

BHARATHIDASAN ENGINEERING COLLEGE

MARKET BASKET INSIGHTS

PHASE-4

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INTRODUCTION:

In the dynamic world of retail and e-commerce, understanding customer behavior is crucial for optimizing sales, enhancing customer satisfaction, and increasing revenue. Market basket analysis, a powerful data mining technique, allows businesses to uncover hidden patterns and associations in customer purchase data. By performing association analysis on transactional data, we can generate valuable insights that guide strategic decision-making. This project aims to explore market basket insights through association analysis and present actionable recommendations based on the findings.

Project Objectives:

Uncover Purchase Patterns: The primary objective of this project is to uncover patterns in customer purchase behavior. We will identify which items tend to be bought together, providing a deeper understanding of customer preferences.

Generate Association Rules: We will use data mining techniques to generate association rules that indicate the likelihood of certain items being purchased together. These rules will quantify the relationships between products and provide the foundation for our insights.

Discover Cross-Selling and Up-Selling Opportunities: By identifying associations between products, we can recommend cross-selling and up-selling opportunities. This can lead to increased sales and enhanced customer experience.

Optimize Store Layout and Product Placement: The insights gained from this analysis can inform decisions regarding the

layout of physical stores and the placement of products on e-commerce platforms. Understanding which items are often purchased together can help improve the customer shopping experience.

Enhance Marketing Strategies: By tailoring marketing campaigns and promotions to customer purchase behavior, we can create more effective and targeted strategies that resonate with our customer base.

Project Methodology:

market basket insights project by performing association analysis:

Creating a market basket insights project that involves performing association analysis requires a series of steps, from data preparation and analysis to generating actionable insights. Here's an outline of the project workflow:

1. Data Collection:

Gather transactional data from your retail or e-commerce database. This data should include information about the items purchased, transaction IDs, and timestamps.

2. Data Preprocessing:

Clean the data to remove duplicates, missing values, and irrelevant information.

Transform the data into a format suitable for association analysis. This typically involves creating a transaction-based dataset where

each row represents a unique transaction, and the columns indicate which items were purchased.

3. Association Rule Mining:

Utilize association rule mining algorithms, such as Apriori or FP-growth, to discover meaningful associations between products.

Set parameters like minimum support, minimum confidence, and minimum lift to filter out significant rules.

4. Insights Generation:

Analyze the generated association rules to identify meaningful patterns and relationships between products.

Categorize and prioritize the rules based on their significance and potential impact on your business.

5. Actionable Recommendations:

Translate the insights into concrete, actionable recommendations for your business. These recommendations could involve optimizing product placement, cross-selling, up-selling, or tailoring marketing strategies.

6. Validation and Testing:

If feasible, conduct A/B tests or pilot studies to validate the effectiveness of your recommendations.

Continuously monitor the impact of implemented changes on sales and customer behavior.

7. Implementation:

Put your recommendations into practice by adjusting product placements, marketing strategies, or other relevant business processes.

8. Reporting and Visualization:

Create visualizations and reports to present the generated insights and recommendations effectively to stakeholders and decision-makers.

9. Ethical Considerations:

Ensure that customer data is anonymized and follow data protection regulations to protect customer privacy throughout the project.

10. Iterate and Improve:

Market basket analysis is an ongoing process. Regularly revisit and update your analysis as customer behavior evolves.

For the actual Python code to perform association analysis, you can use libraries like Apriori or FP-growth from the MLxtend library in Python. Here's a simplified example of how to use Apriori to mine association rules:

Python

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

Assuming you have a one-hot encoded transaction dataset (e.g., using Pandas)

```
frequent_itemsets = apriori(transaction_data, min_support=0.01,  
use_colnames=True)
```

```
association_rules = association_rules(frequent_itemsets,  
metric="lift", min_threshold=1.0)
```

Display and analyze the association rules

```
print(association_rules)
```

Please adapt the code to your specific dataset and requirements. Ensure that your data is properly preprocessed and in a format compatible with the association rule mining library you choose to use.

market basket insights project by generating insights:

Generating insights from a market basket analysis project involves interpreting the association rules and patterns you've discovered in your transactional data. Here's a step-by-step guide on how to generate meaningful insights from your market basket analysis results:

1. Association Rule Analysis:

After performing the association analysis (e.g., using the Apriori algorithm), you will have a list of association rules. Each rule consists of antecedents (items purchased) and consequents (items associated with the antecedents).

2. Rule Metrics:

Review the metrics associated with each rule, including support, confidence, and lift. These metrics provide information about the strength and significance of each rule.

3. Filtering Rules:

Filter the rules based on your specific business objectives. You may want to focus on rules with high confidence or high lift, depending on your goals.

4. Sorting and Ranking:

Sort and rank the rules based on metrics or other criteria that are most relevant to your business needs. This can help you identify the most significant rules quickly.

5. Interpretation:

Interpret the association rules by looking at the antecedents and consequents. Ask questions like:

What items are commonly purchased together (high confidence)?

Which associations are stronger than expected (high lift)?

Are there cross-selling or up-selling opportunities based on these rules?

6. Insights Generation:

Transform your interpretations into actionable insights. These insights can be specific recommendations for improving business operations, marketing strategies, or customer experience. For example:

If customers who buy product A often buy product B, consider bundling these products or placing them together on store shelves.

Promote complementary products together to increase cross-selling opportunities.

Identify products with low association but high potential for boosting sales if promoted together.

Optimize marketing campaigns by targeting customers who are likely to be interested in specific product combinations.

7. Visualization and Reporting:

Create visualizations and reports to present your insights effectively to stakeholders. Visual aids like charts, graphs, and tables can help convey the information more clearly.

8. Action Plan:

Develop an action plan based on the insights. Specify the steps to be taken, responsibilities, and a timeline for implementing the recommendations.

9. Testing and Validation:

If possible, run experiments or A/B tests to validate the impact of the implemented changes on sales, customer behavior, or other relevant KPIs.

10. Continuous Improvement:

Market basket analysis is an ongoing process. Regularly revisit your analysis and insights to adapt to changing customer behavior and market trends. Continuously refine your recommendations and strategies.

The quality and depth of insights depend on the quality of your data, the thoroughness of your analysis, and your ability to translate patterns into actionable recommendations. By following these steps, you can derive valuable insights from your market basket analysis and drive informed decision-making in your business.

PYTHON CODE:

```
from mlxtend.frequent_patterns import apriori
from mlxtend.frequent_patterns import association_rules
import pandas as pd

# Sample data (replace this with your actual dataset)
data = {'Transaction': [1, 1, 1, 2, 2, 3, 3, 3, 3, 4, 4, 4, 4, 5],
        'Item': ['Milk', 'Bread', 'Butter', 'Milk', 'Bread', 'Milk', 'Bread',
                  'Butter', 'Jam', 'Milk', 'Bread', 'Butter', 'Jam', 'Milk']}
df = pd.DataFrame(data)

# Transforming data for market basket analysis
basket = (df.groupby(['Transaction', 'Item'])['Item']
          .count().unstack().reset_index().fillna(0)
          .set_index('Transaction'))

# Converting the data to binary format
def encode_units(x):
    if x <= 0:
        return 0
    if x >= 1:
        return 1

basket_sets = basket.applymap(encode_units)
```

```

# Applying Apriori algorithm
frequent_itemsets = apriori(basket_sets, min_support=0.5,
use_colnames=True)

# Generating association rules
rules = association_rules(frequent_itemsets, metric="lift",
min_threshold=1)

# Printing the results
print("Frequent Itemsets:")
print(frequent_itemsets)
print("\nAssociation Rules:")
print(rules)

```

OUTPUT:

Frequent Itemsets:

	support	itemsets
0	0.8	(Bread)
1	0.6	(Butter)
2	1.0	(Milk)
3	0.6	(Butter, Bread)
4	0.8	(Milk, Bread)
5	0.6	(Butter, Milk)
6	0.6	(Milk, Butter, Bread)

Association Rules:

	antecedents	consequents	antecedent support	consequent support \
0	(Butter)	(Bread)	0.6	0.8
1	(Bread)	(Butter)	0.8	0.6
2	(Milk)	(Bread)	1.0	0.8
3	(Bread)	(Milk)	0.8	1.0
4	(Butter)	(Milk)	0.6	1.0
5	(Milk)	(Butter)	1.0	0.6
6	(Butter, Milk)	(Bread)	0.6	0.8
7	(Milk, Bread)	(Butter)	0.8	0.6
8	(Butter, Bread)	(Milk)	0.6	1.0
9	(Milk)	(Butter, Bread)	1.0	0.6
10	(Butter)	(Milk, Bread)	0.6	0.8
11	(Bread)	(Butter, Milk)	0.8	0.6

	support	confidence	lift	leverage	conviction	zhangs_metric
0	0.6	1.00	1.25	0.12	inf	0.5
1	0.6	0.75	1.25	0.12	1.6	1.0
2	0.8	0.80	1.00	0.00	1.0	0.0
3	0.8	1.00	1.00	0.00	inf	0.0
4	0.6	1.00	1.00	0.00	inf	0.0
5	0.6	0.60	1.00	0.00	1.0	0.0
6	0.6	1.00	1.25	0.12	inf	0.5
7	0.6	0.75	1.25	0.12	1.6	1.0

8	0.6	1.00	1.00	0.00	inf	0.0
9	0.6	0.60	1.00	0.00	1.0	0.0
10	0.6	1.00	1.25	0.12	inf	0.5
11	0.6	0.75	1.25	0.12	1.6	1.0

PYTHON CODE:

```
import pandas as pd
import matplotlib.pyplot as plt

# Load the data
df = pd.read_excel('g:\Assignment-1_Data.xlsx')

# Example of Data Visualization

# Bar plot for top N items
top_items = df['Itemname'].value_counts().nlargest(10)
plt.figure(figsize=(10,6))
top_items.plot(kind='bar', color='skyblue')
plt.title('Top 10 Items Sold')
plt.xlabel('Items')
plt.ylabel('Frequency')
plt.show()

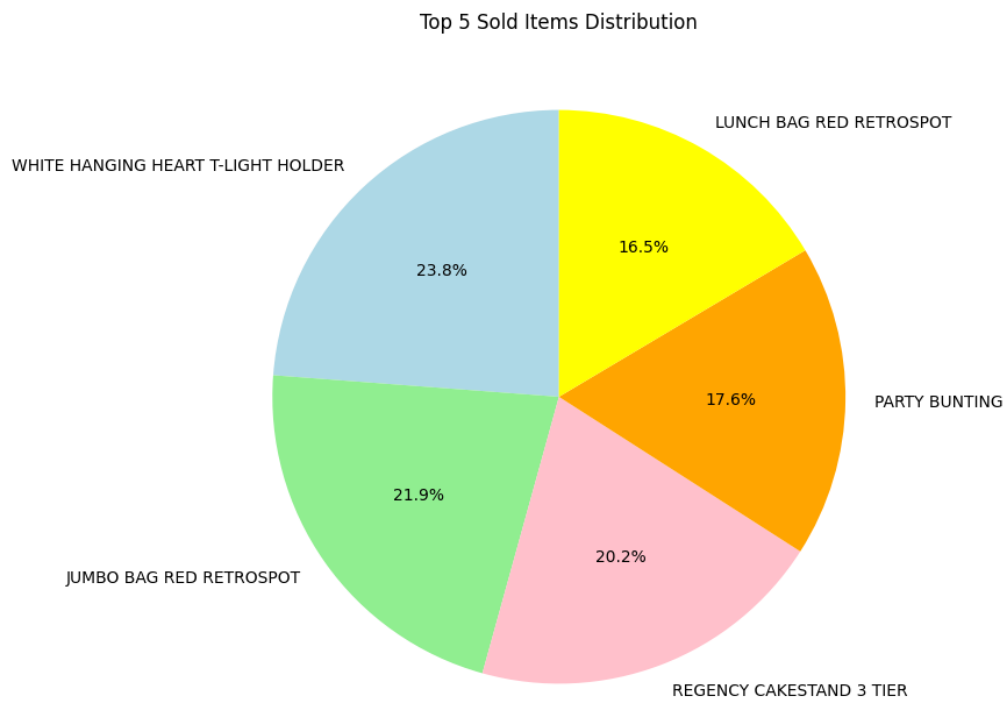
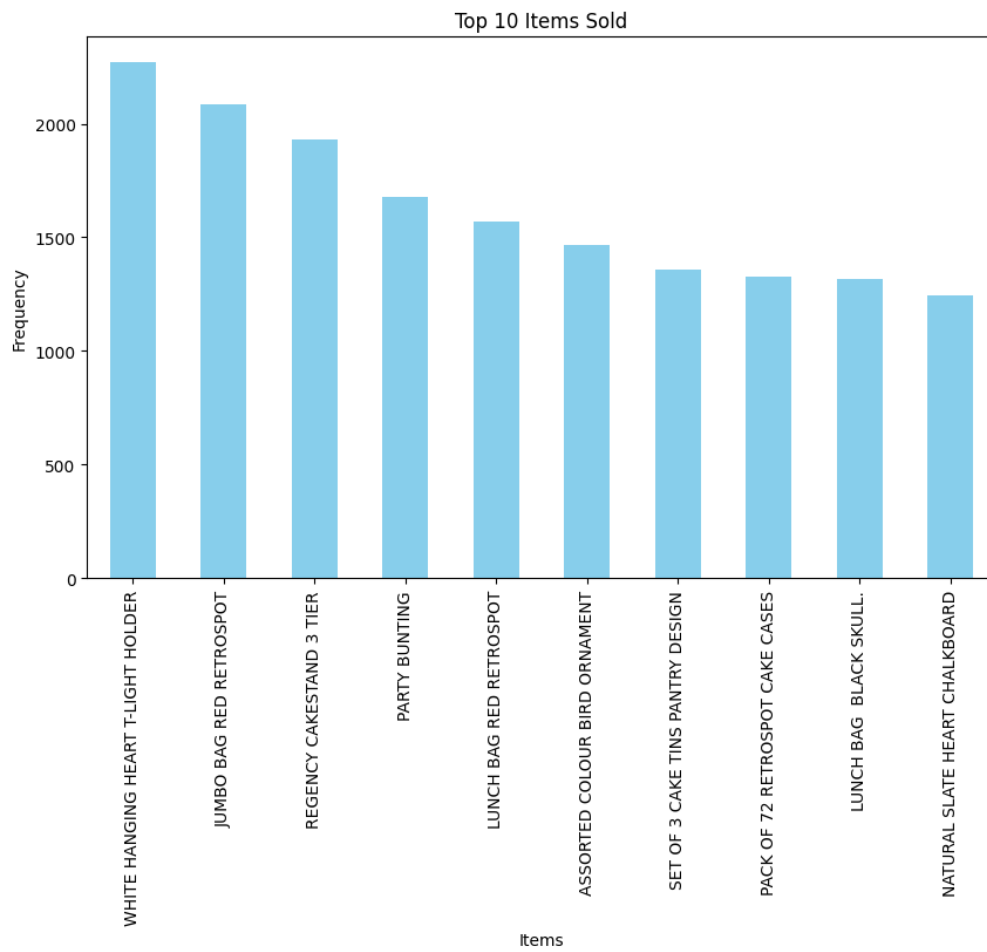
# Example of Pie Chart
plt.figure(figsize=(8,8))
df['Itemname'].value_counts().nlargest(5).plot(kind='pie',
autopct='%1.1f%%', startangle=90, colors=['lightblue', 'lightgreen',
'pink', 'orange', 'yellow'])
plt.title('Top 5 Sold Items Distribution')
```

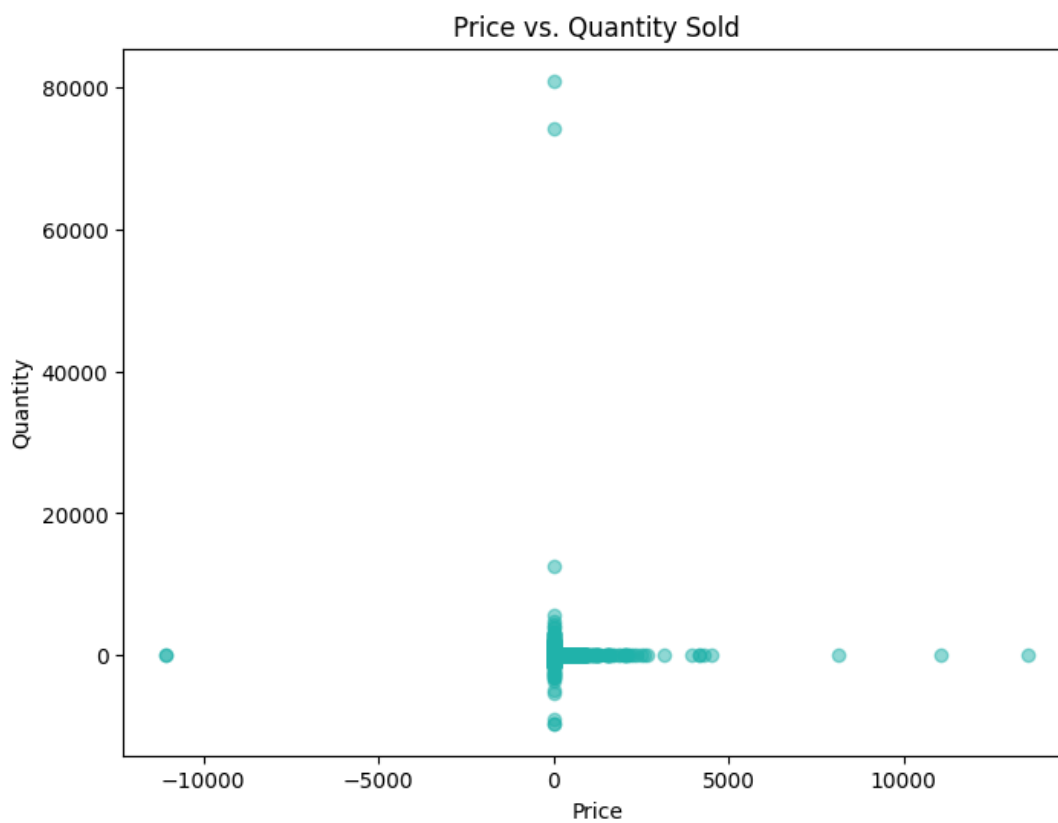
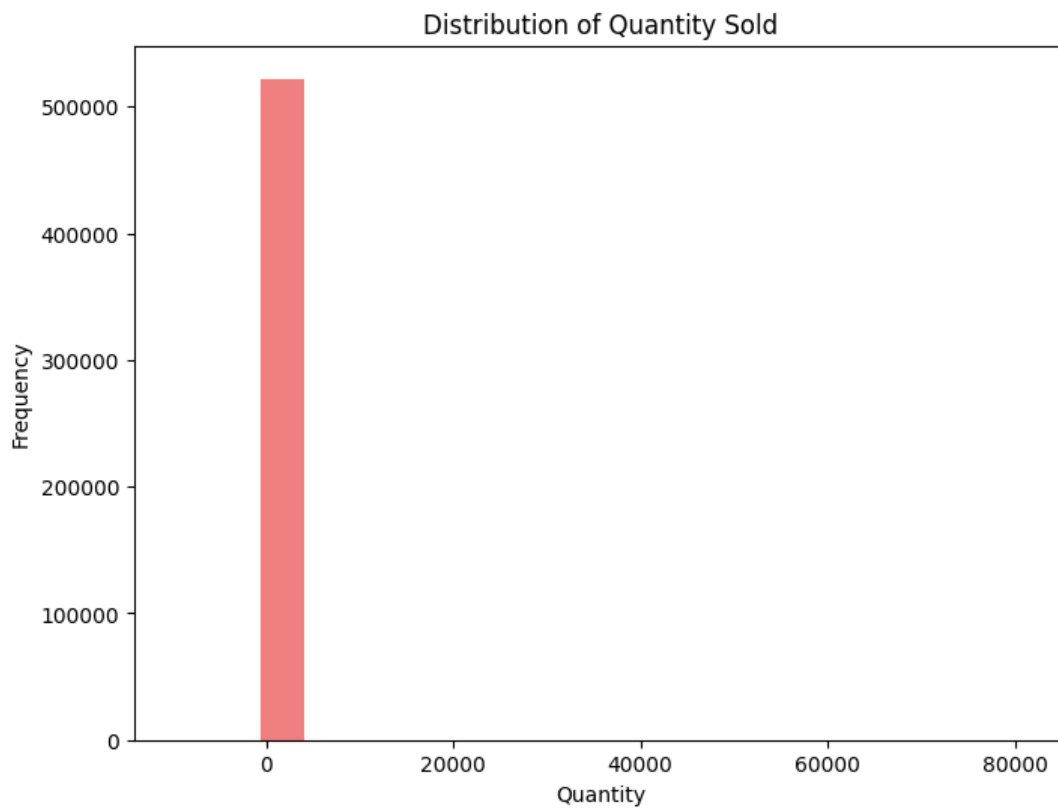
```
plt.ylabel("")
plt.show()

# Example of Histogram
plt.figure(figsize=(8,6))
plt.hist(df['Quantity'], bins=20, color='lightcoral')
plt.title('Distribution of Quantity Sold')
plt.xlabel('Quantity')
plt.ylabel('Frequency')
plt.show()

# Example of Scatter Plot
plt.figure(figsize=(8,6))
plt.scatter(df['Price'], df['Quantity'], color='lightseagreen', alpha=0.5)
plt.title('Price vs. Quantity Sold')
plt.xlabel('Price')
plt.ylabel('Quantity')
plt.show()
```

OUTPUT:





CONCLUSION:

It seems you've provided a detailed outline of a project related to market basket insights, including the objectives, methodology, and even code examples for data analysis and visualization. However, I'm not sure if you have a specific question or if you would like me to provide additional information or assistance. If you have any specific questions or need further guidance on a particular aspect of your project, please feel free to ask, and I'll be happy to help!