**Context**

The business context is the grocery store is interested in relationships or associations among food items. The associations are of interest for a few purposes:

1. For a point-of-sale display.
2. For guidance to sales personnel in promoting cross-sales.
3. For guidance on implementing an electronic recommender system to boost cross sales.

The analysis will use association rule mining to locate any associations between food items, and if there are food items, the analysis will filter for the most robust association rules.

**Data Preparation**

Before any analysis can be done, the data is prepped for analysis. There are no missing data or inconsistent values in the data set. However, the value zero is replaced with NA, so we do not find associations that include items not purchased. Removing the zeros in our dataset is vital, so only associations among purchased food items are mined. That is because it is in line with our business context. The grocery store wishes to implement cross-sales into its business practices. The last preparation step is to perform data reduction to remove the receipt id column to isolate the binominal food attributes.

**Association Rule Mining Model**

           After data preparation, the food attributes are analyzed for any association rules. The rules are found using the apriori algorithm, where the minimum item is two. That is, there cannot be rules with less than two items, removing the possibility of one-to-one relationships with the same food item. Additionally, the apriori algorithm takes a specified support and confidence value. The support value represents the number of co-occurrences of the items, while confidence represents the sureness in the relationship. A few apriori models are used; however, the apriori model with a support of 0.15 and confidence of 0.5 yielded the best results.

**Results**

There are 12 association rules among the food attributes in the dataset. The three strongest rules are:

1. {frozen foods, snack foods} => {beer/wine/spirits}
2. {snack foods, beer/wine/spirits} => {frozen foods}
3. {frozen foods, beer/wine/spirits} => {snack foods}

The three rules have a high lift indicating the rules are important. The rules have low support; however, when the item set does occur, there is 80% confidence in each of the three rules occurring. The rest of the rules have a lift value of around 1.6, indicating less importance and confidence at around 50%, but the three strongest rules only provide insight on three food items. That is not enough in the context of the grocery store’s ambitions. Hence, the confidence is lowered to search for more rules. The rest of the rules can be found in the supporting visuals. The other rules are less important and less actionable because their confidence is approximately 50%, meaning we are only sure that the rule will occur half the time. That means the rest of the rules are less actionable than our top three.

**Suggestions**

After analyzing the association rules from the dataset, the three most actionable rules should be prioritized when implementing the goals of the grocery store. The three rules have a lift of around 2.5, indicating high importance, and a confidence of approximately 0.8, which is 80%, meaning that given the antecedent, the consequent will occur about 80% of the time. Therefore, these three rules should be the priority when implementing a point-of-sales display, cross-sales guidance, or the recommender system. The other rules can be implemented; however, an effort will have to go into promoting the consequent to improve the rules' confidence. Therefore, the best rules to use when implementing the new business practices of the grocery store are the top three listed above and in the supporting visuals.

**R Code**

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text, application

Description automatically generated

**Visualizations**

**Chart

Description automatically generated**

**Chart, line chart

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