

Ex No: 6 Implement Hive Databases, Tables, Views, Functions, and Indexes

AIM:

To create and demonstrate operations on Hive databases including table creation, views, indexes, and user-defined functions (UDFs) using a simulated Hive-like environment in Python.

Algorithm :

1. **Create Hive Database:**
 - Initialize a database (simulated here using SQLite for demonstration).
2. **Create Table:**
 - Define a table to store sample weather data with columns for `record_id`, `year`, and `temperature_c`.
3. **Insert Data:**
 - Load random weather data for multiple years into the table.
4. **Create Index:**
 - Create an index on the `year` column to optimize queries.
5. **Create View:**
 - Define a view (`positive_temps`) showing only records with temperature greater than 0°C.
6. **Create User-Defined Function (UDF):**
 - Implement a Python function to convert Celsius to Fahrenheit.
 - Register the UDF within the database.
7. **Query and Reporting:**
 - Generate reports of **min/max temperatures per year** using SQL queries.
 - Use the UDF within queries to convert values dynamically.

Python Implementation

```
import pandas as pd
import sqlite3
import random
from contextlib import contextmanager

# =====
# 2. Generate Sample Weather Data
# =====
def generate_sample_data(num_records=1000):
    years = list(range(1900, 2021))
    data = {
        'record_id': range(1, num_records + 1),
        'year': [random.choice(years) for _ in range(num_records)],
        'temperature_c': [random.uniform(-50, 50) for _ in range(num_records)]
    }
    return pd.DataFrame(data)
```

```

# =====
# 3. Simulate Hive Database & Table in SQLite
# =====
@contextmanager
def sqlite_connection(db_name):
    conn = sqlite3.connect(db_name)
    try:
        yield conn
    finally:
        conn.close()

def setup_hive_like_db():
    db_name = 'weather_hive.db'
    df = generate_sample_data(1000)

    with sqlite_connection(db_name) as conn:
        # Create Hive-like Table
        df.to_sql('weather_data', conn, if_exists='replace', index=False)

        # Create Index (simulating Hive CREATE INDEX)
        conn.execute('CREATE INDEX idx_year ON weather_data(year)')

        # Create View (simulating Hive CREATE VIEW)
        conn.execute("""
            CREATE VIEW positive_temps AS
            SELECT record_id, year, temperature_c
            FROM weather_data
            WHERE temperature_c > 0
        """)

    print(f'Database '{db_name}', table 'weather_data', index 'idx_year', and view 'positive_temps' created successfully.')

# =====
# 4. Create Hive-Like UDF (Function)
# =====
def celsius_to_fahrenheit(temp_c):
    return (temp_c * 9/5) + 32

def register_udf(conn):
    conn.create_function('c_to_f', 1, celsius_to_fahrenheit)
    print("User Defined Function (UDF) 'c_to_f' registered successfully.")

# =====
# 5. Generate Weather Report
# =====
def generate_weather_report():
    db_name = 'weather_hive.db'
    with sqlite_connection(db_name) as conn:
        register_udf(conn)

        # Query Table: Min/Max per Year

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```

query_table = """
    SELECT year,
           MIN(temperature_c) AS min_temp_c,
           MAX(temperature_c) AS max_temp_c
    FROM weather_data
    GROUP BY year
    ORDER BY year
"""
report_df = pd.read_sql_query(query_table, conn)

# Query View: Max Temp in Fahrenheit using UDF
query_view = """
    SELECT year,
           c_to_f(MAX(temperature_c)) AS max_temp_f
    FROM positive_temps
    GROUP BY year
    ORDER BY year
"""
view_df = pd.read_sql_query(query_view, conn)

# Merge Both Results
result = report_df.merge(view_df, on='year', how='left')
result['max_temp_f'] = result['max_temp_f'].round(1)
result['min_temp_c'] = result['min_temp_c'].round(1)
result['max_temp_c'] = result['max_temp_c'].round(1)

return result

# =====
# 6. Main Execution
# =====
if __name__ == "__main__":
    print("Setting up Hive-like environment...")
    setup_hive_like_db()

    print("\nGenerating Weather Temperature Statistics Report...")
    report = generate_weather_report()

    print("\n=== Weather Report ===")
    print("Year\tMin Temp (°C)\tMax Temp (°C)\tMax Temp (°F)")
    print("-" * 50)
    for _, row in report.iterrows():
        print(f"{int(row['year'])}\t{row['min_temp_c']}\t{row['max_temp_c']}\t{row['max_temp_f']}")

    print("\nSample Data from View (positive_temps):")
    with sqlite_connection('weather_hive.db') as conn:
        sample_view = pd.read_sql_query('SELECT * FROM positive_temps LIMIT 5', conn)
        print(sample_view)

```

Expected Output:

Setting up Hive-like environment...

Database 'weather_hive.db', table 'weather_data', index 'idx_year', and view 'positive_temps' created successfully.

Generating Weather Temperature Statistics Report...

User Defined Function (UDF) 'c_to_f' registered successfully.

=== Weather Report ===

Year	Min Temp (°C)	Max Temp (°C)	Max Temp (°F)
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1900	-47.6	49.9	121.9
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1901	-49.1	48.7	119.7
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1902	-45.2	47.8	118.0
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... (truncated) ...

Sample Data from View (positive_temps):

	record_id	year	temperature_c
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0	2	1910	10.34
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1	12	1954	24.76
---	----	------	-------

2	25	1998	3.25
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3	45	2009	47.92
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4	52	1965	17.13
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Result:

The Hive Experiment was successfully created using Python and SQLite to demonstrate database creation, tables, views, indexes, and user-defined functions. It efficiently generated analytical reports showing yearly temperature statistics in both Celsius and Fahrenheit.