

Programming Assignment 1 Deadline: 11/13

此次作業主要目的在讓同學學習運用 Python 由 Foodmart Database 超級市場的顧客及其交易資料中，探勘 Frequent Itemsets、Association Rules、Quantitative Association Rules。

1. 從 Foodmart Data 的交易資料中，探勘符合 Minimum Support = 0.00015 且 Minimum Confidence = 0.8 的 Association Rules, 並列出 Confidence 最高的前 10 條 Rules 以及 lift 最高的前 10 條, 並比較這兩者的異同。

```
已將 Top 10 Association Rules 寫入 CSV 檔案: C:/Users/rick/Desktop/DM資料探掘/pw1/top_10_association_rules_case2.csv
PS C:/Users/rick/Desktop/DM資料探掘/pw1> cd 'c:/Users/rick/Desktop/DM資料探掘/pw1'; & 'C:/Users/rick/AppData/Local/Programs/Python/Python311/python.exe' 'c:/Users/rick/.vscode/extensions/ms-python.python-2023.20.0/pythonFiles/lib/python/debugpy/adapters/.../debugpy/launcher' '58483' '--' 'c:/Users/rick/Desktop/DM資料探掘/pw1/case1.py'
Top 10 Confidence Rules (Sorted by Confidence):
  antecedents consequents antecedent support consequent support ... lift leverage conviction zhangs_metric
14 (708, 1534) (475) 0.000185 0.003117 ... 320.771186 0.000184 inf 0.997067
4 (1374, 775) (1168) 0.000159 0.003329 ... 300.404762 0.000158 inf 0.996829
6 (1298, 655) (212) 0.000159 0.003197 ... 312.818182 0.000158 inf 0.996961
7 (171, 991) (175) 0.000159 0.003725 ... 268.446809 0.000158 inf 0.996433
1 (1374, 958) (126) 0.000159 0.002959 ... 337.955357 0.000158 inf 0.997199
10 (1226, 1099) (477) 0.000159 0.003197 ... 312.818182 0.000158 inf 0.996961
13 (475, 1534) (708) 0.000211 0.002985 ... 293.094027 0.000184 7.976117 0.996799
0 (958, 126) (1374) 0.000185 0.003514 ... 243.937701 0.000158 6.975404 0.996085
11 (1226, 477) (1099) 0.000185 0.003223 ... 265.932084 0.000158 6.977438 0.996424
15 (920, 714) (244) 0.000185 0.002933 ... 292.285714 0.000158 6.979472 0.996763

[10 rows x 10 columns]
Top 10 Lift Rules (Sorted by Lift):
  antecedents consequents antecedent support consequent support ... lift leverage conviction zhangs_metric
1 (1374, 958) (126) 0.000159 0.002959 ... 337.955357 0.000158 inf 0.997199
14 (708, 1534) (475) 0.000185 0.003117 ... 320.771186 0.000184 inf 0.997067
6 (1298, 655) (212) 0.000159 0.003197 ... 312.818182 0.000158 inf 0.996961
10 (1226, 1099) (477) 0.000159 0.003197 ... 312.818182 0.000158 inf 0.996961
4 (1374, 775) (1168) 0.000159 0.003329 ... 300.404762 0.000158 inf 0.996829
13 (475, 1534) (708) 0.000211 0.002985 ... 293.094027 0.000184 7.976117 0.996799
15 (920, 714) (244) 0.000185 0.002933 ... 292.285714 0.000158 6.979472 0.996763
8 (175, 991) (171) 0.000185 0.003065 ... 279.687192 0.000158 6.978547 0.996609
7 (171, 991) (175) 0.000159 0.003725 ... 268.446809 0.000158 inf 0.996433
9 (171, 175) (991) 0.000185 0.003223 ... 265.932084 0.000158 6.977438 0.996424

[10 rows x 10 columns]
已將 Top 10 Confidence Rules 寫入 CSV 檔案: C:/Users/rick/Desktop/DM資料探掘/pw1/top_10_confidence_rules_case1.csv
已將 Top 10 Lift Rules 寫入 CSV 檔案: C:/Users/rick/Desktop/DM資料探掘/pw1/top_10_lift_rules_case1.csv
PS C:/Users/rick/Desktop/DM資料探掘/pw1>
```

Top 10 Confidence Rules

	A	B	C	D	E	F	G	H	I	J
1	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
2	frozenset({708, 1534})	frozenset({475})	0.000184936	0.003117487	0.000184936	1	320.7711864	0.000184359	inf	0.997066906
3	frozenset({1374, 775})	frozenset({1168})	0.000158516	0.003328842	0.000158516	1	300.4047619	0.000157989	inf	0.996829172
4	frozenset({1298, 655})	frozenset({212})	0.000158516	0.003196745	0.000158516	1	312.8181818	0.00015801	inf	0.996961289
5	frozenset({171, 991})	frozenset({175})	0.000158516	0.003725133	0.000158516	1	268.4468085	0.000157926	inf	0.996432818
6	frozenset({1374, 958})	frozenset({126})	0.000158516	0.002958971	0.000158516	1	337.9553571	0.000158047	inf	0.997199102
7	frozenset({1226, 1099})	frozenset({477})	0.000158516	0.003196745	0.000158516	1	312.8181818	0.00015801	inf	0.996961289
8	frozenset({475, 1534})	frozenset({708})	0.000211355	0.00298539	0.000184936	0.875	293.0940265	0.000184305	7.976116879	0.996798804
9	frozenset({958, 126})	frozenset({1374})	0.000184936	0.003513778	0.000158516	0.857142857	243.9377014	0.000157866	6.975403556	0.996084804
10	frozenset({1226, 477})	frozenset({1099})	0.000184936	0.003223165	0.000158516	0.857142857	265.9320843	0.00015792	6.977437848	0.996423916
11	frozenset({920, 714})	frozenset({244})	0.000184936	0.002932551	0.000158516	0.857142857	292.2857143	0.000157974	6.979472141	0.996763027

Top 10 Lift Rules

	A	B	C	D	E	F	G	H	I	J
1	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
2	frozenset({1374, 958})	frozenset({126})	0.000158516	0.002958971	0.000158516	1	337.9553571	0.000158047	inf	0.997199102
3	frozenset({708, 1534})	frozenset({475})	0.000184936	0.003117487	0.000184936	1	320.7711864	0.000184359	inf	0.997066906
4	frozenset({1298, 655})	frozenset({212})	0.000158516	0.003196745	0.000158516	1	312.8181818	0.00015801	inf	0.996961289
5	frozenset({1226, 1099})	frozenset({477})	0.000158516	0.003196745	0.000158516	1	312.8181818	0.00015801	inf	0.996961289
6	frozenset({1374, 775})	frozenset({1168})	0.000158516	0.003328842	0.000158516	1	300.4047619	0.000157989	inf	0.996829172
7	frozenset({475, 1534})	frozenset({708})	0.000211355	0.00298539	0.000184936	0.875	293.0940265	0.000184305	7.976116879	0.996798804
8	frozenset({920, 714})	frozenset({244})	0.000184936	0.002932551	0.000158516	0.857142857	292.2857143	0.000157974	6.979472141	0.996763027
9	frozenset({175, 991})	frozenset({171})	0.000184936	0.003064648	0.000158516	0.857142857	279.6871921	0.00015795	6.978547462	0.996608886
10	frozenset({171, 991})	frozenset({175})	0.000158516	0.003725133	0.000158516	1	268.4468085	0.000157926	inf	0.996432818
11	frozenset({171, 175})	frozenset({991})	0.000184936	0.003223165	0.000158516	0.857142857	265.9320843	0.00015792	6.977437848	0.996423916

Confidence最高的Rules告訴我們當某些項目（前項**antecedents**）出現時，另一些項目（後項**consequents**）出現的可能性有多高，而**Lift**最高的Rules則告訴我們這些項目（前項和後項）之間的關係有多強。兩組Rules的前後項有些相似，但排序不同。

Confidence 最高的前 10 條：	Lift 最高的前 10 條：
(708, 1534) => (475)	(1374, 958) => (126)
(1374, 775) => (1168)	(708, 1534) => (475)
(1298, 655) => (212)	(1298, 655) => (212)
(171, 991) => (175)	(1226, 1099) => (477)
(1374, 958) => (126)	(1374, 775) => (1168)
(1226, 1099) => (477)	(475, 1534) => (708)
(475, 1534) => (708)	(920, 714) => (244)
(958, 126) => (1374)	(175, 991) => (171)
(1226, 477) => (1099)	(171, 991) => (175)
(920, 714) => (244)	(171, 175) => (991)

Confidence和**Lift**都是評估項目之間關係的指標，但它們的計算方式不同。

Confidence是規則的信心度，表示在前項出現的情況下，後項出現的可能性有多高。

Lift是規則的提升度，表示前項和後項之間的相關性有多強，相對於它們在不同條件下的隨機出現機率，即規則的信心度與結論出現機率的比值。

這兩組**Rules**可能有不同的排序方式，但都提供了關於項目之間關聯性的有用訊息。

- 有時候我們有興趣的資料不只有產品間的資訊，也會想要由 User Profile 探勘顧客的基本資料。在給定 Minimum Support = 0.05 且 Minimum Confidence = 0.9 的條件下，探勘 Foodmart 顧客基本資料的屬性 {customer_state_province, yearly_income, gender, total_children, num_children_at_home, education, occupation, homeowner} 間的 Association Rules, 並列出10條。


```
bugpy\launcher' '58533' '--' 'c:\Users\rick\Desktop\DM資料採掘\pw1\case2.py'
Top 10 Association Rules:
    antecedents      consequents      antecedent support    ...    leverage    conviction    zhangs_metric
21    ($10K - $30K, Manual, 0)    (Partial High School)    0.067017    ...    0.044806    22.935711    0.739130
22    (Y, Manual, $10K - $30K)    (Partial High School)    0.061959    ...    0.041367    22.264950    0.734831
23    ($10K - $30K, Manual, F)    (Partial High School)    0.051746    ...    0.034520    21.876357    0.726728
20    ($10K - $30K, Manual)    (Partial High School)    0.105145    ...    0.069806    19.886318    0.768943
10    (Skilled Manual, Y, $10K - $30K)    (Partial High School)    0.057679    ...    0.038278    19.740024    0.730121
24    ($10K - $30K, Manual, M)    (Partial High School)    0.053399    ...    0.035287    18.275335    0.725847
11    (Skilled Manual, $10K - $30K, 0)    (Partial High School)    0.062737    ...    0.041328    17.341979    0.732362
9    (Skilled Manual, $10K - $30K)    (Partial High School)    0.103297    ...    0.068028    17.265070    0.765423
2    (Professional, $50K - $70K)    (Bachelors Degree)    0.101936    ...    0.071008    15.314326    0.815339
15    (0, Y, $10K - $30K)    (Partial High School)    0.062445    ...    0.040248    12.822694    0.727108

[10 rows x 10 columns]
已將 Top 10 Association Rules 寫入 CSV 檔案: C:/Users/rick/Desktop/DM資料採掘/pw1/top_10_association_rules_case2.csv
第 37 行, 第 119 欄 (已選取 65) 空格: 4 UTF-8 CRLF Python 3.11.6 64-bit
```

Top 10 Association Rules

	A	B	C	D	E	F	G	H	I	J
1	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
2	frozenset({'\$10K - \$30K', 'Manual', 'Y'})	frozenset({'Partial High School'})	0.067016827	0.300943488	0.064974224	0.969521045	3.221604998	0.044805947	22.93571128	0.739129851
3	frozenset({'Y', 'Manual', '\$10K - \$30K'})	frozenset({'Partial High School'})	0.061958953	0.300943488	0.060013617	0.968602826	3.218553863	0.041367474	22.26494991	0.734830803
4	frozenset({'\$10K - \$30K', 'Manual', 'F'})	frozenset({'Partial High School'})	0.051745939	0.300943488	0.050092403	0.968045113	3.216700648	0.0345198	21.87635673	0.72672766
5	frozenset({'\$10K - \$30K', 'Manual'})	frozenset({'Partial High School'})	0.105145414	0.300943488	0.101449275	0.964847364	3.206074901	0.069806448	19.88631814	0.768942953
6	frozenset({'Skilled Manual', 'Y', '\$10K - \$30K'})	frozenset({'Partial High School'})	0.057679214	0.300943488	0.055636611	0.964586847	3.205209234	0.038278427	19.74002436	0.730120674
7	frozenset({'\$10K - \$30K', 'Manual', 'M'})	frozenset({'Partial High School'})	0.053399475	0.300943488	0.051356872	0.961748634	3.195778185	0.035286648	18.27533453	0.725847018
8	frozenset({'Skilled Manual', '\$10K - \$30K', 'Y'})	frozenset({'Partial High School'})	0.062737088	0.300943488	0.060208151	0.959689922	3.188937328	0.041327833	17.34197886	0.732362184
9	frozenset({'Skilled Manual', '\$10K - \$30K'})	frozenset({'Partial High School'})	0.103297345	0.300943488	0.099114872	0.959510358	3.188340656	0.068028209	17.26507013	0.765423437
10	frozenset({'Professional', '\$50K - \$70K'})	frozenset({'Bachelors Degree'})	0.101935609	0.254741757	0.096975002	0.951335878	3.734510943	0.071007746	15.31432626	0.815339444
11	frozenset({'Y', 'Y', '\$10K - \$30K'})	frozenset({'Partial High School'})	0.062445287	0.300943488	0.059040949	0.945482866	3.141728942	0.040248447	12.82269373	0.727108416

3. 請探勘 Foodmart Data 中，顧客背景資料與其交易資料之間的關係 (Quantitative Association Rules)。例如 80% 女性顧客常買保養品。請自行設定 Minimum Support、Minimum Confidence，找出 10 條你覺得有意義的 Rules。請說明你的作法及相關參數設定。

`selected_columns = ['gender', 'yearly_income', 'product_brand']` (選擇一)

`min_support = 0.000025`、`min_confidence = 0.8`

```
PS C:\Users\rick\Desktop\DM資料採掘\pw1> c;; cd 'c:\Users\rick\Desktop\DM資料採掘\pw1'; & 'C:\Users\rick\AppData\Local\Programs\Python\Python311\python.exe' 'c:\Users\rick\.vscode\extensions\ms-python.python-2023.20.0\pythonFiles\lib\python\debugpy\adapter\..\..\debugpy\launcher' '62115' '--' 'c:\Users\rick\Desktop\DM資料採掘\pw1\case3.1.py'
Top 10 Association Rules:
    antecedents      consequents      antecedent support    consequent support    support    confidence    lift    leverage    conviction    zhangs_metric
4    (Gerolli, $110K - $130K)    (M)    0.000066    0.489564    0.000060    0.916667    1.872413    0.000028    6.125228    0.465960
13    ($90K - $110K, Ship Shape)    (M)    0.000060    0.489564    0.000055    0.909091    1.856938    0.000025    5.614792    0.461507
7    (Radius, $110K - $130K)    (M)    0.000098    0.489564    0.000087    0.888889    1.815673    0.000039    4.593921    0.449284
5    ($130K - $150K, Prelude)    (M)    0.000044    0.489564    0.000038    0.875000    1.787303    0.000017    4.083485    0.440517
2    (Genteel, $110K - $130K)    (M)    0.000038    0.489564    0.000033    0.857143    1.750828    0.000014    3.573049    0.428858
6    ($150K +, Tip Top)    (M)    0.000038    0.489564    0.000033    0.857143    1.750828    0.000014    3.573049    0.428858
12    (Kiwi, $110K - $130K)    (M)    0.000038    0.489564    0.000033    0.857143    1.750828    0.000014    3.573049    0.428858
9    (Swell, $110K - $130K)    (M)    0.000033    0.489564    0.000027    0.833333    1.702194    0.000011    3.062614    0.412536
10    (Green Ribbon, $130K - $150K)    (F)    0.000033    0.510436    0.000027    0.833333    1.632592    0.000011    2.937386    0.387490
0    ($150K +, Jumbo)    (M)    0.000060    0.489564    0.000049    0.818182    1.671245    0.000020    2.807396    0.401668

已將 Top 10 Association Rules 寫入 CSV 檔案: C:/Users/rick/Desktop/DM資料採掘/pw1/top_10_association_rules_case3.csv
PS C:\Users\rick\Desktop\DM資料採掘\pw1>
```

1.在收入\$110K-\$130K的男性有91.6%的機率會購買Gerolli(漢堡)

Gerolli Seasoned Hamburger 1.34元

Gerolli Extra Lean Hamburger 3.38元

2.在收入\$90K-\$110K的男性有90.9%的機率會購買Ship Shape(漢堡)

Ship Shape Seasoned Hamburger 1.75元

Ship Shape Extra Lean Hamburger 2.97元

3.在收入\$110K-\$130K的男性有81.8%的機率會購買Radius(穀物)

Radius Oatmeal麥片 2.53元

Radius Corn Puffs玉米澱粉 1.38元

Radius Wheat Puffs小麥粉 2.64元

Radius Grits粗玉米澱粉 0.86元

4.在收入\$130K-\$150K的男性有87.5%的機率會購買Prelude(太陽眼鏡)

Prelude Rosy Sunglasses 2.3元

5.在收入\$110K-\$130K的男性有85.7%的機率會購買Genteel(漢堡)

Genteel Seasoned Hamburger 1.15元

Genteel Extra Lean Hamburger 1.9元

6.在收入\$150K以上的男性有85.7%的機率會購買Tip Top(海鮮)

Tip Top Lox燻鮭魚0.37元

Tip Top Scallops扇貝3.6元

7.在收入\$110K-\$130K的男性有85.7%的機率會購買Kiwi(海鮮)

Kiwi Lox燻鮭魚2.25元

Kiwi Scallops扇貝2.38元

8.在收入\$110K-\$130K的男性有83.3%的機率會購買Swell(水果罐頭)

Swell Canned Mixed Fruit 2.34元

Swell Canned Peaches 1.63元

9.在收入\$130K-\$150K的女性有83.3%的機率會購買Green Ribbon(水果罐頭)

Green Ribbon Canned Mixed Fruit 1.31元

Green Ribbon Canned Peaches 3.11元

10.在收入\$150K以上的男性有81.8%的機率會購買Jumbo(蛋)

Jumbo Small Brown Eggs 1.42元

Jumbo Large Brown Eggs 2.68元

Jumbo Small Eggs 0.75元

Jumbo Large Eggs 3.84元

Jumbo Egg Substitute 2.97元

由上述可推測：

收入\$90K-\$110K的男性很大的機率會購買Ship Shape漢堡

收入提升到\$110K-\$130K的男性，購買健康的穀物、海鮮、水果罐頭的機率較高

當收入\$150K以上的男性購買Prelude太陽眼鏡、Jumbo蛋的機率較高

可以推測收入提升後，生活品質的提升

再來跟改selected_columns = ['gender','customer_country','product_brand'] (選擇二)

min_support = 0.000025、min_confidence = 0.8

```
c:\Users\rick\.vscode\extensions\ms-python.python-2023.20.0\pythonFiles\lib\python\debugpy\adapter\..\..\debugpy\launcher '62323' '--' 'c:\Users\rick\Desktop\DM資料採掘\pw1\case3.1.py'
Top 10 Association Rules:
antecedents consequents antecedent support consequent support support confidence lift leverage conviction zhangs_metric
569 (Canada, Prelude) (F) 0.000038 0.510436 0.000033 0.857143 1.679238 0.000013 3.426951 0.404507
672 (Canada, ADJ) (M) 0.000066 0.489564 0.000049 0.750000 1.531974 0.000017 2.041743 0.347270
410 (Canada, Gerolli) (F) 0.000137 0.510436 0.000098 0.720000 1.410560 0.000029 1.748444 0.291101
40 (Canada, Gauss) (M) 0.000246 0.489564 0.000170 0.688889 1.407147 0.000049 1.640686 0.289413
647 (Canada, Curlew) (M) 0.000087 0.489564 0.000060 0.687500 1.404310 0.000017 1.633394 0.287932
549 (Tip Top, Canada) (F) 0.000104 0.510436 0.000071 0.684211 1.340444 0.000018 1.550287 0.254005
591 (Canada, Toretti) (M) 0.000066 0.489564 0.000044 0.666667 1.361755 0.000012 1.531307 0.265671
417 (Canada, King) (M) 0.000049 0.489564 0.000033 0.666667 1.361755 0.000009 1.531307 0.265667
360 (Canada, James Bay) (M) 0.000142 0.489564 0.000093 0.653846 1.335567 0.000023 1.474592 0.251290
192 (Mexico, Genteel) (F) 0.000574 0.510436 0.000372 0.647619 1.268758 0.000079 1.389304 0.211949
已將 Top 10 Association Rules 寫入 CSV 檔案: C:\Users\rick\Desktop\DM資料採掘\pw1\top_10_association_rules_case3_2.csv
PS C:\Users\rick\Desktop\DM資料採掘\pw1>
```

11.加拿大籍的女性有85.7%的機率會購買Prelude(太陽眼鏡)

12.加拿大籍的男性有75%的機率會購買ADJ(太陽眼鏡)

可以推測同為加拿大籍，女性偏好購買Prelude品牌的太陽眼鏡、男性則是ADJ品牌

13.加拿大籍的女性有72%的機率會購買Gerolli(漢堡)

14.加拿大籍的男性有68.8%的機率會購買Gauss(雜誌)

15.加拿大籍的男性有68.7%的機率會購買Curlew(海鮮)

16.加拿大籍的女性有68.4%的機率會購買Tip Top(海鮮)

可以推測同為加拿大籍，男性偏好購買Curlew的海鮮、女性則是Tip Top的海鮮

17.加拿大籍的男性有66.6%的機率會購買Toretti(太陽眼鏡)

18.加拿大籍的男性有66.6%的機率會購買King(太陽眼鏡)

可以推測加拿大籍的男性很大的機率喜歡購買太陽眼鏡，如ADJ、Toretti、King品牌

19.加拿大籍的男性有65.3%的機率會購買James Bay(五金行：眼鏡螺絲起子、地圖)

20.墨西哥籍的男性有64.7%的機率會購買Genteel(漢堡)

那我們結合(選擇一)'gender', 'yearly_income', 'product_brand'以及(選擇二)'customer_country'

可以推測有55.44%的機率是墨西哥籍男性收入是在\$110K-130K並且喜歡購買Genteel漢堡

4. 在美國由於聖誕節，12月是購物的旺季。請探勘分析比較 12 月與 1 ~ 11 月的顧客購物行為。有哪些相似的地方，有哪些差異的地方？

PS C:\Users\rick\Desktop\DM資料探掘\pw1> c:; cd 'c:\Users\rick\Desktop\DM資料探掘\pw1'; & 'C:\Users\rick\AppData\Local\Programs\Python\Python311\python.exe' 'c:\Users\rick\.vscode\extensions\ms-python.python-2023.20.0\pythonFiles\lib\python\debuggy\adapter' /.../debugpy/launcher '62029' '--' 'c:\Users\rick\Desktop\DM資料探掘\pw1\case4.py'										
December Frequent Rules:										
		antecedents	consequents	...	conviction	zhangs_metric				
0		(['Blue Label', 'Horatio'])	(1998-12-25 00:00:00)	...	inf	0.970627				
1		(['Landslide', 'Tri-State', 'Hermanos'])	(1998-12-04 00:00:00)	...	inf	0.962953				
2		(['Tell Tale', 'Colossal'])	(1998-12-09 00:00:00)	...	inf	0.955808				
3		(['Club', 'Denny', 'Landslide', 'Plato', 'Plea...	(1998-12-21 00:00:00)	...	inf	0.987298				
4		(['Nationaleel', 'Fort West'])	(1998-12-04 00:00:00)	...	inf	0.963208				
5		(['Golden', 'Super', 'Landslide', 'Cormorant'])	(1998-12-07 00:00:00)	...	inf	0.926965				
6		(['Just Right', 'CDR'])	(1998-12-23 00:00:00)	...	inf	0.931463				
7		(['Just Right', 'Fort West'])	(1998-12-09 00:00:00)	...	inf	0.955808				
8		(['Red Wing', 'Tell Tale', 'Cormorant', 'Carri...	(1998-12-11 00:00:00)	...	inf	0.949458				
9		(['Big Time', 'Sphinx', 'Plato', 'Carrington'])	(1998-12-17 00:00:00)	...	inf	0.945753				
10		(['Carlson', 'Tell Tale', 'Horatio', 'Sunset',...	(1998-12-18 00:00:00)	...	inf	0.989944				
11		(['Consolidated', 'Cormorant', 'Plato'])	(1998-12-19 00:00:00)	...	inf	0.960307				
12		(['Denny', 'Big Time'])	(1998-12-08 00:00:00)	...	inf	0.934374				
	A	B	C	D	E	F	G	H	I	J
1	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
2	frozenset({'Blue Label', 'Horatio'})	frozenset({'1998-12-25 00:00:00'})	0.000528961	0.029886273	0.000528961	1	33.46017699	0.000513152	inf	0.97062715
3	frozenset({'Landslide', 'Tri-State', 'Hermanos'})	frozenset({'1998-12-04 00:00:00'})	0.000528961	0.037556202	0.000528961	1	26.62676056	0.000509095	inf	0.962953162
4	frozenset({'Tell Tale', 'Colossal'})	frozenset({'1998-12-09 00:00:00'})	0.000528961	0.04469717	0.000528961	1	22.37278107	0.000505318	inf	0.955808415
5	frozenset({'Club', 'Denny', 'Landslide', 'Plato', 'Pleasant', 'Sunset'})	frozenset({'1998-12-21 00:00:00'})	0.000528961	0.013224015	0.000528961	1	75.62	0.000521966	inf	0.987298227
6	frozenset({'Nationaleel', 'Fort West'})	frozenset({'1998-12-04 00:00:00'})	0.000793441	0.037556202	0.000793441	1	26.62676056	0.000763642	inf	0.963208047
7	frozenset({'Golden', 'Super', 'Landslide', 'Cormorant'})	frozenset({'1998-12-07 00:00:00'})	0.000528961	0.073525522	0.000528961	1	13.60071942	0.000490068	inf	0.926964806
8	frozenset({'Just Right', 'CDR'})	frozenset({'1998-12-23 00:00:00'})	0.000528961	0.069029357	0.000528961	1	14.48659004	0.000492447	inf	0.93146335
9	frozenset({'Just Right', 'Fort West'})	frozenset({'1998-12-09 00:00:00'})	0.000528961	0.04469717	0.000528961	1	22.37278107	0.000505318	inf	0.955808415
10	frozenset({'Red Wing', 'Tell Tale', 'Cormorant', 'Carrington', 'Hilltop'})	frozenset({'1998-12-11 00:00:00'})	0.000528961	0.051044697	0.000528961	1	19.59067358	0.00050196	inf	0.949457528
11	frozenset({'Big Time', 'Sphinx', 'Plato', 'Carrington'})	frozenset({'1998-12-17 00:00:00'})	0.000528961	0.054747421	0.000528961	1	18.26570048	0.000500001	inf	0.945752845
12	frozenset({'Carlson', 'Tell Tale', 'Horatio', 'Sunset', 'Fort West'})	frozenset({'1998-12-18 00:00:00'})	0.000528961	0.010579212	0.000528961	1	94.525	0.000523965	inf	0.98994443
13	frozenset({'Consolidated', 'Cormorant', 'Plato'})	frozenset({'1998-12-19 00:00:00'})	0.000528961	0.040201005	0.000528961	1	24.875	0.000507696	inf	0.96030696
14	frozenset({'Denny', 'Big Time'})	frozenset({'1998-12-08 00:00:00'})	0.000528961	0.066120074	0.000528961	1	15.124	0.000493986	inf	0.934374173
	A	B	C	D	E	F	G	H	I	J
1	antecedents	consequents	antecedent support	consequent support	support	confidence	lift	leverage	conviction	zhangs_metric
2	frozenset({'BBB Best White Sugar'})	frozenset({'1998-12-08 00:00:00'})	0.00053	0.06612	0.00053	1	15.124	0.00049	inf	0.93437
3	frozenset({'Club Butter', 'Denny Scented Toilet Tissue', 'Landslide Hot Chocolate', 'Plato Apple Butter', 'Pleasant Creamed Corn', 'Sunset Plastic Forks'})	frozenset({'1998-12-21 00:00:00'})	0.00053	0.01322	0.00053	1	75.62	0.00052	inf	0.9873
4	frozenset({'Nationaleel Avocado Dip'})	frozenset({'1998-12-12 00:00:00'})	0.00053	0.04681	0.00053	1	21.3616	0.0005	inf	0.95369

由12月份的資料可推測，Plato(烘焙坊)、Fort West(零食)、Cormorant(餐具)為當月購買機率最大的品牌，其中Plato它家的Apple Butter為必買商品。

	A	B	C	D	E	F	G	H	I	J
1	antecedents	consequents	antecedent	consequent	support	confidence	lift	leverage	conviction	zhangs_me
2	frozenset({'High Top', 'Tell Tale', 'Hermanos', 'Red Wing'})	frozenset({'Tri-State'})	0.06774	0.351099	0.054959	0.811321	2.310802	0.031176	3.439174	0.608468
3	frozenset({'High Top', 'Tell Tale', 'Tri-State', 'Red Wing'})	frozenset({'Hermanos'})	0.067996	0.358512	0.054959	0.808271	2.254513	0.030582	3.345799	0.597042
4	frozenset({'Ebony', 'Tell Tale', 'Tri-State', 'Red Wing'})	frozenset({'Hermanos'})	0.071191	0.358512	0.057643	0.809695	2.258486	0.03212	3.370836	0.599936
5	frozenset({'Ebony', 'Tell Tale', 'Hermanos', 'Red Wing'})	frozenset({'Tri-State'})	0.070808	0.351099	0.057643	0.814079	2.318659	0.032783	3.490204	0.612055
6	frozenset({'Hermanos', 'Tell Tale', 'Tri-State', 'Red Wing'})	frozenset({'Ebony'})	0.071958	0.342664	0.057643	0.801066	2.337761	0.032986	3.304289	0.616661
7	frozenset({'High Top', 'Ebony', 'Tri-State', 'Red Wing'})	frozenset({'Hermanos'})	0.071575	0.358512	0.05726	0.8	2.231444	0.031599	3.207439	0.594404
8	frozenset({'High Top', 'Ebony', 'Hermanos', 'Red Wing'})	frozenset({'Tri-State'})	0.069402	0.351099	0.05726	0.825046	2.349895	0.032893	3.70898	0.61729
9	frozenset({'High Top', 'Ebony', 'Tell Tale', 'Red Wing'})	frozenset({'Hermanos'})	0.066846	0.358512	0.054703	0.818356	2.282643	0.030739	3.531559	0.602163
10	frozenset({'High Top', 'Tell Tale', 'Hermanos', 'Red Wing'})	frozenset({'Ebony'})	0.06774	0.342664	0.054703	0.807547	2.356676	0.031491	3.415571	0.617503
11	frozenset({'High Top', 'Ebony', 'Tell Tale', 'Red Wing'})	frozenset({'Tri-State'})	0.066846	0.351099	0.054448	0.814532	2.319947	0.030978	3.498713	0.609712
12	frozenset({'High Top', 'Tell Tale', 'Tri-State', 'Red Wing'})	frozenset({'Ebony'})	0.067996	0.342664	0.054448	0.800752	2.336845	0.031148	3.299085	0.613809
13	frozenset({'High Top', 'Horatio', 'Hermanos', 'Red Wing'})	frozenset({'Tri-State'})	0.065951	0.351099	0.05317	0.806202	2.296222	0.030014	3.348328	0.60436
14	frozenset({'High Top', 'Horatio', 'Tri-State', 'Red Wing'})	frozenset({'Hermanos'})	0.066207	0.358512	0.05317	0.803089	2.240059	0.029434	3.257751	0.592833
15	frozenset({'Horatio', 'Tell Tale', 'Tri-State', 'Red Wing'})	frozenset({'Hermanos'})	0.065056	0.358512	0.052658	0.80943	2.257748	0.029335	3.366157	0.595844

- 1.購買High Top、Tell Tale、Hermanos、Reg Wing的產品，有很大的機率會一同購買Tri-State的商品
- 2.購買High Top、Tell Tale、Tri-State、Reg Wing的產品，有很大的機率會一同購買Hermanos的商品
- 3.購買Ebony、Tell Tale、Tri-State、Reg Wing的產品，有很大的機率會一同購買Hermanos的商品
- 4.購買Ebony、Tell Tale、Hermanos、Reg Wing的產品，有很大的機率會一同購買Tri-State的商品
5. 購買High Top、Horatio、Hermanos、Reg Wing的產品，有很大的機率會一同購買Ebony的商品

可以推測1月到11月最常購買的商品是這五個品牌High Top、Tell Tale、Reg Wing、Tri-State、Hermanos，再來是Ebony品牌，接下來是Horatio品牌。而這幾個品牌分別是High Top食材店、Tell Tale食材店、Reg Wing器具行、Tri-State食材店、Hermanos食材店、Ebony食材店、Horatio零食店。

可以得知1月到11月平時主要都是去購買日常食材、器具，再來才是零食。而12月購物的旺季，反而是買些果醬、零食、餐具為主。

相似的地方是，美國人真的很喜歡吃零食，雖然日常所需為優先，但很大的機率是會購買零食。而到了12月開始買糖、巧克力、果醬、奶油等等，或許是為了聖誕節的到來而準備，做些甜點、塔派，然後放縱吃零食，還需要增添餐具去擺放、使用食物。