**WEEK-2**

**AIM:**

Write a program to generate Association Rules using the FP-Growth algorithm.

**Description:**

In Data Mining, finding frequent patterns in large databases is very important and has been studied on a large scale in the past few years. Unfortunately, this task is computationally expensive, especially when many patterns exist.

The FP-Growth Algorithm proposed by **Han in**. This is an efficient and scalable method for mining the complete set of frequent patterns by pattern fragment growth, using an extended prefix-tree structure for storing compressed and crucial information about frequent patterns named frequent-pattern tree (FP-tree). In his study, Han proved that his method outperforms other popular methods for mining frequent patterns, e.g. the Apriori Algorithm and the TreeProjection. In some later works, it was proved that FP-Growth performs better than other methods, including **Eclat** and **Relim**. The popularity and efficiency of the FP-Growth Algorithm contribute to many studies that propose variations to improve its performance.

The FP-Growth Algorithm is an alternative way to find frequent item sets without using candidate generations, thus improving performance. For so much, it uses a divide-and-conquer strategy. The core of this method is the usage of a special data structure named frequent-pattern tree (FP-tree), which retains the item set association information.

**Code:**

import sys

!{sys.executable} -m pip install fpgrowth

Looking in indexes: <https://pypi.org/simple>, <https://us-python.pkg.dev/colab-wheels/public/simple/>

Collecting fpgrowth

Downloading fpGrowth-1.0.0.tar.gz (2.1 kB)

Building wheels for collected packages: fpgrowth

Building wheel for fpgrowth (setup.py) ... done

Created wheel for fpgrowth: filename=fpGrowth-1.0.0-py3-none-any.whl size=2866 sha256=458dd64cdcdca2a32dd39b0d375e68d6d04546eba93e66f5255e27362d23650f

Stored in directory: /root/.cache/pip/wheels/64/33/72/1991a9117d1813325c4ef85597ba8ece8c4780adc240bd0b0f

Successfully built fpgrowth

Installing collected packages: fpgrowth

Successfully installed fpgrowth-1.0.0

%pip install mlxtend –upgrade

Looking in indexes: <https://pypi.org/simple>, <https://us-python.pkg.dev/colab-wheels/public/simple/>

Requirement already satisfied: mlxtend in /usr/local/lib/python3.7/dist-packages (0.14.0)

Collecting mlxtend

Downloading mlxtend-0.21.0-py2.py3-none-any.whl (1.3 MB)

|████████████████████████████████| 1.3 MB 22.6 MB/s

Requirement already satisfied: numpy>=1.16.2 in /usr/local/lib/python3.7/dist-packages (from mlxtend) (1.21.6)

Requirement already satisfied: scikit-learn>=1.0.2 in /usr/local/lib/python3.7/dist-packages (from mlxtend) (1.0.2)

Requirement already satisfied: joblib>=0.13.2 in /usr/local/lib/python3.7/dist-packages (from mlxtend) (1.2.0)

Requirement already satisfied: setuptools in /usr/local/lib/python3.7/dist-packages (from mlxtend) (57.4.0)

Requirement already satisfied: matplotlib>=3.0.0 in /usr/local/lib/python3.7/dist-packages (from mlxtend) (3.2.2)

Requirement already satisfied: scipy>=1.2.1 in /usr/local/lib/python3.7/dist-packages (from mlxtend) (1.7.3)

Requirement already satisfied: pandas>=0.24.2 in /usr/local/lib/python3.7/dist-packages (from mlxtend) (1.3.5)

Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=3.0.0->mlxtend) (3.0.9)

Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=3.0.0->mlxtend) (1.4.4)

Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=3.0.0->mlxtend) (2.8.2)

Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-packages (from matplotlib>=3.0.0->mlxtend) (0.11.0)

Requirement already satisfied: typing-extensions in /usr/local/lib/python3.7/dist-packages (from kiwisolver>=1.0.1->matplotlib>=3.0.0->mlxtend) (4.1.1)

Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas>=0.24.2->mlxtend) (2022.4)

Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil>=2.1->matplotlib>=3.0.0->mlxtend) (1.15.0)

Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from scikit-learn>=1.0.2->mlxtend) (3.1.0)

Installing collected packages: mlxtend

Attempting uninstall: mlxtend

Found existing installation: mlxtend 0.14.0

Uninstalling mlxtend-0.14.0:

Successfully uninstalled mlxtend-0.14.0

Successfully installed mlxtend-0.21.0

EXAMPLE2:

import pandas as pd

from mlxtend.preprocessing import TransactionEncoder

from mlxtend.frequent\_patterns import fpgrowth

dataset = [['k', 'O', 'N', 'M', 'E', 'Y'],

           ['N', 'O', 'D', 'K', 'E', 'Y'],

           ['M', 'A', 'K', 'E'],

           ['N', 'U', 'A', 'K', 'Y'],

           ['C', 'O', 'O', 'k']]

te = TransactionEncoder()

te\_ary = te.fit(dataset).transform(dataset)

df = pd.DataFrame(te\_ary, columns=te.columns\_)

print(df)

fpgrowth(df, min\_support=0.6)

fpgrowth(df, min\_support=0.6, use\_colnames=True)

A C D E K M N O U Y k

0 False False False True False True True True False True True

1 False False True True True False True True False True False

2 True False False True True True False False False False False

3 True False False False True False True False True True False

4 False True False False False False False True False False True

|  | **support** | **itemsets** |
| --- | --- | --- |
| **0** | 0.6 | (Y) |
| **1** | 0.6 | (O) |
| **2** | 0.6 | (N) |
| **3** | 0.6 | (E) |
| **4** | 0.6 | (K) |
| **5** | 0.6 | (N, Y) |