**6. To understand and implement OLAP operations on a multi-dimensional data cube.**

import pandas as pd

import numpy as np

# Creating the dataset

data = {

'Year': [2023, 2023, 2023, 2024, 2024, 2024],

'Quarter': ['Q1', 'Q2', 'Q3', 'Q1', 'Q2', 'Q3'],

'Region': ['North America', 'North America', 'Europe', 'Europe', 'Asia', 'Asia'],

'Country': ['USA', 'Canada', 'UK', 'Germany', 'India', 'China'],

'Category': ['Electronics', 'Clothing', 'Electronics', 'Clothing', 'Electronics', 'Clothing'],

'Product Name': ['Laptop', 'T-Shirt', 'Smartphone', 'Jacket', 'Tablet', 'Shoes'],

'Sales': [10000, 7000, 15000, 9000, 11000, 8000]

}

df = pd.DataFrame(data)

print("Original Data:")

print(df)

# 1. Roll-Up (Aggregate Sales by Year)

rollup\_df = df.groupby('Year', as\_index=False)['Sales'].sum()

print("\nRoll-Up (Aggregate Sales by Year):")

print(rollup\_df)

# 2. Drill-Down (Sales by Year and Quarter)

drilldown\_df = df.groupby(['Year', 'Quarter'], as\_index=False)['Sales'].sum()

print("\nDrill-Down (Sales by Year and Quarter):")

print(drilldown\_df)

# 3. Slice (Data for Year 2023)

slice\_df = df[df['Year'] == 2023]

print("\nSlice (Data for Year 2023):")

print(slice\_df)

# 4. Dice (Sales for Year 2023 and Region 'North America')

dice\_df = df[(df['Year'] == 2023) & (df['Region'] == 'North America')]

print("\nDice (Sales for Year 2023 and Region 'North America'):")

print(dice\_df)

# 5. Pivot Table Visualization

pivot\_table = df.pivot\_table(values='Sales', index='Year', columns='Region', aggfunc=np.sum, fill\_value=0)

print("\nPivot Table (Sales by Year and Region):")

print(pivot\_table)