

```
In [1]: import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline

from mlxtend.frequent_patterns import apriori
from mlxtend.frequent_patterns import association_rules
```

```
In [2]: df = pd.read_csv('groceries.csv', sep='/', header=None, engine='python')
```

```
In [3]: df
```

```
Out[3]:
```

	0
0	citrus fruit,semi-finished bread,margarine,rea...
1	tropical fruit,yogurt,coffee
2	whole milk
3	pip fruit,yogurt,cream cheese,meat spreads
4	other vegetables,whole milk,condensed milk,lon...
...	...
9830	sausage,chicken,beef,hamburger meat,citrus fru...
9831	cooking chocolate
9832	chicken,citrus fruit,other vegetables,butter,y...
9833	semi-finished bread,bottled water,soda,bottled...
9834	chicken,tropical fruit,other vegetables,vinega...

9835 rows × 1 columns

```
In [4]: df = df[0].str.split('/', expand=True)
```

```
In [5]: df.head(10)
```

Out[5]:

	0	1	2	3	4	5	6	7	8	9	...
0	citrus fruit	semi-finished bread	margarine	ready soups	None	None	None	None	None	None	..
1	tropical fruit	yogurt	coffee	None	None	None	None	None	None	None	..
2	whole milk	None	None	None	None	None	None	None	None	None	..
3	pip fruit	yogurt	cream cheese	meat spreads	None	None	None	None	None	None	..
4	other vegetables	whole milk	condensed milk	long life bakery product	None	None	None	None	None	None	..
5	whole milk	butter	yogurt	rice	abrasive cleaner	None	None	None	None	None	..
6	rolls/buns	None	None	None	None	None	None	None	None	None	..
7	other vegetables	UHT-milk	rolls/buns	bottled beer	liquor (appetizer)	None	None	None	None	None	..
8	potted plants	None	None	None	None	None	None	None	None	None	..
9	whole milk	cereals	None	None	None	None	None	None	None	None	..

10 rows × 32 columns

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

```

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9835 entries, 0 to 9834
Data columns (total 32 columns):
 #   Column  Non-Null Count  Dtype
---  -
 0    0      9835 non-null   object
 1    1      7676 non-null   object
 2    2      6033 non-null   object
 3    3      4734 non-null   object
 4    4      3729 non-null   object
 5    5      2874 non-null   object
 6    6      2229 non-null   object
 7    7      1684 non-null   object
 8    8      1246 non-null   object
 9    9       896 non-null   object
10   10      650 non-null   object
11   11      468 non-null   object
12   12      351 non-null   object
13   13      273 non-null   object
14   14      196 non-null   object
15   15      141 non-null   object
16   16       95 non-null   object
17   17       66 non-null   object
18   18       52 non-null   object
19   19       38 non-null   object
20   20       29 non-null   object
21   21       18 non-null   object
22   22       14 non-null   object
23   23        8 non-null   object
24   24        7 non-null   object
25   25        7 non-null   object
26   26        6 non-null   object
27   27        5 non-null   object
28   28        4 non-null   object
29   29        1 non-null   object
30   30        1 non-null   object
31   31        1 non-null   object
dtypes: object(32)
memory usage: 2.4+ MB

```

```

In [7]: import numpy as np
        basket = np.array(df)
        basket

```

```

Out[7]: array([[ 'citrus fruit', 'semi-finished bread', 'margarine', ..., None,
                None, None],
               [ 'tropical fruit', 'yogurt', 'coffee', ..., None, None, None],
               [ 'whole milk', None, None, ..., None, None, None],
               ...,
               [ 'chicken', 'citrus fruit', 'other vegetables', ..., None, None,
                None],
               [ 'semi-finished bread', 'bottled water', 'soda', ..., None, None,
                None],
               [ 'chicken', 'tropical fruit', 'other vegetables', ..., None, None,
                None]], dtype=object)

```

```
In [8]: basket = [x for x in row if str(x)!='None'] for row in basket]
basket
```

```
Out[8]: [['citrus fruit', 'semi-finished bread', 'margarine', 'ready soups'],
          ['tropical fruit', 'yogurt', 'coffee'],
          ['whole milk'],
          ['pip fruit', 'yogurt', 'cream cheese', 'meat spreads'],
          ['other vegetables',
            'whole milk',
            'condensed milk',
            'long life bakery product'],
          ['whole milk', 'butter', 'yogurt', 'rice', 'abrasive cleaner'],
          ['rolls/buns'],
          ['other vegetables',
            'UHT-milk',
            'rolls/buns',
            'bottled beer',
            'liquor (appetizer)'],
          ['potted plants'],
          ['whole milk', 'cereals'],
          ['tropical fruit',
            'other vegetables',
            'white bread',
            'bottled water',
            'chocolate'],
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            'tropical fruit',
            'whole milk',
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            'curd',
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            'flour',
            'bottled water',
            'dishes'],
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          ['chicken', 'tropical fruit'],
          ['butter', 'sugar', 'fruit/vegetable juice', 'newspapers'],
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          ['packaged fruit/vegetables'],
          ['chocolate'],
          ['specialty bar'],
          ['other vegetables'],
          ['butter milk', 'pastry'],
          ['whole milk'],
          ['tropical fruit',
            'cream cheese',
            'processed cheese',
            'detergent',
            'newspapers'],
          ['tropical fruit',
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            'other vegetables',
            'frozen dessert',
            'rolls/buns',
            'flour',
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            'salty snack',
            'waffles'],
```

```
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['yogurt'],  
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['other vegetables'],  
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 'shopping bags'],  
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['hamburger meat',  
 'other vegetables',  
 'rolls/buns',  
 'spices',  
 'bottled water',  
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['pork',  
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```
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 'oil',  
 'soda',  
 'chocolate',  
 'newspapers'],  
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 'white bread',  
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'chocolate',
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'yogurt',
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['hygiene articles'],
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'newspapers'],
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'fruit/vegetable juice',
'rum'],
['other vegetables', 'whole milk', 'yogurt'],
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 'canned fish',
 'chocolate',
 'candy',
 'napkins'],
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```
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 'shopping bags'],  
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 'oil',  
 'soda',  
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 'frozen vegetables',  
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 'long life bakery product'],  
['pork',  
 'whole milk',  
 'curd',  
 'yogurt',
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```
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'baking powder',
'coffee',
'cocoa drinks',
'salty snack',
'waffles',
'candy',
'napkins'],
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'other vegetables',
'whole milk',
'curd',
'yogurt',
'whipped/sour cream',
'cream cheese',
'pastry',
'vinegar',
'oil',
'coffee',
'long life bakery product',
'detergent',
'cleaner',
'napkins',
'newspapers'],
['light bulbs'],
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['sausage',
'curd',
'frozen meals',
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'cake bar',
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'cleaner',
'house keeping products',
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'pip fruit',
'root vegetables',
'other vegetables',
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'butter',
'yogurt',
'whipped/sour cream',
'hard cheese',
'frozen vegetables',
'frozen fish',
'domestic eggs',
```

```

'white bread',
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'long life bakery product',
'softener',
'napkins',
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['pork',
'tropical fruit',
'other vegetables',
'yogurt',
'semi-finished bread',
'flour',
'margarine',
'artif. sweetener',
'organic products',
'chocolate marshmallow'],
...]

```

```

In [9]: from mlxtend.preprocessing import TransactionEncoder
te = TransactionEncoder()
te_arr = te.fit(basket).transform(basket).astype(int)
dt=pd.DataFrame(te_arr, columns=te.columns_)
dt

```

```

Out[9]:

```

	Instant food products	UHT- milk	abrasive cleaner	artif. sweetener	baby cosmetics	baby food	bags	baking powder	bathroom cleaner	b
0	0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	
...
9830	0	0	0	0	0	0	0	0	0	
9831	0	0	0	0	0	0	0	0	0	
9832	0	0	0	0	0	0	0	0	0	
9833	0	0	0	0	0	0	0	0	0	
9834	0	0	0	0	0	0	0	0	0	

9835 rows × 169 columns

In [10]: `#APRIORI`

```
In [11]: import time
Apriori_results = []
Apriori_execute_time = []
x=np.linspace(0.01,0.1,num=10)
x=np.round(x,2)
j=0
for i in (x):
    print("Minsup", i, ":")
    start_time = time.time()
    itemsets=apriori(dt.astype('bool'), min_support=i, use_colnames = True)
    end_time = time.time()
    Apriori_results.append(itemsets)
    Apriori_execute_time.append(end_time-start_time)
    print(Apriori_results[j])
    j=j+1
```

```

Minsup 0.01 :
      support      itemsets
0    0.033452      (UHT-milk)
1    0.017692      (baking powder)
2    0.052466      (beef)
3    0.033249      (berries)
4    0.026029      (beverages)
..    ...
328  0.011998      (root vegetables, whole milk, tropical fruit)
329  0.014540      (root vegetables, whole milk, yogurt)
330  0.010473      (whole milk, yogurt, soda)
331  0.015150      (whole milk, yogurt, tropical fruit)
332  0.010880      (whipped/sour cream, whole milk, yogurt)

```

[333 rows x 2 columns]

```

Minsup 0.02 :
      support      itemsets
0    0.033452      (UHT-milk)
1    0.052466      (beef)
2    0.033249      (berries)
3    0.026029      (beverages)
4    0.080529      (bottled beer)
..    ...
117  0.032232      (whipped/sour cream, whole milk)
118  0.020742      (whipped/sour cream, yogurt)
119  0.056024      (whole milk, yogurt)
120  0.023183      (other vegetables, root vegetables, whole milk)
121  0.022267      (other vegetables, whole milk, yogurt)

```

[122 rows x 2 columns]

```

Minsup 0.03 :
      support      itemsets
0    0.033452      (UHT-milk)
1    0.052466      (beef)
2    0.033249      (berries)
3    0.080529      (bottled beer)
4    0.110524      (bottled water)
..    ...
58   0.048907      (root vegetables, whole milk)
59   0.040061      (whole milk, soda)
60   0.042298      (whole milk, tropical fruit)
61   0.032232      (whipped/sour cream, whole milk)
62   0.056024      (whole milk, yogurt)

```

[63 rows x 2 columns]

```

Minsup 0.04 :
      support      itemsets
0    0.052466      (beef)
1    0.080529      (bottled beer)
2    0.110524      (bottled water)
3    0.064870      (brown bread)
4    0.055414      (butter)
5    0.077682      (canned beer)
6    0.042908      (chicken)
7    0.049619      (chocolate)
8    0.082766      (citrus fruit)

```

9	0.058058	(coffee)
10	0.053279	(curd)
11	0.063447	(domestic eggs)
12	0.058973	(frankfurter)
13	0.048094	(frozen vegetables)
14	0.072293	(fruit/vegetable juice)
15	0.058566	(margarine)
16	0.052364	(napkins)
17	0.079817	(newspapers)
18	0.193493	(other vegetables)
19	0.088968	(pastry)
20	0.075648	(pip fruit)
21	0.057651	(pork)
22	0.183935	(rolls/buns)
23	0.108998	(root vegetables)
24	0.093950	(sausage)
25	0.098526	(shopping bags)
26	0.174377	(soda)
27	0.104931	(tropical fruit)
28	0.071683	(whipped/sour cream)
29	0.042095	(white bread)
30	0.255516	(whole milk)
31	0.139502	(yogurt)
32	0.042603	(other vegetables, rolls/buns)
33	0.047382	(other vegetables, root vegetables)
34	0.074835	(other vegetables, whole milk)
35	0.043416	(other vegetables, yogurt)
36	0.056634	(whole milk, rolls/buns)
37	0.048907	(root vegetables, whole milk)
38	0.040061	(whole milk, soda)
39	0.042298	(whole milk, tropical fruit)
40	0.056024	(whole milk, yogurt)

Minsup 0.05 :

	support	itemsets
0	0.052466	(beef)
1	0.080529	(bottled beer)
2	0.110524	(bottled water)
3	0.064870	(brown bread)
4	0.055414	(butter)
5	0.077682	(canned beer)
6	0.082766	(citrus fruit)
7	0.058058	(coffee)
8	0.053279	(curd)
9	0.063447	(domestic eggs)
10	0.058973	(frankfurter)
11	0.072293	(fruit/vegetable juice)
12	0.058566	(margarine)
13	0.052364	(napkins)
14	0.079817	(newspapers)
15	0.193493	(other vegetables)
16	0.088968	(pastry)
17	0.075648	(pip fruit)
18	0.057651	(pork)
19	0.183935	(rolls/buns)
20	0.108998	(root vegetables)
21	0.093950	(sausage)


```

22 0.098526 (shopping bags)
23 0.174377 (soda)
24 0.104931 (tropical fruit)
25 0.071683 (whipped/sour cream)
26 0.255516 (whole milk)
27 0.139502 (yogurt)
28 0.074835 (other vegetables, whole milk)
29 0.056634 (whole milk, rolls/buns)
30 0.056024 (whole milk, yogurt)

```

Minsup 0.06 :

```

support itemsets
0 0.080529 (bottled beer)
1 0.110524 (bottled water)
2 0.064870 (brown bread)
3 0.077682 (canned beer)
4 0.082766 (citrus fruit)
5 0.063447 (domestic eggs)
6 0.072293 (fruit/vegetable juice)
7 0.079817 (newspapers)
8 0.193493 (other vegetables)
9 0.088968 (pastry)
10 0.075648 (pip fruit)
11 0.183935 (rolls/buns)
12 0.108998 (root vegetables)
13 0.093950 (sausage)
14 0.098526 (shopping bags)
15 0.174377 (soda)
16 0.104931 (tropical fruit)
17 0.071683 (whipped/sour cream)
18 0.255516 (whole milk)
19 0.139502 (yogurt)
20 0.074835 (other vegetables, whole milk)

```

Minsup 0.07 :

```

support itemsets
0 0.080529 (bottled beer)
1 0.110524 (bottled water)
2 0.077682 (canned beer)
3 0.082766 (citrus fruit)
4 0.072293 (fruit/vegetable juice)
5 0.079817 (newspapers)
6 0.193493 (other vegetables)
7 0.088968 (pastry)
8 0.075648 (pip fruit)
9 0.183935 (rolls/buns)
10 0.108998 (root vegetables)
11 0.093950 (sausage)
12 0.098526 (shopping bags)
13 0.174377 (soda)
14 0.104931 (tropical fruit)
15 0.071683 (whipped/sour cream)
16 0.255516 (whole milk)
17 0.139502 (yogurt)
18 0.074835 (other vegetables, whole milk)

```

Minsup 0.08 :

```

support itemsets
0 0.080529 (bottled beer)

```

```

1  0.110524      (bottled water)
2  0.082766      (citrus fruit)
3  0.193493      (other vegetables)
4  0.088968      (pastry)
5  0.183935      (rolls/buns)
6  0.108998      (root vegetables)
7  0.093950      (sausage)
8  0.098526      (shopping bags)
9  0.174377      (soda)
10 0.104931      (tropical fruit)
11 0.255516      (whole milk)
12 0.139502      (yogurt)

```

Minsup 0.09 :

```

      support      itemsets
0  0.110524      (bottled water)
1  0.193493      (other vegetables)
2  0.183935      (rolls/buns)
3  0.108998      (root vegetables)
4  0.093950      (sausage)
5  0.098526      (shopping bags)
6  0.174377      (soda)
7  0.104931      (tropical fruit)
8  0.255516      (whole milk)
9  0.139502      (yogurt)

```

Minsup 0.1 :

```

      support      itemsets
0  0.110524      (bottled water)
1  0.193493      (other vegetables)
2  0.183935      (rolls/buns)
3  0.108998      (root vegetables)
4  0.174377      (soda)
5  0.104931      (tropical fruit)
6  0.255516      (whole milk)
7  0.139502      (yogurt)

```

FP-Growth

```

In [12]: import time
from mlxtend.frequent_patterns import fpgrowth
fpgrowth_results = []
fpgrowth_execute_time = []
x=np.linspace(0.01,0.1,num=10)
x=np.round(x,2)
j=0
for i in (x):
    print("Minsup", i, ":")
    start_time = time.time()
    itemsets=fpgrowth(dt.astype('bool'), min_support=i, use_colnames = True)
    end_time = time.time()
    fpgrowth_results.append(itemsets)
    fpgrowth_execute_time.append(end_time-start_time)
    print(fpgrowth_results[j])
    j=j+1

```

```

Minsup 0.01 :
      support      itemsets
0    0.082766      (citrus fruit)
1    0.058566      (margarine)
2    0.017692      (semi-finished bread)
3    0.139502      (yogurt)
4    0.104931      (tropical fruit)
..    ...
328  0.010168      (frozen vegetables, rolls/buns)
329  0.012405      (frozen vegetables, yogurt)
330  0.014235      (onions, other vegetables)
331  0.012100      (onions, whole milk)
332  0.010778      (whole milk, sliced cheese)

```

[333 rows x 2 columns]

```

Minsup 0.02 :
      support      itemsets
0    0.082766      (citrus fruit)
1    0.058566      (margarine)
2    0.139502      (yogurt)
3    0.104931      (tropical fruit)
4    0.058058      (coffee)
..    ...
117  0.022166      (pork, whole milk)
118  0.021657      (pork, other vegetables)
119  0.029995      (whole milk, domestic eggs)
120  0.022267      (other vegetables, domestic eggs)
121  0.020437      (whole milk, frozen vegetables)

```

[122 rows x 2 columns]

```

Minsup 0.03 :
      support      itemsets
0    0.082766      (citrus fruit)
1    0.058566      (margarine)
2    0.139502      (yogurt)
3    0.104931      (tropical fruit)
4    0.058058      (coffee)
..    ...
58   0.033249      (pastry, whole milk)
59   0.047382      (other vegetables, root vegetables)
60   0.048907      (root vegetables, whole milk)
61   0.030605      (sausage, rolls/buns)
62   0.032232      (whipped/sour cream, whole milk)

```

[63 rows x 2 columns]

```

Minsup 0.04 :
      support      itemsets
0    0.082766      (citrus fruit)
1    0.058566      (margarine)
2    0.139502      (yogurt)
3    0.104931      (tropical fruit)
4    0.058058      (coffee)
5    0.255516      (whole milk)
6    0.075648      (pip fruit)
7    0.193493      (other vegetables)
8    0.055414      (butter)

```

9	0.183935	(rolls/buns)
10	0.080529	(bottled beer)
11	0.110524	(bottled water)
12	0.049619	(chocolate)
13	0.042095	(white bread)
14	0.053279	(curd)
15	0.052466	(beef)
16	0.174377	(soda)
17	0.058973	(frankfurter)
18	0.042908	(chicken)
19	0.079817	(newspapers)
20	0.072293	(fruit/vegetable juice)
21	0.088968	(pastry)
22	0.108998	(root vegetables)
23	0.077682	(canned beer)
24	0.093950	(sausage)
25	0.098526	(shopping bags)
26	0.064870	(brown bread)
27	0.052364	(napkins)
28	0.071683	(whipped/sour cream)
29	0.057651	(pork)
30	0.063447	(domestic eggs)
31	0.048094	(frozen vegetables)
32	0.056024	(whole milk, yogurt)
33	0.043416	(other vegetables, yogurt)
34	0.042298	(whole milk, tropical fruit)
35	0.074835	(other vegetables, whole milk)
36	0.042603	(other vegetables, rolls/buns)
37	0.056634	(whole milk, rolls/buns)
38	0.040061	(whole milk, soda)
39	0.047382	(other vegetables, root vegetables)
40	0.048907	(root vegetables, whole milk)

Minsup 0.05 :

	support	itemsets
0	0.082766	(citrus fruit)
1	0.058566	(margarine)
2	0.139502	(yogurt)
3	0.104931	(tropical fruit)
4	0.058058	(coffee)
5	0.255516	(whole milk)
6	0.075648	(pip fruit)
7	0.193493	(other vegetables)
8	0.055414	(butter)
9	0.183935	(rolls/buns)
10	0.080529	(bottled beer)
11	0.110524	(bottled water)
12	0.053279	(curd)
13	0.052466	(beef)
14	0.174377	(soda)
15	0.058973	(frankfurter)
16	0.079817	(newspapers)
17	0.072293	(fruit/vegetable juice)
18	0.088968	(pastry)
19	0.108998	(root vegetables)
20	0.077682	(canned beer)
21	0.093950	(sausage)

```

22 0.098526 (shopping bags)
23 0.064870 (brown bread)
24 0.052364 (napkins)
25 0.071683 (whipped/sour cream)
26 0.057651 (pork)
27 0.063447 (domestic eggs)
28 0.056024 (whole milk, yogurt)
29 0.074835 (other vegetables, whole milk)
30 0.056634 (whole milk, rolls/buns)

```

Minsup 0.06 :

```

support itemsets
0 0.082766 (citrus fruit)
1 0.139502 (yogurt)
2 0.104931 (tropical fruit)
3 0.255516 (whole milk)
4 0.075648 (pip fruit)
5 0.193493 (other vegetables)
6 0.183935 (rolls/buns)
7 0.080529 (bottled beer)
8 0.110524 (bottled water)
9 0.174377 (soda)
10 0.079817 (newspapers)
11 0.072293 (fruit/vegetable juice)
12 0.088968 (pastry)
13 0.108998 (root vegetables)
14 0.077682 (canned beer)
15 0.093950 (sausage)
16 0.098526 (shopping bags)
17 0.064870 (brown bread)
18 0.071683 (whipped/sour cream)
19 0.063447 (domestic eggs)
20 0.074835 (other vegetables, whole milk)

```

Minsup 0.07 :

```

support itemsets
0 0.082766 (citrus fruit)
1 0.139502 (yogurt)
2 0.104931 (tropical fruit)
3 0.255516 (whole milk)
4 0.075648 (pip fruit)
5 0.193493 (other vegetables)
6 0.183935 (rolls/buns)
7 0.080529 (bottled beer)
8 0.110524 (bottled water)
9 0.174377 (soda)
10 0.079817 (newspapers)
11 0.072293 (fruit/vegetable juice)
12 0.088968 (pastry)
13 0.108998 (root vegetables)
14 0.077682 (canned beer)
15 0.093950 (sausage)
16 0.098526 (shopping bags)
17 0.071683 (whipped/sour cream)
18 0.074835 (other vegetables, whole milk)

```

Minsup 0.08 :

```

support itemsets
0 0.082766 (citrus fruit)

```

```

1  0.139502      (yogurt)
2  0.104931      (tropical fruit)
3  0.255516      (whole milk)
4  0.193493      (other vegetables)
5  0.183935      (rolls/buns)
6  0.080529      (bottled beer)
7  0.110524      (bottled water)
8  0.174377      (soda)
9  0.088968      (pastry)
10 0.108998      (root vegetables)
11 0.093950      (sausage)
12 0.098526      (shopping bags)

```

Minsup 0.09 :

```

      support      itemsets
0  0.139502      (yogurt)
1  0.104931      (tropical fruit)
2  0.255516      (whole milk)
3  0.193493      (other vegetables)
4  0.183935      (rolls/buns)
5  0.110524      (bottled water)
6  0.174377      (soda)
7  0.108998      (root vegetables)
8  0.093950      (sausage)
9  0.098526      (shopping bags)

```

Minsup 0.1 :

```

      support      itemsets
0  0.139502      (yogurt)
1  0.104931      (tropical fruit)
2  0.255516      (whole milk)
3  0.193493      (other vegetables)
4  0.183935      (rolls/buns)
5  0.110524      (bottled water)
6  0.174377      (soda)
7  0.108998      (root vegetables)

```

```

In [13]: data = {'Execute time of Apriori': Apriori_execute_time, 'Execute time of FP-Growth
table = pd.DataFrame(data, x)
table

```

Out[13]:

	Execute time of Apriori	Execute time of FP-Growth
0.01	0.253453	0.157675
0.02	0.093306	0.166364
0.03	0.068671	0.128577
0.04	0.029670	0.110883
0.05	0.030472	0.083709
0.06	0.015720	0.060231
0.07	0.015636	0.135402
0.08	0.019755	0.049575
0.09	0.002484	0.037588
0.10	0.014019	0.056039

In [15]: *#Vẽ biểu đồ execute time*

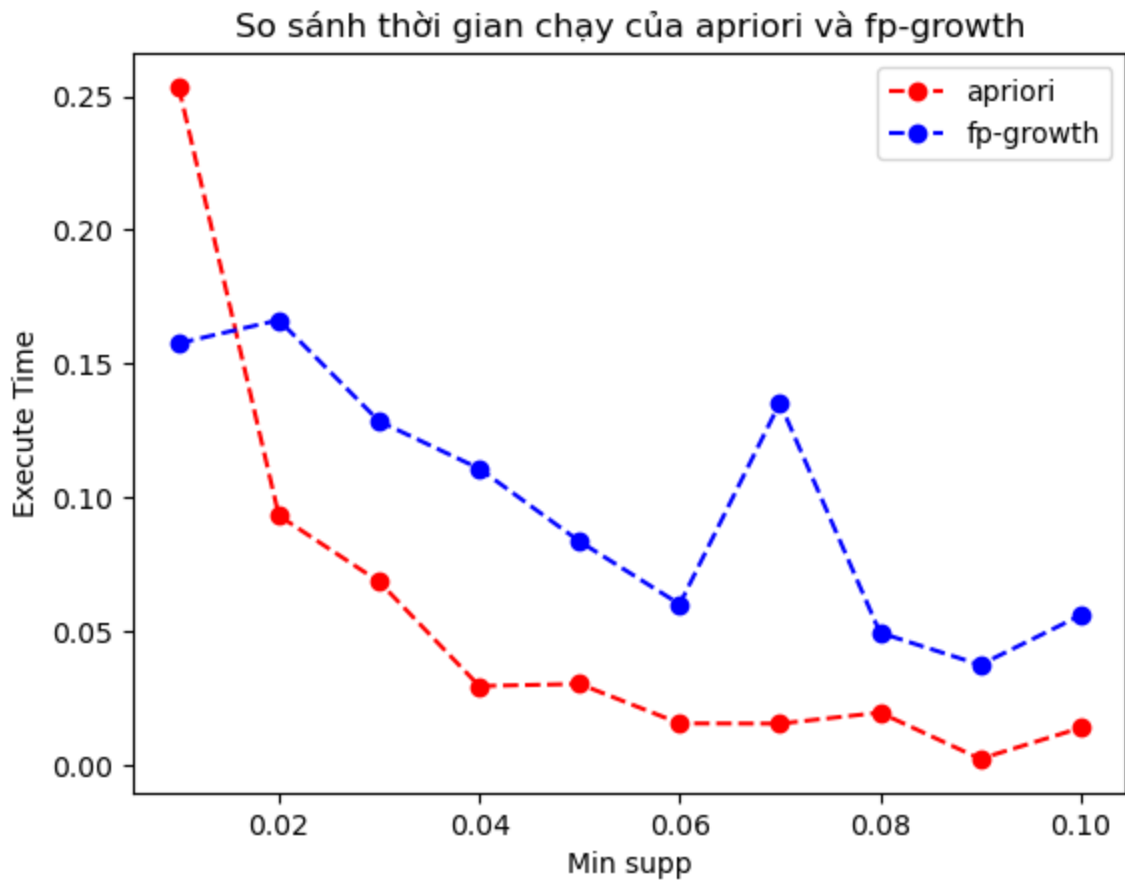
In [17]: `label=['0.01', '0.02', '0.03', '0.04', '0.05', '0.06', '0.07', '0.08', '0.09', '0.1']`

In [18]: `plt.figure(figsize=(15,7))`

Out[18]: <Figure size 1500x700 with 0 Axes>

<Figure size 1500x700 with 0 Axes>

In [21]: `plt.plot(x, Apriori_execute_time, color='r', marker='o', label='apriori', linestyle
plt.plot(x, fpgrowth_execute_time, color='b', marker='o', label='fp-growth', linest
plt.title('So sánh thời gian chạy của apriori và fp-growth')
plt.xlabel('Min supp')
plt.ylabel('Execute Time')
plt.legend()
plt.show()`



```
In [ ]: #Nhận xét
- Ban đầu khi Min_supp = 0.01 thì thuật toán FP-Growth tốn ít thời gian hơn so với
- Dần dần về sau khi Min_supp tăng dần lên thì thuật toán Apriori chạy nhanh hơn thu
#Giải thích
- Vì khi min_sup càng lớn thì sẽ giúp ta loại bớt những giá trị không thỏa yêu
```