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Div: TY-3

Roll No: 26

Batch: B

Subject: DWM

Experiment No 01

AIM : For the objective given below, build Data warehouse/ DataMart.Write detailed Problem statement and design dimensional modeling (Creation of star and snowflake schema) Implementation of all dimension tables and fact table.

Problem statement :

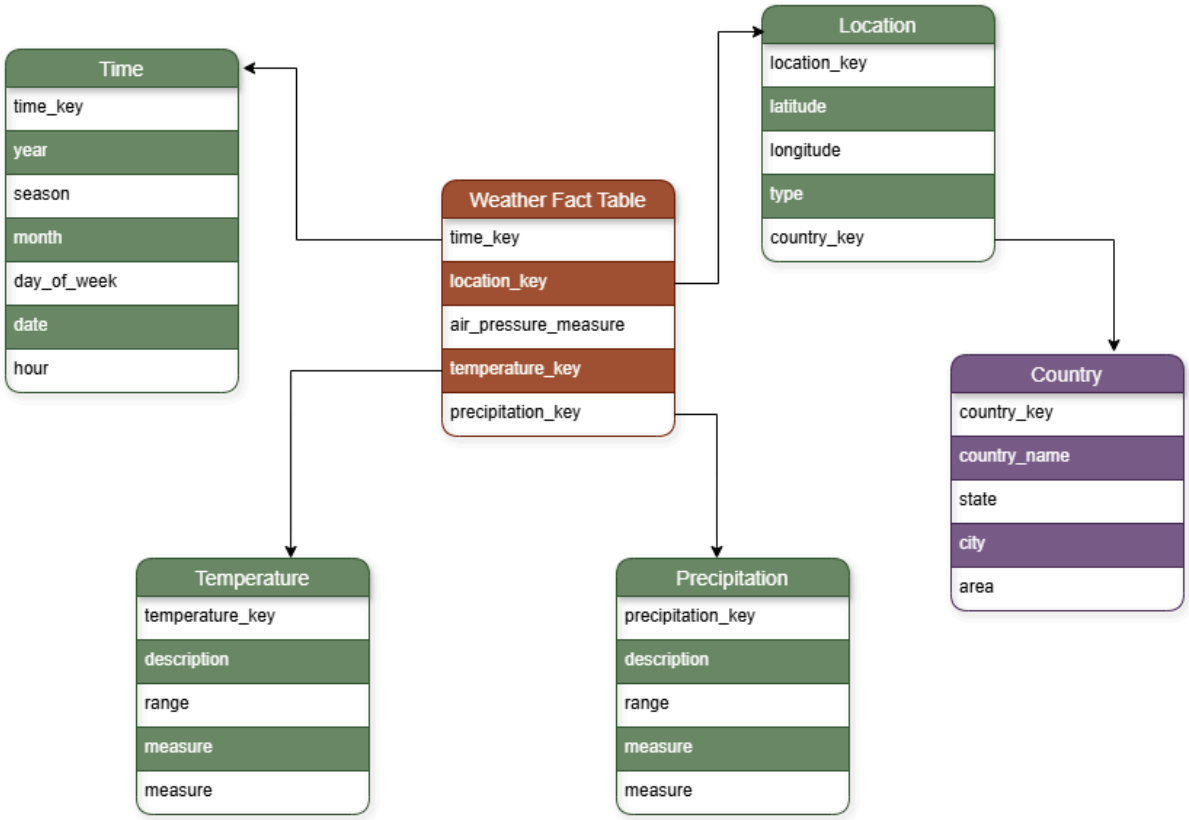
Design a data warehouse for a regional weather bureau. The weather bureau has about 100 probs, which are scattered throughout various land and ocean locations in the region to collect basic weather data, including air pressure, temperature and precipitation at each hour. All data are sent to the central station, which has collected such data for more than 10 years. Design Star schema and Snowflake schema such that it should facilitate efficient querying and online analytical processing and derive general weather patterns in multidimensional space. Explain all aspects of the diagram. Design Star and Snowflake schema for above case.

THEORY :

- ➢ Star Schema: Star schema is the simplest method for arranging data in a data warehouse. It contains a fact table at the center connected to dimension tables around it. Star schema is most effective for quick and simple data query execution.
- ➢ Snowflake Schema: Snowflake schema is a more complex method of storing data in which fact tables, dimension tables and sub-dimension tables are connected through foreign keys. Snowflake is most effective for in-depth data query analyses.

Dimensional Modelling :

(creation of star and snowflake schema)



Code :

```
CREATE TABLE Time (
    time_key INT PRIMARY KEY,
    year INT,
    season VARCHAR(20),
    month INT,
    day_of_week VARCHAR(20),
    dates DATE,
    hour INT
)

CREATE TABLE Country (
    country_key INT PRIMARY KEY,
    country_name VARCHAR(50),
    state VARCHAR(50),
    city VARCHAR(50),
    area VARCHAR(100)
)

CREATE TABLE Location (
    location_key INT PRIMARY KEY,
    latitude DECIMAL(10, 6),
    longitude DECIMAL(10, 6),
```

```
    type VARCHAR(50),
    country_key INT,
    FOREIGN KEY (country_key) REFERENCES Country(country_key)
)

CREATE TABLE Temperature (
    temperature_key INT PRIMARY KEY,
    description VARCHAR(100),
    range VARCHAR(50),
    measure DECIMAL(5,2)
)

CREATE TABLE Precipitation (
    precipitation_key INT PRIMARY KEY,
    description VARCHAR(100),
    range VARCHAR(50),
    measure DECIMAL(5,2)
)

CREATE TABLE WeatherFactTable (
    time_key INT,
    location_key INT,
    air_pressure_measure DECIMAL(5,2),
    temperature_key INT,
    precipitation_key INT,
    PRIMARY KEY (time_key, location_key),
```

```
    FOREIGN KEY (time_key) REFERENCES Time(time_key),
    FOREIGN KEY (location_key) REFERENCES Location(location_key),
    FOREIGN KEY (temperature_key) REFERENCES Temperature(temperature_key),
    FOREIGN KEY (precipitation_key) REFERENCES Precipitation(precipitation_key)
)
```

```
INSERT INTO Time VALUES (1, 2025, 'Winter', 1, 'Monday', TO_DATE('2025/01/28', 'yyyy/mm/dd'), 10)
INSERT INTO Time VALUES (2, 2025, 'Winter', 1, 'Tuesday', TO_DATE('2025/01/28', 'yyyy/mm/dd'), 12)
INSERT INTO Country VALUES (1, 'USA', 'California', 'Los Angeles', 'Downtown')
INSERT INTO Country VALUES (2, 'Canada', 'Ontario', 'Toronto', 'North York')
INSERT INTO Location VALUES (1, 34.0522, -118.2437, 'Urban', 1)
INSERT INTO Location VALUES (2, 43.7001, -79.4163, 'Urban', 2)
INSERT INTO Temperature VALUES (1, 'Cold', '-5 to 5°C', 2.5)
INSERT INTO Temperature VALUES (2, 'Mild', '10 to 20°C', 15.0)
INSERT INTO Precipitation VALUES (1, 'Light Rain', '0 to 5 mm', 3.2)
INSERT INTO Precipitation VALUES (2, 'Heavy Rain', '10 to 50 mm', 25.4)
INSERT INTO WeatherFactTable VALUES (1, 1, 20.25, 1, 1)
INSERT INTO WeatherFactTable VALUES (2, 2, 10.80, 2, 2)
```

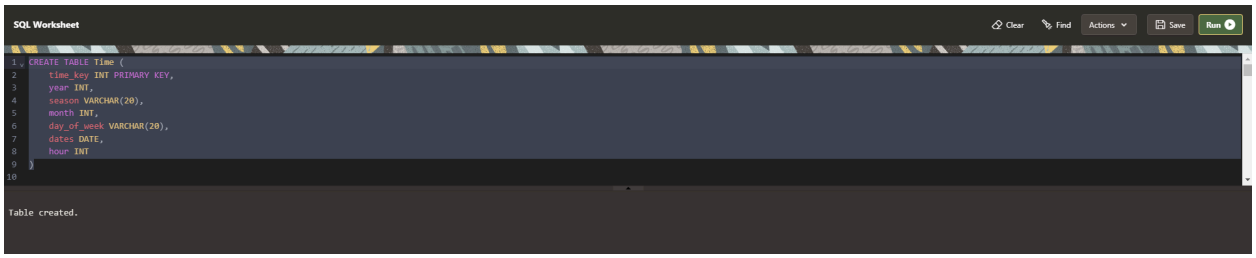
```
SELECT * FROM WeatherFactTable
```

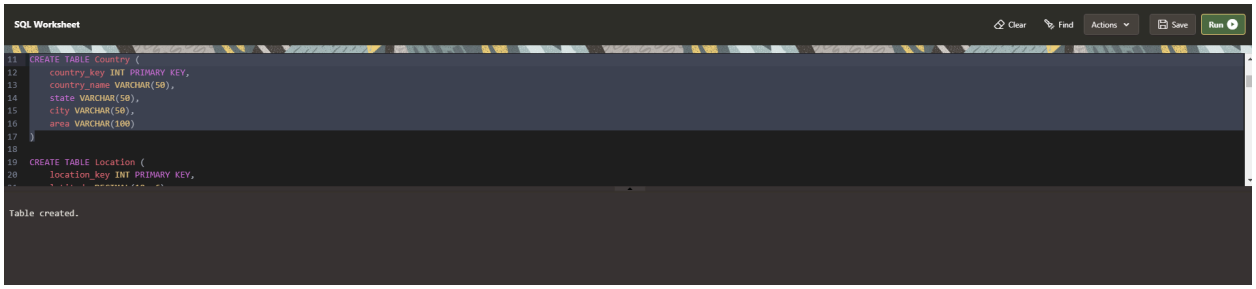
```
SELECT W.*, T.year, T.month, T.dates, L.latitude, L.longitude, C.country_name, Temp.description AS Temperature, Prec.description AS Precipitation
FROM WeatherFactTable W
JOIN Time T ON W.time_key = T.time_key
JOIN Location L ON W.location_key = L.location_key
JOIN Country C ON L.country_key = C.country_key
JOIN Temperature Temp ON W.temperature_key = Temp.temperature_key
JOIN Precipitation Prec ON W.precipitation_key = Prec.precipitation_key
WHERE T.dates = TO_DATE('2025/01/28', 'yyyy/mm/dd')
```

```
SELECT L.location_key, C.city, AVG(W.air_pressure_measure) AS Avg_Pressure
FROM WeatherFactTable W
JOIN Location L ON W.location_key = L.location_key
JOIN Country C ON L.country_key = C.country_key
GROUP BY L.location_key, C.city
```

```
SELECT L.location_key, C.city, P.description, W.air_pressure_measure
FROM WeatherFactTable W
JOIN Location L ON W.location_key = L.location_key
JOIN Country C ON L.country_key = C.country_key
JOIN Precipitation P ON W.precipitation_key = P.precipitation_key
ORDER BY P.measure DESC
```

Output :


SQL Worksheet
Clear
Find
Actions
Save
Run
CREATE TABLE Time (
time_key INT PRIMARY KEY,
year INT,
season VARCHAR(20),
month INT,
day_of_week VARCHAR(20),
dates DATE,
hour INT
)
Table created.


SQL Worksheet
Clear
Find
Actions
Save
Run
CREATE TABLE Country (
country_key INT PRIMARY KEY,
country_name VARCHAR(50),
state VARCHAR(50),
city VARCHAR(50),
area VARCHAR(100)
)
CREATE TABLE Location (
location_key INT PRIMARY KEY,
Table created.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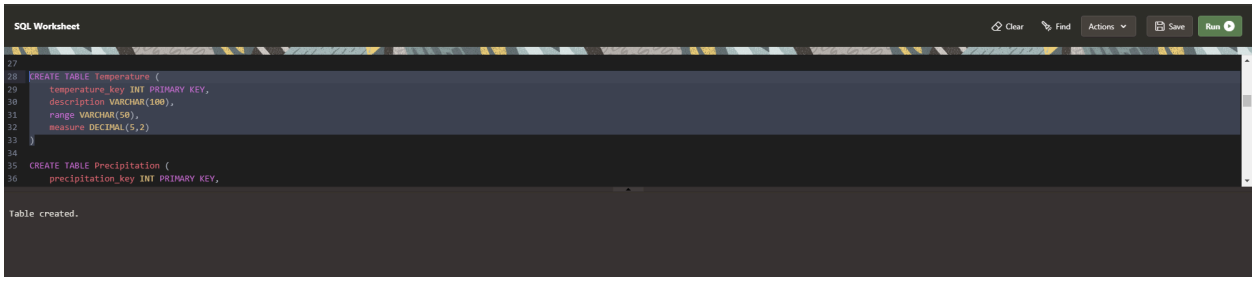
SQL Worksheet
Clear
Find
Actions
Save
Run
CREATE TABLE Location (
location_key INT PRIMARY KEY,
latitude DECIMAL(10, 6),
longitude DECIMAL(10, 6),
type VARCHAR(50),
country_key INT,
FOREIGN KEY (country_key) REFERENCES Country(country_key)
)
Table created.


SQL Worksheet
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CREATE TABLE Temperature (
temperature_key INT PRIMARY KEY,
description VARCHAR(100),
range VARCHAR(50),
measure DECIMAL(5,2)
)
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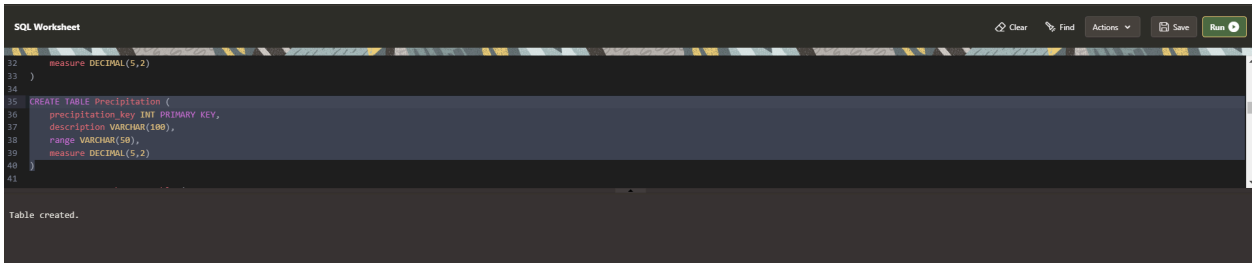
precipitation_key INT PRIMARY KEY,
Table created.


SQL Worksheet
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Find
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Save
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measure DECIMAL(5,2)
)
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precipitation_key INT PRIMARY KEY,
description VARCHAR(100),
range VARCHAR(50),
measure DECIMAL(5,2)
)
Table created.

SQL Worksheet

Clear Find Actions Save Run

```
)

CREATE TABLE WeatherFactTable (
    time_key INT,
    location_key INT,
    air_pressure_measure DECIMAL(5,2),
    temperature_key INT,
    precipitation_key INT,
    PRIMARY KEY (time_key, location_key),
    FOREIGN KEY (time_key) REFERENCES Time(time_key),
    FOREIGN KEY (location_key) REFERENCES Location(location_key),
    FOREIGN KEY (temperature_key) REFERENCES Temperature(temperature_key),
    FOREIGN KEY (precipitation_key) REFERENCES Precipitation(precipitation_key)
)



INSERT INTO Time VALUES (1, 2025, 'Winter', 1, 'Monday', TO_DATE('2025/01/28', 'yyyy/mm/dd'), 10)
INSERT INTO Time VALUES (2, 2025, 'Winter', 1, 'Tuesday', TO_DATE('2025/01/28', 'yyyy/mm/dd'), 12)
INSERT INTO Country VALUES (1, 'USA', 'California', 'Los Angeles', 'Downtown')
```

Table created.

SQL Worksheet

Clear Find Actions Save Run

```
INSERT INTO Time VALUES (1, 2025, 'Winter', 1, 'Monday', TO_DATE('2025/01/28', 'yyyy/mm/dd'), 10);
INSERT INTO Time VALUES (2, 2025, 'Winter', 1, 'Tuesday', TO_DATE('2025/01/28', 'yyyy/mm/dd'), 12);
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INSERT INTO Location VALUES (2, 43.7001, -79.4163, 'Urban', 2);
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INSERT INTO Temperature VALUES (2, 'Mild', '10 to 20°C', 15.0);
INSERT INTO Precipitation VALUES (1, 'Light Rain', '0 to 5 mm', 3.2);
INSERT INTO Precipitation VALUES (2, 'Heavy Rain', '10 to 50 mm', 25.4);
INSERT INTO WeatherFactTable VALUES (1, 1, 20.25, 1, 1);
INSERT INTO WeatherFactTable VALUES (2, 2, 10.80, 2, 2);
```

1 row(s) inserted.

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SQL Worksheet

Clear Find Actions Save Run

```
SELECT * FROM WeatherFactTable


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FROM WeatherFactTable W
JOIN Time T ON W.time_key = T.time_key
JOIN Location L ON W.location_key = L.location_key
JOIN Country C ON L.country_key = C.country_key
JOIN Temperature Temp ON W.temperature_key = Temp.temperature_key
JOIN Precipitation Prec ON W.precipitation_key = Prec.precipitation_key
```

TIME_KEY	LOCATION_KEY	AIR_PRESSURE_MEASURE	TEMPERATURE_KEY	PRECIPITATION_KEY
1	1	20.25	1	1
2	2	10.8	2	2

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2 rows selected.

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SQL Worksheet

Clear Find Actions Save Run

```
74
75
76  SELECT W.*, T.year, T.month, T.dates, L.latitude, L.longitude, C.country_name, Temp.description AS Temperature, Prec.description AS Precipitation
77  FROM WeatherFactTable W
78  JOIN Time T ON W.time_key = T.time_key
79  JOIN Location L ON W.location_key = L.location_key
80  JOIN Country C ON L.country_key = C.country_key
81  JOIN Temperature Temp ON W.temperature_key = Temp.temperature_key
82  JOIN Precipitation Prec ON W.precipitation_key = Prec.precipitation_key
83  WHERE T.dates = TO_DATE('2025/01/28', 'yyyy/mm/dd')
84
```

TIME_KEY	LOCATION_KEY	AIR_PRESSURE_MEASURE	TEMPERATURE_KEY	PRECIPITATION_KEY	YEAR	MONTH	DATES	LATITUDE	LONGITUDE	COUNTRY_NAME	TEMPERATURE	PRECIPITATION
1	1	20.25	1	1	2025	1	28-JAN-25	34.0522	-118.2437	USA	Cold	Light Rain
2	2	10.8	2	2	2025	1	28-JAN-25	43.7001	-79.4163	Canada	Mild	Heavy Rain

Download CSV

2 rows selected.

SQL Worksheet

Clear Find Actions Save Run

```
84
85  SELECT L.location_key, C.city, AVG(W.air_pressure_measure) AS Avg_Pressure
86  FROM WeatherFactTable W
87  JOIN Location L ON W.location_key = L.location_key
88  JOIN Country C ON L.country_key = C.country_key
89  GROUP BY L.location_key, C.city
90
91  SELECT L.location_key, C.city, P.description, W.air_pressure_measure
92  FROM WeatherFactTable W
93  JOIN Location L ON W.location_key = L.location_key
94  JOIN Country C ON L.country_key = C.country_key
```

LOCATION_KEY	CITY	AVG_PRESSURE
1	Los Angeles	20.25
2	Toronto	10.8

Download CSV

2 rows selected.

SQL Worksheet

Clear Find Actions Save Run

```
86  FROM WeatherFactTable W
87  JOIN Location L ON W.location_key = L.location_key
88  JOIN Country C ON L.country_key = C.country_key
89  GROUP BY L.location_key, C.city
90
91  SELECT L.location_key, C.city, P.description, W.air_pressure_measure
92  FROM WeatherFactTable W
93  JOIN Location L ON W.location_key = L.location_key
94  JOIN Country C ON L.country_key = C.country_key
95  JOIN Precipitation P ON W.precipitation_key = P.precipitation_key
96  ORDER BY P.measure DESC
```

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LOCATION_KEY	CITY	DESCRIPTION	AIR_PRESSURE_MEASURE
2	Toronto	Heavy Rain	10.8
1	Los Angeles	Light Rain	20.25

Download CSV

2 rows selected.

Review Question :

1. In a star schema, how is the fact table typically related to the dimension tables?

Ans: In a star schema, the fact table is centrally located and is connected to multiple dimension tables through foreign key relationships, meaning each row in the fact table references one or more corresponding rows in the dimension tables to provide context and descriptive details about the measured data stored in the fact table; essentially, the fact table is the "many" side of a one-to-many relationship with each dimension table.

2. What is the main difference between a star schema and a snowflake schema?

Ans: The primary difference between a star schema and a snowflake schema is that a star schema uses denormalized dimension tables, leading to faster queries but potential data redundancy, while a snowflake schema normalizes dimension tables by breaking them down into multiple related tables, reducing redundancy but potentially increasing query complexity due to more joins required.