

**Some sample screenshots on how my program was run on my machine and showing the results that I got from my machine, and how the results match with the graphs/tables that are included in the paper**

### **Product Bundling at a Time-based Sales Promotion Recommendation System**

By considering the purchase behavior of these three customer clusters, we determine the segments of the product bundling in this market. Based on association rules and diagrams, we use useful information to find out a preference ranking of product bundling in these three clusters (Table 3-5).

#### (1) Product bundling of recommendation systems for sales promotion on bread

In this study, cluster analysis results show that the top three purchased product bundling in these three clusters respectively. For example, cluster 1 is the bundling of mineral water with pineapple juice; milk with pineapple juice; and milk with chocolate bread. Cluster 2 is the bundling of mineral water with chocolate bread; green tea with chocolate bread; and mixed fruit juices with pure water. Cluster 3 is the bundling of latte with dorayaki; latte with pineapple juice; and latte with cocoa croissant.

Table 3 Cluster 1 customer preferences for bread product bundling

| Cluster1 Bread AM 6:00~10:59 | Links | Field 1       | Field 2          |
|------------------------------|-------|---------------|------------------|
|                              | 71    | Mineral water | Pineapple bread  |
|                              | 68    | Milk          | Pineapple bread  |
|                              | 64    | Milk          | Chocolate bread  |
|                              | 60    | Mineral water | Chocolate bread  |
|                              | 59    | Pure water    | Pineapple bread  |
|                              | 57    | Pure water    | Chocolate bread  |
|                              | 57    | Soymilk       | Pineapple bread  |
|                              | 57    | Mineral water | Dorayaki         |
|                              | 56    | Milk          | Dorayaki         |
|                              | 56    | Milk          | Cocoa croissants |

Table 4 Cluster 2 customer preferences for bread product bundling

| Cluster2 Bread AM 6:00~10:59 | Links | Field 1          | Field 2           |
|------------------------------|-------|------------------|-------------------|
|                              | 40    | Pure water       | Chocolate bread   |
|                              | 39    | Green Tea        | Chocolate bread   |
|                              | 39    | Integrated juice | Pure water        |
|                              | 39    | Chocolate bread  | Cocoa croissants  |
|                              | 38    | Green Tea        | Milk              |
|                              | 38    | Pure water       | Bean milk         |
|                              | 37    | Green Tea        | Cocoa croissants  |
|                              | 36    | Green Tea        | Souffles          |
|                              | 36    | Integrated juice | Grapefruit flavor |
|                              | 36    | Green Tea        | Deep-sea water    |

Based on product associations the in the first three product bundling preferences with other product, we recommend certain products for conditional sales in promotion

sales. In Table 6, this study sets up minimum support as 5%, minimum confidence as 60% and selects four rules which have lift value is larger than 1. Thus, the bread product recommendation is chocolate toasts with discount for sale promotion. On the other hand, customers who are accustomed to purchasing pineapple juice can also buy apple cider by half price discount for second items as a rule of recommendation. Customers who buy milk can buy grape juice by promotion with coupons. In addition, customers who purchase mineral water can be encouraged to buy vanilla latte using half price discounts (Table 6- 8).

Table 6 Cluster 1 bread product recommendation

| (min sup=5% ; min conf=60%) |        |        |       |                 |   |          |
|-----------------------------|--------|--------|-------|-----------------|---|----------|
| Rule                        | Sup    | Conf   | Lift  | Cons            | Antecedent                              |          |
| R1                          | 11.336 | 89.286 | 2.141 | Chocolate bread | Chocolate toast                         | Discount |
| R2                          | 5.668  | 78.571 | 1.866 | Bo luo          | Half price for the same second purchase | Cider    |
| R3                          | 6.478  | 93.75  | 1.666 | Milk            | Grape juice                             | Coupons  |
| R4                          | 6.478  | 87.5   | 1.578 | Mineral water   | Grape thick toast                       | Discount |

Table7 Cluster 2 bread product recommendation

| (min sup=5% ; min conf=60%) |       |        |       |                        |               |                 |
|-----------------------------|-------|--------|-------|------------------------|---------------|-----------------|
| Rule                        | Sup   | Conf   | Lift  | Cons                   | Antecedent    |                 |
| R1                          | 9.74  | 86.667 | 2.053 | Integrated fruit juice | Mizuho toast  | Discount        |
| R2                          | 5.195 | 100    | 2.026 | Pure water             | Fruit vinegar | Discount        |
| R3                          | 5.195 | 87.5   | 1.982 | Chocolate bread        | limited       | Cranberry juice |
| R4                          | 6.494 | 100    | 1.638 | Green tea              | Lottery       | Dorayaki        |

Table8 Cluster 3 bread product recommendation

| (min sup=5% ; min conf=60%) |       |        |       |                  |                  |   |
|-----------------------------|-------|--------|-------|------------------|------------------|---|
| Rule                        | Sup   | Conf   | Lift  | Cons             | Antecedent       |   |
| R1                          | 5.288 | 90.909 | 2.394 | Bo luo           | Lemon tea        | Half price for the same second purchase |
| R2                          | 5.288 | 72.727 | 2.161 | Cocoa croissants | Point activities | Cranberry juice                         |
| R3                          | 7.212 | 73.333 | 2.089 | Dorayaki         | Butter pudding   | Discount                                |