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Batch : B

## DWM Ex5- Implementation of Association Rule Mining Algorithm (Apriori)

```
!pip install mlxtend networkx matplotlib
```

```
import pandas as pd
from mlxtend.frequent_patterns import apriori, association_rules
import networkx as nx
import matplotlib.pyplot as plt

data = {
    'Bread': [1, 1, 0, 1, 1],
    'Milk': [1, 1, 1, 1, 0],
    'Butter': [0, 1, 1, 1, 1],
    'Cheese': [1, 0, 1, 1, 1]
}

df = pd.DataFrame(data)

print("Transaction Data:")
print(df)

frequent_itemsets = apriori(df, min_support=0.5, use_colnames=True)
print("\nFrequent Itemsets:")
print(frequent_itemsets)

rules = association_rules(frequent_itemsets, metric="confidence",
min_threshold=0.7)
print("\nAssociation Rules:")
print(rules)

G = nx.DiGraph()

for index, row in rules.iterrows():
    antecedent = list(row['antecedents'])[0]
    consequent = list(row['consequents'])[0]
```

```

G.add_edge(antecedent, consequent, weight=row['confidence'])

plt.figure(figsize=(10, 6))
pos = nx.spring_layout(G, k=0.5, seed=42)
nx.draw(G, pos, with_labels=True, node_size=3000, node_color='skyblue',
font_size=12, font_weight='bold', edge_color='gray')
labels = nx.get_edge_attributes(G, 'weight')
nx.draw_networkx_edge_labels(G, pos, edge_labels=labels)
plt.title("Association Rules Graph")
plt.show()

```

```

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packages (0.23.4)
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/usr/local/lib/python3.11/dist-packages (from matplotlib) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
/usr/local/lib/python3.11/dist-packages (from pandas>=0.24.2->mlxtend)
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/usr/local/lib/python3.11/dist-packages (from pandas>=0.24.2->mlxtend)
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Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.7->matplotlib) (1.17.0)

Requirement already satisfied: threadpoolctl>=3.1.0 in /usr/local/lib/python3.11/dist-packages (from scikit-learn>=1.3.1->mlxtend) (3.6.0)

Transaction Data:

	Bread	Milk	Butter	Cheese
0	1	1	0	1
1	1	1	1	0
2	0	1	1	1
3	1	1	1	1
4	1	0	1	1

Frequent Itemsets:

	support	itemsets
0	0.8	(Bread)
1	0.8	(Milk)
2	0.8	(Butter)
3	0.8	(Cheese)
4	0.6	(Milk, Bread)
5	0.6	(Butter, Bread)
6	0.6	(Cheese, Bread)
7	0.6	(Milk, Butter)
8	0.6	(Cheese, Milk)
9	0.6	(Cheese, Butter)

Association Rules:

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

	confidence	lift	representativity	leverage	conviction	zhangs_metric
0	0.75	0.9375	1.0	-0.04	0.8	-0.25
1	0.75	0.9375	1.0	-0.04	0.8	-0.25
2	0.75	0.9375	1.0	-0.04	0.8	-0.25
3	0.75	0.9375	1.0	-0.04	0.8	-0.25
4	0.75	0.9375	1.0	-0.04	0.8	-0.25
5	0.75	0.9375	1.0	-0.04	0.8	-0.25

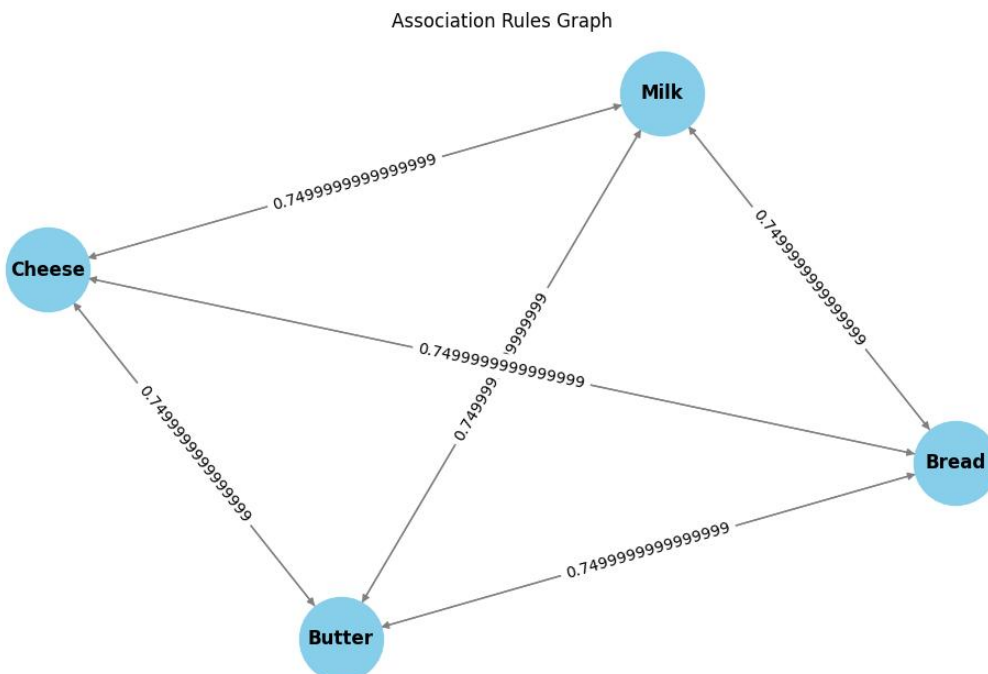
6	0.75	0.9375	1.0	-0.04	0.8	-0.25
7	0.75	0.9375	1.0	-0.04	0.8	-0.25
8	0.75	0.9375	1.0	-0.04	0.8	-0.25
9	0.75	0.9375	1.0	-0.04	0.8	-0.25
10	0.75	0.9375	1.0	-0.04	0.8	-0.25
11	0.75	0.9375	1.0	-0.04	0.8	-0.25

	jaccard	certainty	kulczynski
0	0.6	-0.25	0.75
1	0.6	-0.25	0.75
2	0.6	-0.25	0.75
3	0.6	-0.25	0.75
4	0.6	-0.25	0.75
5	0.6	-0.25	0.75
6	0.6	-0.25	0.75
7	0.6	-0.25	0.75
8	0.6	-0.25	0.75
9	0.6	-0.25	0.75
10	0.6	-0.25	0.75
11	0.6	-0.25	0.75

```

/usr/local/lib/python3.11/dist-
packages/mlxtend/frequent_patterns/fpcommon.py:161: DeprecationWarning:
DataFrames with non-bool types result in worse computational performance and
their support might be discontinued in the future. Please use a DataFrame with
bool type
  warnings.warn(

```



Q.1) What is the Apriori algorithm in Association Rule Mining?

-> The Apriori algorithm is a fundamental technique in Association Rule Mining used to identify frequent itemsets in large datasets and derive strong association rules. It follows a bottom-up approach, where frequent itemsets are extended one item at a time (the Apriori property), ensuring that all subsets of a frequent itemset are also frequent. The algorithm consists of two main steps: candidate generation (finding potential frequent itemsets) and pruning (removing infrequent ones). It is widely used in market basket analysis, recommendation systems, and data mining applications to uncover relationships between items, such as products frequently purchased together.

## Q.2) What is the significance of support, confidence, and lift in Apriori?

->In the **Apriori algorithm**, three key metrics evaluate association rules:

1. **Support:** Measures how frequently an itemset appears in the dataset, helping identify popular item combinations.
1. **Confidence:** Indicates the likelihood of item **Y** being purchased when item **X** is bought, assessing rule reliability.
2. **Lift:** Compares confidence to the expected probability of **Y** occurring independently. A **lift > 1** suggests a strong positive correlation, **=1** means independence, and **<1** implies a negative relationship.

These metrics help in filtering meaningful rules in **market basket analysis** and other data mining tasks.