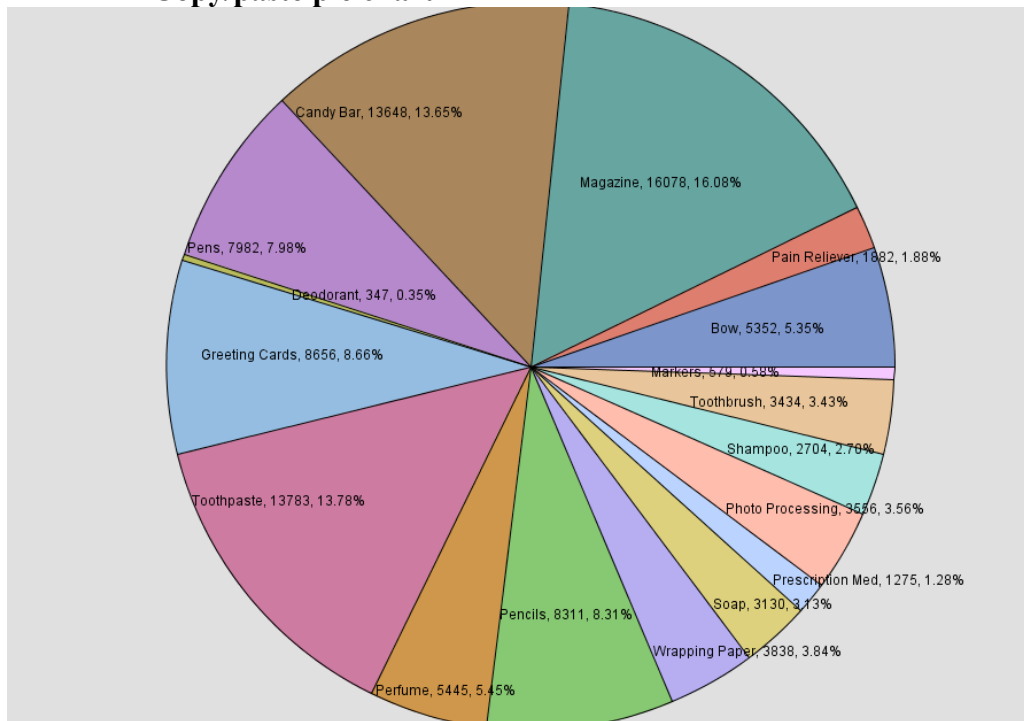## Pharmacy Association Analysis

In order to plan promotions to sell items often purchased together, you will perform a market basket analysis. Specific items from the Health and Beauty Aids Department and the Stationary Department were downloaded into the **Transactions** data set. The data set contains 17 different products from these two departments that were purchased in over 400,000 sales transactions from multiple stores of a branded pharmacy.

Variable	Model Role	Measurement Level	Description
STORE	Rejected	Nominal	ID number of the store
TRANSACTION	ID	Nominal	Transaction ID number
PRODUCT	Target	Nominal	Product purchased
QUANTITY	Rejected	Interval	Quantity of product

Explore the Data Set
1. What is the business purpose of the analysis? The pharmacy wants to determine which items sets are frequently purchased together, along with the likelihood of subsequent purchases, to plan innovative promotions on their products.
2. How many records are in the data set? 459258
3. How many variables are in the data set? 4
    a. What does each row/record in the dataset represent? A transaction
4. Sample Statistics:
    a. How many Pharmacy Store locations are represented in the data set? 10
    b. How many different products are being tested for associations? 17
    c. What is the most popular product? Magazine
    d. What is the 2nd most purchased product? Toothpaste
5. Create a pie chart of products: Actions - Plot – Pie – Product - Category role – Finish – Graph Properties – select Category Name, Value, Percentage - deselect 'other' slice
    a. **Copy/paste pie chart**

Pie chart data: Candy Bar, 13648, 13.65%; Magazine, 16078, 16.08%; Pain Reliever, 1882, 1.88%; Bow, 5352, 5.35%; Markers, 579, 0.58%; Toothbrush, 3434, 3.43%; Shampoo, 2704, 2.70%; Photo Processing, 3556, 3.56%; Prescription Med, 1275, 1.28%; Soap, 3130, 3.13%; Wrapping Paper, 3838, 3.84%; Pencils, 8311, 8.31%; Perfume, 5445, 5.45%; Toothpaste, 13783, 13.78%; Greeting Cards, 8656, 8.66%; Deodorant, 347, 0.35%; Pens, 7982, 7.98%

    b. What product is <u>least</u> purchased and in what % of transactions is it found? Deodorant; 0.35%

6. **Add the Association Node to the Diagram and Link it to the data source.**
   a. In the Property panel change the setting for the 'Export Rule by ID' to **Yes.**
   b. RUN the node.

7. <u>Statistics Plot</u>
   a. What two products are purchased together most often? Candy bars and greeting cards
   b. In what % of transactions are they found? 4.37%
   c. Which 'B' item is more likely purchased with the 'A' item? Candy bars are more likely to be purchased with greeting cards.

Association Report Questions - **Copy/Paste** screenshot of the Association Report

Association Report

Relations	Expected Confidence (%)	Confidence (%)	Support (%)	Lift	Transaction Count	Rule	Left Hand of Rule	Right Hand of Rule	Rule Item 1	Rule Item 2	Rule Item 3
2	6.74	24.26	2.18	3.60	4364.0	Perfume ==> Toothbrush	Perfume	Toothbrush	Perfume	=======================> Toothbrush	
2	9.00	32.40	2.18	3.60	4364.0	Toothbrush ==> Perfume	Toothbrush	Perfume	Toothbrush	=======================> Perfume	
3	14.69	41.11	1.67	2.80	3333.0	Magazine & Candy Bar ==> Greeting Cards	Magazine & Candy Bar	Greeting Cards	Magazine	Candy Bar	================
3	4.05	11.35	1.67	2.80	3333.0	Greeting Cards ==> Magazine & Candy Bar	Greeting Cards	Magazine & Candy Bar	Greeting Cards	=======================> Magazine	
3	17.10	45.86	1.67	2.68	3333.0	Magazine & Greeting Cards ==> Candy Bar	Magazine & Greeting Cards	Candy Bar	Magazine	Greeting Cards	================
3	17.10	43.33	1.37	2.53	2744.0	Toothpaste & Magazine ==> Candy Bar	Toothpaste & Magazine	Candy Bar	Toothpaste	Magazine	================
3	17.10	41.07	1.32	2.40	2635.0	Toothpaste & Greeting Cards ==> Candy Bar	Toothpaste & Greeting Cards	Candy Bar	Toothpaste	Greeting Cards	================
3	14.69	33.12	1.32	2.25	2635.0	Toothpaste & Candy Bar ==> Greeting Cards	Toothpaste & Candy Bar	Greeting Cards	Toothpaste	Candy Bar	================
3	16.04	33.85	1.37	2.11	2744.0	Magazine & Candy Bar ==> Toothpaste	Magazine & Candy Bar	Toothpaste	Magazine	Candy Bar	================
3	16.04	30.18	1.32	1.88	2635.0	Greeting Cards & Candy Bar ==> Toothpaste	Greeting Cards & Candy Bar	Toothpaste	Greeting Cards	Candy Bar	================
2	14.69	25.53	4.37	1.74	8732.0	Candy Bar ==> Greeting Cards	Candy Bar	Greeting Cards	Candy Bar	=======================> Greeting Cards	
2	17.10	29.72	4.37	1.74	8732.0	Greeting Cards ==> Candy Bar	Greeting Cards	Candy Bar	Greeting Cards	=======================> Candy Bar	
3	24.13	38.17	1.67	1.58	3333.0	Greeting Cards & Candy Bar ==> Magazine	Greeting Cards & Candy Bar	Magazine	Greeting Cards	Candy Bar	================
2	14.69	21.67	2.92	1.48	5848.0	Pencils ==> Greeting Cards	Pencils	Greeting Cards	Pencils	=======================> Greeting Cards	
2	13.49	19.91	2.92	1.48	5848.0	Greeting Cards ==> Pencils	Greeting Cards	Pencils	Greeting Cards	=======================> Pencils	
2	16.04	23.26	3.98	1.45	7956.0	Candy Bar ==> Toothpaste	Candy Bar	Toothpaste	Candy Bar	=======================> Toothpaste	
2	17.10	24.80	3.98	1.45	7956.0	Toothpaste ==> Candy Bar	Toothpaste	Candy Bar	Toothpaste	=======================> Candy Bar	
2	17.10	24.47	3.30	1.43	6603.0	Pencils ==> Candy Bar	Pencils	Candy Bar	Pencils	=======================> Candy Bar	
2	13.49	19.31	3.30	1.43	6603.0	Candy Bar ==> Pencils	Candy Bar	Pencils	Candy Bar	=======================> Pencils	
3	24.13	34.49	1.37	1.43	2744.0	Toothpaste & Candy Bar ==> Magazine	Toothpaste & Candy Bar	Magazine	Toothpaste	Candy Bar	================
2	14.69	20.00	3.21	1.36	6416.0	Toothpaste ==> Greeting Cards	Toothpaste	Greeting Cards	Toothpaste	=======================> Greeting Cards	
2	16.04	21.84	3.21	1.36	6416.0	Greeting Cards ==> Toothpaste	Greeting Cards	Toothpaste	Greeting Cards	=======================> Toothpaste	
2	24.13	28.14	1.65	1.17	3291.0	Photo Processing ==> Magazine	Photo Processing	Magazine	Photo Processing	=======================> Magazine	
2	13.49	15.31	2.46	1.13	4912.0	Toothpaste ==> Pencils	Toothpaste	Pencils	Toothpaste	=======================> Pencils	
2	16.04	18.20	2.46	1.13	4912.0	Pencils ==> Toothpaste	Pencils	Toothpaste	Pencils	=======================> Toothpaste	

8. What two products have the strongest <u>association?</u> Perfume and toothbrush
   a. What statistic represents the strength of the association? Lift
   b. How often (percentage) were these two products purchased together? 2.18%
   c. How many times were they purchased together? 4,364
   d. The manager was surprised by this co-occurrence of products. Use the **stats** to explain **why** this is a valid association. With a lift value well above 1, perfume and toothbrushes have the strongest association and highest lift out all the products sampled in the data set.
   e. The manager is convinced by your answer and wants to put both items on sale next week to drive overall sales of these products.
      i. What would you advise the manager to do and why? The manager should leverage the strong association between toothbrushes and perfumes by offering 10% off select perfumes with the purchase of a toothbrush – since customers who purchase toothbrushes are 32.4% likely to purchase a perfume. Perfume sales also generate higher profit margins for the store; therefore, an increase in perfume sales will increase revenue more rapidly.

9. What products occur <u>most often</u> in one transaction (or marketbasket)? Candy bars and greeting cards
   a. What % of all transactions contain these products? 4.37%
   b. Which product might you put on sale to drive sales of both? Put the greeting cards on sale first since there is a 29.72% chance that someone purchasing a greeting card will also purchase a candy bar

10. Refer to Rules #3 and #4:
    a. Why is Support the same? Symmetric rules have the same support %
    b. Interpret the Confidence for Rule #3. There's a 41.11% probability that customers purchasing magazines & candy bar will also purchase greeting cards.

11. Looking at the Right-Hand rules in the top 25 rules, what **item** is most often purchased with other products? Candy bar
    a. What might this reveal about the shopping behavior of customers? There may be a lot of candy bar purchases while waiting in line to checkout.

12. If the profit margin of greeting cards is the highest of all items in the store, what item(s) would be best to put on sale next week to drive greeting card sales? The magazine and candy bars could be bundled together and offered at a discounted price to drive greeting card sales since there's a 41.11% probability that a [magazine & candy bar] sale will drive a greeting card sale.

Select: View – Rules – Rules Table
13. You are an **expert** Market Basket analyst. Given this title, your manager wants a promotion for Rule #34.
    a. What is your expert advice? I would advise the manager not to run a promotion for this rule since there is no strong association between toothbrushes and magazines. The rule has a low lift value of 0.81, which indicates its weak association. Relative to the other item sets in the store, toothbrushes and magazines aren't frequently purchased together – indicated by its lowed support percentage of 1.32%. There's also only a 19.56% chance that a customer purchasing a toothbrush will purchase a magazine – as indicated by the confidence %. To recap, the manager should not run a promotion on the rule since the products have a weak correlation, and because the confidence and support percentages are relatively low.