0
C581106				0.0						0.0
C581117				0.0						0.0
C581121				0.0						0.0
C581124				0.0						0.0
C581145				0.0						0.0
C581162				0.0						0.0
C581178				0.0						0.0
C581228				0.0						0.0
C581235				0.0						0.0
C581305				0.0						0.0
C581322				0.0						0.0
C581330				0.0						0.0
C581384				0.0						0.0
C581390				0.0						0.0
C581393				0.0						0.0
C581460				0.0						0.0
C581462				0.0						0.0
C581463				0.0						0.0
C581464				0.0						0.0
C581465				0.0						0.0
C581466				0.0						0.0
C581468				0.0						0.0
C581470				0.0						0.0
C581484				0.0						0.0
C581490				0.0						0.0
C581499				0.0						0.0
C581568				0.0						0.0
C581569				0.0						0.0
CJ01J0J				0.0						0.0
Description	wrongly	sold.	(22710)	harcode	wrongly	sold	25	ς _Δ +c	١	
InvoiceNo	wi oligiy	30±u	(22/13)	Jui Coue	wi oligiy	301U	us	5003	\	
536365				0.0				0.0		
536366				0.0				0.0		
536367				0.0				0.0		

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	Bonus_Association_Analysis.ipynb -	
536369	۵.۵	۵.۵
536371	0.0	0.0
536372	0.0	0.0
536373	0.0	0.0
536374	0.0	0.0
536375	0.0	0.0
536376	0.0	0.0
536377	0.0	0.0
536378	0.0	0.0
536380	0.0	0.0
536381	0.0	0.0
536382	0.0	0.0
536384	0.0	0.0
536385	0.0	0.0
536386	0.0	0.0
536387	0.0	0.0
536388	0.0	0.0
536390	0.0	0.0
536392	0.0	0.0
536393	0.0	0.0
536394	0.0	0.0
536395	0.0	0.0
536396	0.0	0.0
536397	0.0	0.0
536398	0.0	0.0
536399	0.0	0.0
• • •	•••	
C581012	0.0	0.0
C581100	0.0	0.0
C581106	0.0	0.0
C581117	0.0	0.0
C581121	0.0	0.0
C581124	0.0	0.0
C581145	0.0	0.0
C581162	0.0	0.0
C581178	0.0	0.0
C581228	0.0	0.0
C581235	0.0	0.0
C581305	0.0	0.0
C581322	0.0	0.0
C581330	0.0	0.0
C581384	0.0	0.0
C581390	0.0	0.0
C581393	0.0	0.0
C581460	0.0	0.0
C581462	0.0	0.0
C581463	0.0	0.0
C581464	0.0	0.0
C581465	0.0	0.0
C581466	0.0	0.0
C581468	0.0	0.0
C581470	0.0	0.0
C581484	0.0	0.0
C581490	0.0	0.0
C581490	0.0	0.0
C581499		
C581568	0.0 0.0	0.0
C301303	0.0	0.0

Description InvoiceNo 536365 536366 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536376 536387 536388 536388 536388 536388 536388 536388 536388 536389 536389 536390 536391 536391 536392 536393 536394 536395 536396 536397 536398 536399 536399 536399 536399 536399 536399 536399 536399 536399 536391 536398 536399 536399 536399 536399 536399 536399 536399 536390 536391 536398 536399 536399 536398 536399 5				DOLL
536365 0.0 536366 0.0 536368 0.0 536369 0.0 536371 0.0 536372 0.0 536373 0.0 536374 0.0 536375 0.0 536376 0.0 536377 0.0 536380 0.0 536381 0.0 536382 0.0 536383 0.0 536384 0.0 536385 0.0 536386 0.0 536387 0.0 536388 0.0 536390 0.0 536391 0.0 536392 0.0 536393 0.0 536396 0.0 536397 0.0 536398 0.0 536399 0.0 0.581106 0.0 0.581121 0.0 0.581228 0.0 0.581393 0.0 0.581394 0.0 0.581395 0	Description	wrongly	sold	sets
536366 0.0 536367 0.0 536368 0.0 536371 0.0 536372 0.0 536373 0.0 536374 0.0 536375 0.0 536376 0.0 536377 0.0 536380 0.0 536381 0.0 536382 0.0 536384 0.0 536385 0.0 536386 0.0 536387 0.0 536390 0.0 536391 0.0 536392 0.0 536393 0.0 536394 0.0 536395 0.0 536398 0.0 536399 0.0 0.581101 0.0 C581124 0.0 C581178 0.0 C581235 0.0 C581305 0.0 C581393 0.0 C581390 0.0 C581346 0.0 C581390 0.0	InvoiceNo			
536367 0.0 536368 0.0 536371 0.0 536372 0.0 536373 0.0 536374 0.0 536375 0.0 536376 0.0 536377 0.0 536380 0.0 536381 0.0 536382 0.0 536383 0.0 536384 0.0 536385 0.0 536386 0.0 536387 0.0 536388 0.0 536390 0.0 536391 0.0 536392 0.0 536393 0.0 536394 0.0 536395 0.0 536398 0.0 536399 0.0 536398 0.0 536399 0.0 5361100 0.0 C581121 0.0 C581146 0.0 C581325 0.0 C581330 0.0 C581384 0.0 <td>536365</td> <td></td> <td></td> <td>0.0</td>	536365			0.0
536368 0.0 536371 0.0 536372 0.0 536373 0.0 536374 0.0 536375 0.0 536376 0.0 536377 0.0 536380 0.0 536381 0.0 536382 0.0 536384 0.0 536385 0.0 536386 0.0 536387 0.0 536390 0.0 536391 0.0 536392 0.0 536393 0.0 536394 0.0 536395 0.0 536396 0.0 536399 0.0 0.0 0.0 C581100 0.0 C581140 0.0 C581121 0.0 C581122 0.0 C581235 0.0 C581305 0.0 C581330 0.0 C581393 0.0 C581393 0.0 C581462 0.0 <td>536366</td> <td></td> <td></td> <td>0.0</td>	536366			0.0
536369 0.0 536371 0.0 536372 0.0 536373 0.0 536374 0.0 536375 0.0 536376 0.0 536377 0.0 536388 0.0 536380 0.0 536381 0.0 536382 0.0 536385 0.0 536386 0.0 536387 0.0 536388 0.0 536390 0.0 536391 0.0 536392 0.0 536393 0.0 536394 0.0 536395 0.0 536396 0.0 536399 0.0 0.0 0.0 536110 0.0 C581117 0.0 C581124 0.0 C581125 0.0 C58128 0.0 C581305 0.0 C581390 0.0 C581390 0.0 C581390 0.0	536367			0.0
536371 0.0 536372 0.0 536373 0.0 536374 0.0 536375 0.0 536376 0.0 536377 0.0 536388 0.0 536380 0.0 536381 0.0 536382 0.0 536383 0.0 536385 0.0 536386 0.0 536387 0.0 536390 0.0 536391 0.0 536392 0.0 536393 0.0 536394 0.0 536395 0.0 536398 0.0 536399 0.0 536399 0.0 536310 0.0 C581100 0.0 C581121 0.0 C581122 0.0 C581305 0.0 C58145 0.0 C581330 0.0 C581393 0.0 C581460 0.0 C581462 0.0 </td <td>536368</td> <td></td> <td></td> <td>0.0</td>	536368			0.0
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C581484 0.0
C581490 0.0
C581499 0.0
C581568 0.0
C581569 0.0
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[22040 rows x 4202 columns]

```
def encode_units(x):
    if x <= 0:
        return 0
    if x >= 1:
        return 1

basket_sets = basket.applymap(encode_units)

print(basket_sets)
```

Docamintion	4 DUDDLE ELOCK DI	INNER CANDLEC	FOLC CURTCEMAC	CTET DAG LADGE
Description InvoiceNo	4 PURPLE FLOCK DI	INNER CANDLES	50'S CHRISTMAS	GIFT BAG LARGE
536365		0		a
		0		0
536366		0		0
536367		0		0
536368		0		0
536369		0		0
536371		0		0
536372		0		0
536373		0		0
536374		0		0
536375		0		0
536376		0		0
536377		0		0
536378		0		0
536380		0		0
536381		0		0
536382		0		0
536384		0		0
536385		0		0
536386		0		0
536387		0		0
536388		0		0
536390		0		0
536392		0		0
536393		0		0
536394		0		0
536395		0		0
536396		0		0
536397		0		0
536398		0		0
536399		0		0
		V		0
 C581012		0		0
C581012		0		0
C581106		0		
C581106		0		0
C581117		0		0
				0
C581124		0		0
C581145		0		0
C581162		0		0
C581178		0		0
C581228		0		0
C581235		0		0
C581305		0		0
C581322		0		0
C581330		0		0
C581384		0		0
C581390		0		0
C581393		0		0
C581460		0		0
C581462		0		0
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C581465		0		0
C581466		0		0
C581468		0		0
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C581484	0	0
C581490	0	0
C581499	0	0
C581568	0	0
C581569	0	0

C581568		0	
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C301303		•	
Description	DOLLY GIRL BEAKER	I LOVE LONDON MINI BACKPACK	\
InvoiceNo			`
536365	0	0	
536366	0	0	
536367	0	0	
536368	0	0	
536369	0	0	
536371	0	0	
536372	0	0	
536373	0	0	
536374	0	0	
536375	0	0	
536376	0	0	
536377	0	0	
536378	0	0	
536380	0	0	
536381	0	0	
536382	0	0	
	0		
536384		0	
536385	0	0	
536386	0	0	
536387	0	0	
536388	0	0	
536390	0	0	
536392	0	0	
536393	0	0	
536394	0	0	
536395	0	0	
536396	0	0	
536397	0	0	
536398	0	0	
536399	0	0	
 C581012	0	•••	
C581012 C581100	0	0	
C581100	0	0	
C581106	0	0	
C581117	0	0	
C581121 C581124	0	0	
C581124 C581145	0	0	
C581162	0	0	
C581178	0	0	
C581178	0		
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C581235 C581305	0	0	
C581305 C581322	0	0	
		0	
C581330	0	0	
C581384	0	0	
C581390	0	0	
C581393	0	0	
C581460	0	0	

			Donu	15_A550Cl	allon_Ana	iysis.ipy	iib - Colabo	ratory		
C581462			0					0		
C581463			0					0		
C581464			0					0		
C581465			0					0		
C581466			0					0		
C581468			0					0		
C581408			0					0		
C581476										
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C581490			0					0		
C581499			0					0		
C581568			0					0		
C581569			0					0		
5	NITNIE	DDALIED	055565	TTD\/	0) (4)		итррор	DIAMANTE		,
Description	NTNE	DRAWER	OFFICE	LIDA	OVAL	WALL	MIKKOK	DIAMANTE		,
InvoiceNo									_	
536365				0					0	
536366				0					0	
536367				0					0	
536368				0					0	
536369				0					0	
536371				0					0	
536372				0					0	
536373				0					0	
536374				0					0	
536375				0					0	
536376				0					0	
536377				0					0	
536378				0					0	
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536381				0					0	
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536386				0					0	
536387				0					0	
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536395				0					0	
536396				0					0	
536397				0					0	
536398				0					0	
536399				0					0	
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C581012				0					0	
C581100				0					0	
C581106				0					0	
C581117				0					0	
C581121				0					0	
C581124				0					0	
C581145				0					0	
C581162				0					0	
C581178				0					0	
C581228				0					0	
C581235				0					0	
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CE8130E

	Bonus_Association_Analysis.ipynb - Colaboratory	
CACTOCA	U	0
C581322	0	0
C581330	0	0
C581384	0	0
C581390	0	0
C581393	0	0
C581460	0	0
C581462	0	0
C581463	0	0
C581464	0	0
C581465	0	0
C581466	0	0
C581468	0	0
C581470	0	0
C581484	0	0
C581490	0	0
C581499	0	0
C581568	0	0
C581569	0	0
Description	RED SPOT GIFT BAG LARGE SET 2 TEA TOWELS I LOVE L	ONDON.
InvoiceNo		
536365	0	0
536366	0	0
536367	0	0
536368	0	0
536369	0	0
536371	0	0
536372	0	0
536373	0	0
536374	0	0
536375	0	0
536376	0	0
536377	0	0
536378	0	0
536380	0	0
536381	0	0
536382	0	0
536384	0	0
536385	0	0
536386	0	0
536387	0	0
536388	0	0
536390	0	0
536392	0	0
536393	0	0
536394	0	0
536395	0	0
536396	0	0
536397	0	0
536398	0	0
536399	0	0
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 C581012	0	0
C581100	0	0
C581106	0	0
C581117	0	0
C581121	0	0

	Bonus_Associatio	n_Analysis.ipynb - Colaboratory
C581124	0	
C581145	0	
C581162	0	
C581178	0	
C581228	0	
C581235	0	
C581305	0	
C581322	0	
C581330	0	
C581384	0	
C581390	0	
C581393	0	
C581460	0	
C581462	0	
C581463	0	
C581464	0	
C581465	0	
C581466	0	
C581468	0	
C581470	0	
C581484	0	
C581490	0	
C581499	0	
C581568	0	
C581569	0	
Description	SPACEBOY BABY GIFT SET TO	DADSTOOL BEDSIDE LIGHT
InvoiceNo		
536365	0	0
536366	0	۵
536367	0	٥
536368	0	0
536369	0	0
536371	0	0
536372	0	0
536373	0	0
536374	0	0
536375	0	0
536376	0	0
536377	0	0
536378	0	0
536380	0	0
536381	0	0
536382	0	0
536384	0	0
536385	0	0
536386	0	0
536387	0	0
536388	0	0
536390	0	0
536392	0	0
536393	0	0
536394	0	
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536395	0	0
536396	0	0
536397	0	0
536398	0	0
536399	0	0

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C581012		0	0
C581100		0	0
C581106		0	0
C581117		0	0
C581121		0	0
C581124		0	ο
C581124		0	ο
C581143			
		0	0
C581178		0	0
C581228		0	0
C581235		0	0
C581305		0	0
C581322		0	0
C581330		0	0
C581384		0	0
C581390		0	0
C581393		0	0
C581460		0	0
C581462		0	0
C581463		0	0
C581464		0	ο
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C581466		0	0
C581468		0	0
C581470		0	0
C581484		0	0
C581490		0	0
C581499		0	0
C581568		0	0
C301300		0	0
C581569		0	0
C581569	unongly coded 20712	0	0
C581569 Description	wrongly coded 20713		0
C581569 Description InvoiceNo		0 wrongly coded 23343	0 wrongly coded-23343 \
C581569 Description InvoiceNo 536365	0	0 wrongly coded 23343	<pre>0 wrongly coded-23343 \ 0</pre>
C581569 Description InvoiceNo 536365 536366	0	0 wrongly coded 23343 0 0	0 wrongly coded-23343 \ 0 0
C581569 Description InvoiceNo 536365 536366 536367	0 0 0	0 wrongly coded 23343 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368	0 0 0 0	0 wrongly coded 23343 0 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369	0 0 0 0	0 wrongly coded 23343 0 0 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371	0 0 0 0	0 wrongly coded 23343 0 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372	0 0 0 0	0 wrongly coded 23343 0 0 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0 0 0 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371	0 0 0 0 0	0 wrongly coded 23343 0 0 0 0 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372	0 0 0 0 0	<pre>0 wrongly coded 23343</pre>	0 wrongly coded-23343 \ 0 0 0 0 0 0 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373	0 0 0 0 0 0	0 wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0 0 0 0 0 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374	0 0 0 0 0 0	0 wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0 0 0 0 0 0 0 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376	0 0 0 0 0 0 0	0 wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 wrongly coded-23343 \ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377	0 0 0 0 0 0 0	<pre>wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</pre>	<pre>0 wrongly coded-23343 \</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536377 536377	0 0 0 0 0 0 0 0	<pre>wrongly coded 23343</pre>	<pre>0 wrongly coded-23343 \</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380	0 0 0 0 0 0 0 0	<pre>wrongly coded 23343</pre>	<pre>0 wrongly coded-23343 \</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381	0 0 0 0 0 0 0 0 0	<pre>wrongly coded 23343</pre>	<pre>0 wrongly coded-23343 \</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382	0 0 0 0 0 0 0 0	<pre>wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</pre>	<pre>wrongly coded-23343 \ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384	0 0 0 0 0 0 0 0 0	wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	<pre>wrongly coded-23343 \ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385	0 0 0 0 0 0 0 0 0	<pre>wrongly coded 23343</pre>	<pre> wrongly coded-23343 \ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385 536386	0 0 0 0 0 0 0 0 0 0	wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	<pre>wrongly coded-23343 \ 0</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385 536386 536387		wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	<pre>wrongly coded-23343 \ 0</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536388 536380 536381 536382 536384 536385 536387 536388		wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	<pre>wrongly coded-23343 \ ### wrongly coded-23343 \ ### ### ### ### #### #############</pre>
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536378 536380 536381 536382 536384 536385 536385 536386 536387 536388		wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	wrongly coded-23343 \ 0
C581569 Description InvoiceNo 536365 536366 536367 536368 536369 536371 536372 536373 536374 536375 536376 536377 536388 536380 536381 536382 536384 536385 536387 536388		wrongly coded 23343 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	<pre>wrongly coded-23343 \ ### wrongly coded-23343 \ ### ### ### ### #### #############</pre>

		Bonus_Association_Analysis	s.ipynb -	Colaboratory
כככסככ		U		U
536394		0		0
536395		0		0
536396		0		0
536397		0		0
536398		0		0
536399		0		0
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C581012		0		0
C581100		0		0
C581106		0		0
C581117		0		0
C581121		0		0
C581124		0		0
C581145		0		0
C581162		0		0
C581178		0		0
C581228		0		0
C581235		0		0
C581305		0		0
C581322		0		0
C581330		0		0
C581384		0		0
C581390		0		0
C581393		0		0
C581460		0		0
C581462		0		0
C581463		0		0
C581464		0		0
C581465		0		0
C581466		0		0
C581468		0		0
C581470		0		0
C581484		0		0
C581490		0		0
C581499		0		0
C581568		0		0
C581569		0		0
Description	wrongly marked	wrongly marked 233	343 \	
InvoiceNo				
536365	0		0	
536366	0		0	
536367	0		0	
536368	0		0	
536369	0		0	
536371	0		0	
536372	0		0	
536373	0		0	
536374	0		0	
536375	0		0	
536376	0		0	
536377	0		0	
F26270	0		0	

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536385	0		0	
536386	0		0	
536387	0		0	
536388	0		0	
536390	0		0	
536392	0		0	
536393	0		0	
536394	0		0	
536395	0		0	
536396	0		0	
536397	0		0	
536398	0		0	
536399	0		0	
 C581012				
C581100	0		0	
C581106	0		0	
C581117	0		0	
C581121	0		0	
C581124	0		0	
C581145	0		0	
C581162	0		0	
C581178	0		0	
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C581235	0		0	
C581305	0		0	
C581322	0		0	
C581330	0		0	
C581384	0		0	
C581390	0		0	
C581393	0		0	
C581460	0		0	
C581462	0		0	
C581463	0		0	
C581464	0		0	
C581465	0		0	
C581466	0		0	
C581468	0		0	
C581470	0		0	
C581484	0		0	
C581490	0		0	
C581499	0		0	
C581568	0		0	
C581569	0		0	
Description	wrongly marked	carton 22804	wrongly	marked

Description InvoiceNo	wrongly marked	carton 22804	wrongly marked.	23343 in box	\
536365		0		0	
220202		Ð		Ø	
536366		0		0	
536367		0		0	
536368		0		0	
536369		0		0	
536371		0		0	
536372		0		0	
536373		0		0	
536374		0		0	
536375		0		0	
536376		0		0	

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536377				0						0
536378				0						0
536380				0						0
536381				0						
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536382				0						0
536384				0						0
536385				0						0
536386				0						0
536387				0						0
536388				0						0
536390				0						0
536392				0						0
536393				0						0
536394				0						0
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536397				0						0
536398				0						0
536399				0						0
220222				V						O
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C581100				0						0
C581106				0						0
C581117				0						0
C581121				0						0
C581124				0						0
C581145				0						0
C581162				0						0
C581178				0						0
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C581235				0						0
C581305				0						0
C581322				0						0
C581330				0						0
C581384				0						0
C581390				0						0
C581393				0						0
C581460				0						0
C581462				0						0
C581463				0						0
C581464				0						0
C581465				0						0
C581466				0						0
C581468				0						0
C581470				0						0
C581484				0						0
C581490				0						0
C581499				0						0
C581568				0						0
C581569				0						0
	wrongly	sold	(22719)	barcode	wrongly	sold	as	sets	\	
InvoiceNo										
536365				0				0		
536366				0				0		
536367				0				0		
536368				9				9		

	Bonus_Association_Analysis.ipynb - C	olaboratory
536369	Ø	ь
536371	0	0
536372	0	0
536373	0	0
536374	0	0
536375	0	0
536376	0	0
536377	0	0
536378	0	0
536380	0	0
536381	0	0
536382	0	0
536384	0	0
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536387	0	0
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536390	0	0
536392	0	0
536393	0	0
536394	0	0
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536396	0	0
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536399	0	0
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 C581012	0	0
C581100	0	0
C581106	0	0
C581117	0	0
C581121	0	0
C581124	0	0
C581145	0	0
C581162	0	0
C581178	0	0
C581228	0	0
C581235	0	0
C581305	0	0
C581322	0	0
C581330	0	0
C581384	0	0
C581390	0	0
C581393	0	0
C581460	0	0
C581462	0	0
C581463	0	0
C581464	0	0
C581465	0	0
C581466	0	0
C581468	0	0
C581470	0	0
C581484	0	0
C581490	0	0
C581499	0	0
C581568	0	0
C581569	0	0
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			DC
Description	wrongly	sold	sets
InvoiceNo	0 1		
536365			0
536366			0
536367			0
536368			0
536369			0
536371			0
536372			0
536373			0
536374			0
536375			0
536376			0
536377			0
536378			0
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536385			0
536386			0
536387			0
536388			0
536390			0
536392			0
536393			0
536394			0
536395			0
536396			0
536397			0
536398			0
536399			0
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C581012			0
C581100			0
C581106			0
C581117			0
C581121			0
C581121			
			0
C581145			0
C581162			0
C581178			0
C581228			0
C581235			0
C581305			0
C581322			0
C581330			0
C581384			0
C581390			0
C581393			0
C581460			0
C581462			0
C581463			0
C581464			0
C581465			0
C581466			0
C581468			0
C581470	triva/1v IV/Si	VI ITUA	0 (Ea DV)

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C581484	0
C581490	0
C581499	0
C581568	0
C581569	0

[22040 rows x 4202 columns]

▼ Data Preprocessing

To make use of the apriori module given by mlxtend library, we need to convert the dataset according dataframe that has either 0 and 1 or True and False as data. The data we have is all string (name of it data.

▼ Custom One Hot Encoding

```
frequent_itemsets = apriori(basket_sets, min_support=0.049, use_colnames=True)
print (frequent itemsets)
```



```
support
                                           itemsets
0
    0.062205
                   (ASSORTED COLOUR BIRD ORNAMENT)
                            (HEART OF WICKER SMALL)
1
    0.052813
2
    0.052586
                          (JUMBO BAG PINK POLKADOT)
3
    0.087931
                          (JUMBO BAG RED RETROSPOT)
4
    0.051407
               (JUMBO SHOPPER VINTAGE RED PAISLEY)
5
    0.051270
                           (JUMBO STORAGE BAG SUKI)
6
    0.055172
                          (LUNCH BAG BLACK SKULL.)
7
    0.063158
                          (LUNCH BAG RED RETROSPOT)
    0.055309
                 (NATURAL SLATE HEART CHALKBOARD )
                 (PACK OF 72 RETROSPOT CAKE CASES)
9
    0.051225
   0.051044
                 (PAPER CHAIN KIT 50'S CHRISTMAS )
10
   0.072323
                                    (PARTY BUNTING)
11
                         (REGENCY CAKESTAND 3 TIER)
12
   0.076452
   0.056307
13
               (SET OF 3 CAKE TINS PANTRY DESIGN )
              (WHITE HANGING HEART T-LIGHT HOLDER)
14
   0.098276
```

Applying Apriori

apriori module from mlxtend library provides fast and efficient apriori implementation.

apriori(df, min_support=0.5, use_colnames=False, max_len=None, verbose=0, low_memory=Fa

Parameters

- df: One-Hot-Encoded DataFrame or DataFrame that has 0 and 1 or True and False as values
- min_support: Floating point value between 0 and 1 that indicates the minimum support requi
 # of observation with item / total observation
- use_colnames: This allows to preserve column names for itemset making it more readable.
- max_len: Max length of itemset generated. If not set, all possible lengths are evaluated.
- verbose: Shows the number of iterations if >= 1 and low_memory is True. If =1 and low_memory combinations.
- low_memory:

If True, uses an iterator to search for combinations above min_support. Note that while low_me dataset if memory resources are limited, because this implementation is approx. 3-6x slower th

```
#Applying Apriori
frequent_itemsets = apriori(basket_sets, min_support=0.03, use_colnames=True)
print (frequent_itemsets)
```



	support	itemsets
0	0.038793	(6 RIBBONS RUSTIC CHARM)
1	0.034165	(60 TEATIME FAIRY CAKE CASES)
2	0.039746	(ALARM CLOCK BAKELIKE GREEN)
3	0.042196	(ALARM CLOCK BAKELIKE RED)
4	0.030672	(ANTIQUE SILVER T-LIGHT GLASS)
5	0.062205	(ASSORTED COLOUR BIRD ORNAMENT)
6	0.035799	(BAKING SET 9 PIECE RETROSPOT)
7	0.030581	(CHARLOTTE BAG PINK POLKADOT)
8	0.036479	(CHARLOTTE BAG SUKI DESIGN)
9	0.037205	(CHOCOLATE HOT WATER BOTTLE)
10	0.031171	(CLOTHES PEGS RETROSPOT PACK 24)
11	0.031261	(COOK WITH WINE METAL SIGN)
12	0.031715	(DOLLY GIRL LUNCH BOX)
13	0.031579	(DOORMAT KEEP CALM AND COME IN)
14	0.032123	(DOTCOM POSTAGE)
15	0.034029	(GARDENERS KNEELING PAD CUP OF TEA)
16	0.040744	(GARDENERS KNEELING PAD KEEP CALM)
17	0.033167	(GIN + TONIC DIET METAL SIGN)
18	0.042377	(GREEN REGENCY TEACUP AND SAUCER)
19	0.030309	(HAND OVER THE CHOCOLATE SIGN)
20	0.031307	(HANGING HEART JAR T-LIGHT HOLDER)
21	0.041515	(HEART OF WICKER LARGE)
22	0.052813	(HEART OF WICKER SMALL)
23	0.033938	(HOME BUILDING BLOCK WORD)
24	0.034256	(HOT WATER BOTTLE KEEP CALM)
25	0.045735	(JAM MAKING SET PRINTED)
26	0.045327	(JAM MAKING SET WITH JARS)
27	0.041289	(JUMBO BAG BAROQUE BLACK WHITE)
28	0.030490	(JUMBO BAG 50'S CHRISTMAS)
29	0.038475	(JUMBO BAG ALPHABET)
		••••
57	0.036978	(PLEASE ONE PERSON METAL SIGN)
58	0.033893	(POPCORN HOLDER)
59	0.037795	(RABBIT NIGHT LIGHT)
60	0.046869	(RECIPE BOX PANTRY YELLOW DESIGN)
61	0.032214	(RECYCLING BAG RETROSPOT)
62	0.031942	(RED HANGING HEART T-LIGHT HOLDER)
63	0.041062	(RED RETROSPOT CHARLOTTE BAG)
64	0.076452	(REGENCY CAKESTAND 3 TIER)
65	0.036887	(RETROSPOT TEA SET CERAMIC 11 PC)
66	0.039065	(REX CASH+CARRY JUMBO SHOPPER)
67	0.043421	(ROSES REGENCY TEACUP AND SAUCER)
68	0.033303	(SCOTTIE DOG HOT WATER BOTTLE)
69	0.056307	(SET OF 3 CAKE TINS PANTRY DESIGN)
70	0.032940	(SET OF 3 REGENCY CAKE TINS)
71	0.045372	(SET OF 4 PANTRY JELLY MOULDS)
72	0.034936	(SET OF 6 SPICE TINS PANTRY DESIGN)
73	0.038113	(SET/20 RED RETROSPOT PAPER NAPKINS)
74	0.037024	(SET/5 RED RETROSPOT LID GLASS BOWLS)
75	0.037024	(SET/3 KED KETKOSFOT EID GLASS BOWES) (SPACEBOY LUNCH BOX)
75 76	0.031806	(SPACEBOY LUNCH BOX) (SPOTTY BUNTING)
76 77	0.047232	(STRAWBERRY CHARLOTTE BAG)
77 78	0.045463	· · · · · · · · · · · · · · · · · · ·
78 79		(VICTORIAN GLASS HANGING T-LIGHT)
	0.039701	(VINTAGE SNAP CARDS)
80 01	0.098276	(WHITE HANGING HEART T-LIGHT HOLDER)
81	0.042740	(WOODEN FRAME ANTIQUE WHITE)

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82 0.048820 (WOODEN PICTURE FRAME WHITE FINISH)
83 0.030989 (WOODLAND CHARLOTTE BAG)
84 0.031806 (GREEN REGENCY TEACUP AND SAUCER, ROSES REGENC...
85 0.035617 (JUMBO BAG PINK POLKADOT, JUMBO BAG RED RETROS...
86 0.031670 (JUMBO BAG RED RETROSPOT, JUMBO STORAGE BAG SUKI)
```

[87 rows x 2 columns]

frequent_itemsets = apriori(basket_sets, min_support=0.02, use_colnames=True)
print (frequent_itemsets)

rules = association_rules(frequent_itemsets, metric="lift", min_threshold=1)
rules

antecedents		consequents	antecedent support	consequent support	suļ	
0	(GREEN REGENCY TEACUP AND SAUCER)	(ROSES REGENCY TEACUP AND SAUCER)	0.042377	0.043421	0.00	
1	(ROSES REGENCY TEACUP AND SAUCER)	(GREEN REGENCY TEACUP AND SAUCER)	0.043421	0.042377	0.00	
2	(JUMBO BAG PINK POLKADOT)	(JUMBO BAG RED RETROSPOT)	0.052586	0.087931	0.03	
3	(JUMBO BAG RED RETROSPOT)	(JUMBO BAG PINK POLKADOT)	0.087931	0.052586	0.00	
4	(JUMBO BAG RED RETROSPOT)	(JUMBO STORAGE BAG SUKI)	0.087931	0.051270	0.03	
5	(JUMBO STORAGE BAG SUKI)	(JUMBO BAG RED RETROSPOT)	0.051270	0.087931	0.03	



```
rules[ (rules['lift'] >= 0.6) & (rules['confidence'] >= 0.3) ]

(ONLE | NEOLINE | (NOOLO | NEOLINE | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424 | 0.043424
```

▼ Visualizing results

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1. Support vs Confidence

```
plt.scatter(rules['support'], rules['confidence'], alpha=0.5)
plt.xlabel('support')
plt.ylabel('confidence')
plt.title('Support vs Confidence')
plt.show()
```

