DATA WAREHOUSE

(SS G515) PROJECT REPORT

Milk Marketing Company (Amul)

Under the supervision of

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TEAM 07

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INTRODUCTION

WHAT AND WHY ?

A data warehouse is a large, central repository of data that is used to support business intelligence and decision-making processes. It is a system designed to store and manage data from various sources, such as transactional systems, operational databases, and other external sources.

The purpose of a data warehouse is to provide a single, unified view of data that is consistent and reliable. This allows organizations to analyze and extract insights from large amounts of data to support their decision-making processes. By storing historical data, a data warehouse enables organizations to identify trends and patterns over time, which can help in forecasting and planning.

Overall, a data warehouse plays a crucial role in helping organizations to leverage their data assets effectively, gain insights into their operations and customers, and make informed decisions.

PROBLEM STATEMENT

Design a data warehouse for a milk marketing company akin to Amul with a well-defined STAR Schema, information package diagrams and clearly show the business queries implemented on the warehouse.

Structure, store and analyze data associated with :

1. Procurement of milk
2. Manufacturing of milk products from the procured milk
3. Distribution of manufactured milk products to :
    a. Dedicated company outlets
    b. Milk products distributors

BUSINESS REQUIREMENTS

To extract strategic information such as :-

1.) Calculating net profit by considering losses incurred on unsold items.
2.) Calculating net profit that would have been yielded had all items that were manufactured were sold (What if? Analysis and Benchmarking).
3.) Determining which items sell the least at dedicated company outlets with respect to quantity, amount, profit generated.
4.) Calculating the profit earned at each store on a quarterly basis for a given year.
5.) Calculating the difference in quantities of all products produced and sold.
6.) Determining the top suppliers that provided the highest total quantity of milk in a given year.
7.) Determining which plants have the highest and lowest production quantity in a given year.

INFORMATION PACKAGE DIAGRAMS

Milk Procurement

Time	Location	Supplier	Procurement Product
Year	State	Name	Fat Content
Quarter	City	Address	Cost
Month	Pincode	Phone Number	Type
Date		Email	
Day Number			
Facts : Quantity, Procurement Cost			

Milk Products Manufacturing

Time	Location	Plant	Product
Year	State	Name	Name
Quarter	City	Address	Type
Month	Pincode		Sub-type
Date			Selling Price
Day Number			Cost
			Shelf Life
Facts : Quantity, Manufacturing Cost			

Milk Products Distribution

Dedicated Store Outlets

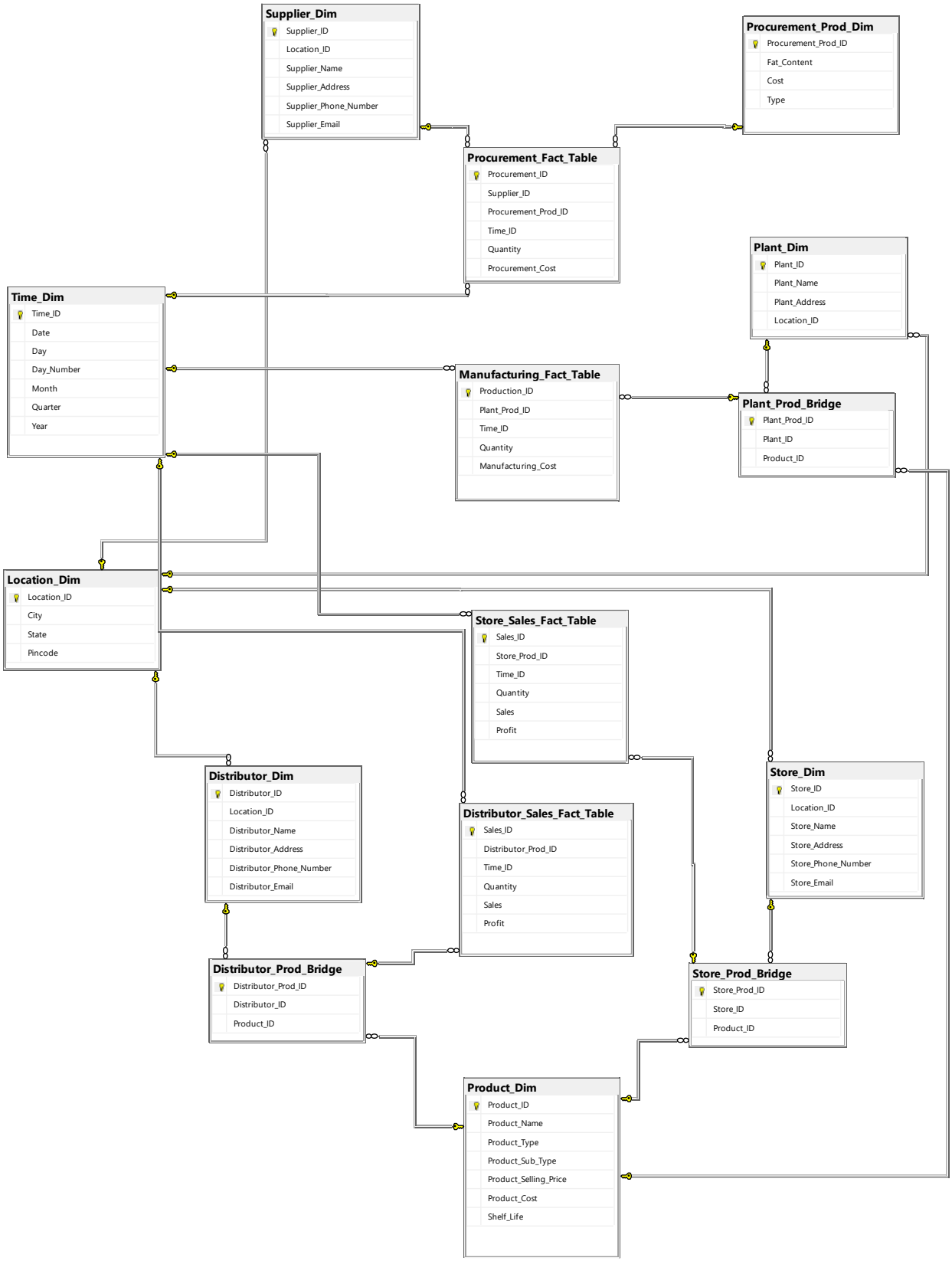
Time	Location	Store	Product
Year	State	Name	Name
Quarter	City	Address	Type
Month	Pincode	Phone Number	Sub-type
Date		Email	Selling Price
Day Number			Cost
			Shelf Life
Facts : Quantity, Sales, Profit			

Milk Products Distributors

Time	Location	Distributor	Product
Year	State	Name	Name
Quarter	City	Address	Type
Month	Pincode	Phone Number	Sub-type
Date		Email	Selling Price
Day Number			Cost
			Shelf Life
Facts : Quantity, Sales, Profit			

STAR SCHEMA

Schema Diagram



Schema Definition

LEGEND
Dimension Table
Fact Table
Bridge Table

Common Dimension Tables :-

1. **Time_Dim Table :** This table stores the dimension of time and is used in all fact tables. This table contains 2 years' worth of data (2021-22). Its columns are :
    a. Time_ID
    b. Date
    c. Day (Mon/Tue/Wed/Thu/Fri/Sat/Sun)
    d. Day_Number (1-730)
    e. Month (1-12)
    f. Quarter (1-4)
    g. Year
    h. Holiday_Flag (1-Holiday, 0-Working Day)

2. **Location_Dim Table :** This table stores the dimension of location and is used in all fact tables. This table contains 4 cities having 4 pincodes each. Its columns are :
    a. Location_ID
    b. City
    c. State
    d. Pincode

1.) Milk Procurement Tables :-

a.) Procurement_Prod_Dim Table : This table stores the dimension of the raw material (milk in this case) and is used in the procurement fact table. This table contains 10 rows. Its columns are :

i.) Procurement_Prod_ID
ii.) Fat_Content (in %)
iii.) Cost (per L)
iv.) Type (Cow/Buffalo)

b.) **Supplier_Dim Table :** This table stores the dimension of the suppliers providing the raw material (milk in this case) and is used in the procurement fact table. This table contains 40 rows. Its columns are :

i.) Supplier_ID
ii.) Location_ID
iii.) Supplier_Name
iv.) Supplier_Address
v.) Supplier_Phone_Number
vi.) Supplier_Email

c.) **Procurement_Fact_Table :** This table stores the facts associated with raw material (milk in this case) procurement. This table contains 200 rows. Its columns are :

i.) Procurement_ID
ii.) Supplier_ID
iii.) Procurement_Prod_ID
iv.) Time_ID
v.) Quantity (in L)
vi.) Procurement_Cost

Table common for 2 & 3 :-

Product_Dim Table : This table stores the dimension of the products manufactured / to be manufactured from raw material. It is used in all bridge tables. This table contains 25 rows. Its columns are :

i.) Product_ID
ii.) Product_Name
iii.) Product_Type (Cow Milk/Buffalo Milk /Chocolate/Ice-Cream/Butter/Cheese/Cream/Ghee/Curd)
iv.) Product_Sub_Type (Milk - Pasteurised, Skimmed, Toned ; Chocolate - Milk, Dark ; Ice-Cream : Cone, Family Pack, Cup ; Butter : Salted, Unsalted ; Cream : Fresh Cream , Ghee : Cow Ghee, Ghee , Curd : Curd, Sweet)
v.) Product_Selling_Price
vi.) Product_Cost (Individual Product Cost)
vii.) Shelf_Life (In days)

2.) Manufacturing Tables :-

a.) Plant_Dim Table : This table stores the dimension of the manufacturing plants processing the raw material into the final milk products to be sold. This table contains 4 rows. Its columns are :

i.) Plant_ID
ii.) Plant_Name
iii.) Plant_Address
iv.) Location_ID

b.) Plant_Prod_Bridge Table : This bridge table stores the mapping between manufacturing plants and products indicating which products are manufactured at which manufacturing plants and is used in the manufacturing fact table. This table contains 100 rows. Its columns are :

i.) Plant_Prod_ID
ii.) Plant_ID
iii.) Product_ID

c.) **Manufacturing_Fact_Table :** This table stores the facts associated with the manufacturing of milk products from raw material. This table contains 200 rows. Its columns are :

i.) Production_ID
ii.) Plant_Prod_ID
iii.) Time_ID
iv.) Quantity (Units)
v.) Manufacturing_Cost (Cost of total product amount produced at a plant)

3.) Distribution Tables :-

a.) Store_Dim Table : This table stores the dimension of the dedicated company outlets where the manufactured milk products are sold and is used in the store sales fact table. This table contains 40 rows. Its columns are :

i.) Store_ID
ii.) Location_ID
iii.) Store_Name
iv.) Store_Address
v.) Store_Phone_Number

vi.) Store_Email

b.) **Distributor_Dim Table :** This table stores the dimension of the Milk products distributors where the manufactured milk products are distributed and is used in the distributor sales fact table. This table contains 20 rows. Its columns are :

i.) Distributor_ID
ii.) Location_ID
iii.) Distributor_Name
iv.) Distributor_Address
v.) Distributor_Phone_Number
vi.) Distributor_Email

c.) **Store_Prod_Bridge Table :** This bridge table stores the mapping between company stores and products indicating which products are sold at which store and is used in the store sales fact table. This table contains 1000 rows. Its columns are :

i.) Store_Prod-ID
ii.) Store_ID
iii.) Product_ID

d.) **Distributor_Prod_Bridge Table :** This bridge table stores the mapping between distributors and products indicating which products are sold at which distributor and is used in the distributor sales fact table. This table contains 200 rows. Its columns are :

i.) Distributor_Prod_ID
ii.) Distributor_ID
iii.) Product_ID

e.) **Store_Sales_Fact_Table :** This table stores the facts associated with the sales of milk products from different company outlets. This table contains 200 rows. Its columns are :

i.) Sales_ID
ii.) Store_Prod_ID
iii.) Time_ID
iv.) Quantity (Units)
v.) Sales
vi.) Profit

f.) **Distributor_Sales_Fact_Table :** This table stores the facts associated with the sales of milk products to different milk distributors. This table contains 400 rows. Its columns are :

i.) Sales_ID
ii.) Distributor_Prod_ID
iii.) Time_ID
iv.) Quantity (Units)
v.) Sales
vi.) Profit

BUSINESS QUERIES

1. **Calculate Net profit by subtracting losses on unsold items from total profit earned.**

Query :-

```
DECLARE @Total_Sales DECIMAL(10,2);
SET @Total_Sales = (SELECT SUM(Sales) from Store_Sales_Fact_Table) + (SELECT
SUM(Sales) from Distributor_Sales_Fact_Table)

-- Manufacturing cost involves the costs associated with both sold and unsold items
as all items were manufactured prior to distribution
DECLARE @Total_Manufacturing_Cost DECIMAL(10,2);
SET @Total_Manufacturing_Cost = (SELECT SUM(Manufacturing_Cost) from
Manufacturing_Fact_Table)

-- Subtracting sales and manufacturing cost will also take the manufacturing costs
associated with unsold items into account
SELECT @Total_Sales-@Total_Manufacturing_Cost AS 'Net Profit'
```

Output :-

	Net Profit
1	4752803.00

2. **Calculate Net profit that would have been yielded had all items that were manufactured were sold (What if? Analysis and Benchmarking).**

Query :-

```
/* CREATING TEMPORARY TABLE :- */

SELECT MFT.Quantity * PD.Product_Selling_Price AS Benchmark_Sales INTO
#TEMP_TABLE FROM Manufacturing_Fact_Table MFT INNER JOIN
Plant_Prod_Bridge PPB ON MFT.Plant_Prod_ID = PPB.Plant_Prod_ID
INNER JOIN Product_Dim PD ON PD.Product_ID = PPB.Product_ID

DECLARE @Total_Sales_Benchmark DECIMAL(10,2);
SET @Total_Sales_Benchmark = (SELECT SUM(Benchmark_Sales) from
#TEMP_TABLE)
```

-- Manufacturing cost involves the costs associated with both sold and unsold items as all items were manufactured prior to distribution
DECLARE @Total_Manufacturing_Cost DECIMAL(10,2);
SET @Total_Manufacturing_Cost = (SELECT SUM(Manufacturing_Cost) from Manufacturing_Fact_Table)

-- Subtracting sales and manufacturing cost will also take the manufacturing costs associated with unsold items into account
SELECT @Total_Sales_Benchmark-@Total_Manufacturing_Cost AS 'Net Profit (Benchmark)'

Output :-

	Net Profit (Benchmark)
1	11214400.00

3. Calculate Net profit by subtracting losses on unsold items from total profit earned per year.

Query :-

```
/* CREATING TEMPORARY TABLE FOR STORES :- */
SELECT SFT.Sales,TD.Year INTO #TEMP_TABLE_STORE_YEARS FROM
Store_Sales_Fact_Table SFT INNER JOIN Time_Dim TD ON SFT.Time_ID=TD.Time_ID
SELECT SUM(Sales) AS 'Yearly Sales',Year INTO
#TEMP_TABLE_YEARLY_STORE_SALES FROM #TEMP_TABLE_STORE_YEARS
GROUP BY Year

/* CREATING TEMPORARY TABLE FOR DISTRIBUTORS :- */
SELECT SFT.Sales,TD.Year INTO #TEMP_TABLE_DISTRIBUTOR_YEARS FROM
Distributor_Sales_Fact_Table SFT INNER JOIN Time_Dim TD ON
SFT.Time_ID=TD.Time_ID
SELECT SUM(Sales) AS 'Yearly Sales',Year INTO
#TEMP_TABLE_YEARLY_DISTRIBUTOR_SALES FROM
#TEMP_TABLE_DISTRIBUTOR_YEARS GROUP BY Year

/* CREATING TEMPORARY TABLE FOR SUM :- */
SELECT Year, SUM([Yearly Sales]) AS TotalSales INTO
#TEMP_TABLE_YEARLY_TOTAL_SALES
FROM (
   SELECT Year, [Yearly Sales]
   FROM #TEMP_TABLE_YEARLY_DISTRIBUTOR_SALES
   UNION ALL
   SELECT Year, [Yearly Sales]
   FROM #TEMP_TABLE_YEARLY_STORE_SALES
) AS CombinedSales
GROUP BY Year;


/* CREATING TEMPORARY TABLE FOR MANUFACTURING COST :- */
```

```
SELECT MFT.Manufacturing_Cost,TD.Year INTO #TEMP_TABLE_COST_YEARS FROM
Manufacturing_Fact_Table MFT INNER JOIN Time_Dim TD ON
MFT.Time_ID=TD.Time_ID
SELECT SUM(Manufacturing_Cost) AS 'Yearly Cost',Year INTO
#TEMP_TABLE_YEARLY_COST FROM #TEMP_TABLE_COST_YEARS GROUP BY Year

SELECT t1.Year, (t1.TotalSales - t2.[Yearly Cost]) AS 'Difference'
FROM #TEMP_TABLE_YEARLY_TOTAL_SALES t1
INNER JOIN #TEMP_TABLE_YEARLY_COST t2 ON t1.Year = t2.Year
```

Output :-

	Year	Difference
1	2021	4200632.00
2	2022	552171.00

4. **See which items sell the least at stores with respect to :-**
    a. **Quantity**
    b. **Amount**
    c. **Profit Generated**

Queries :-

```
--a.) Quantity
SELECT PD.Product_Name, SUM(SFT.Quantity) AS Total_Sales_in_Units FROM
Store_Sales_Fact_Table SFT INNER JOIN Store_Prod_Bridge SB ON
SB.Store_Prod_ID = SFT.Store_Prod_ID INNER JOIN Product_Dim PD ON
SB.Product_ID = PD.Product_ID GROUP BY Product_Name ORDER BY
Total_Sales_in_Units ASC;

--b.) Amount
SELECT PD.Product_Name, SUM(SFT.Sales) AS Total_Sales_in_INR FROM
Store_Sales_Fact_Table SFT INNER JOIN Store_Prod_Bridge SB ON
SB.Store_Prod_ID = SFT.Store_Prod_ID INNER JOIN Product_Dim PD ON
SB.Product_ID = PD.Product_ID GROUP BY Product_Name ORDER BY
Total_Sales_in_INR ASC;

--c.) Profit Generated
SELECT PD.Product_Name, SUM(SFT.Profit) AS Total_Profit_in_INR FROM
Store_Sales_Fact_Table SFT INNER JOIN Store_Prod_Bridge SB ON
SB.Store_Prod_ID = SFT.Store_Prod_ID INNER JOIN Product_Dim PD ON
SB.Product_ID = PD.Product_ID GROUP BY Product_Name ORDER BY
Total_Profit_in_INR ASC;
```

Outputs :-

a.)

	Product_ID	Product_Name	Total_Sales_in_Units
1	10	Amul Dark Chocolate 150G	784
2	1	Amul A2 Cow Milk 1L	860
3	25	Amul Mishti Doi 200ml	1232
4	3	Amul Slim Trim 1L	1365
5	7	Amul Milk Chocolate 150G	1380
6	11	Amul Chocolate Ice-Cream	2440
7	8	Amul Milk Chocolate 40G	2514
8	24	Amul Curd 200ml	3132
9	15	Amul Butterscotch Ice-Cream 1L	3150
10	12	Amul Chocolate Ice-Cream 1L	4300
11	13	Amul Chocolate Ice-Cream	4305
12	19	Amul Ghee 1L	4740
13	2	Amul Cow Milk 1L	5272
14	14	Amul Butterscotch Ice-Cream	6330
15	4	Amul Taaza 1L	7632
16	22	Amul Shrikhand 50G	8118
17	5	Amul Gold 1L	8400
18	9	Amul Dark Chocolate 40G	8520
19	21	Amul Fresh Cream 25G	9633
20	16	Amul Butterscotch Ice-Cream	9693
21	23	Amul Lassi 200ml	10584
22	17	Amul Butter 200G	13430
23	18	Amul Butter Unsalted 200G	19596
24	20	Amul Cow Ghee 1L	22000
25	6	Amul Fruit N Nut Chocolate 40G	33566

b.)

	Product_ID	Product_Name	Total_Sales_in_INR
1	25	Amul Mishti Doi 200ml	36960.00
2	3	Amul Slim Trim 1L	57330.00
3	24	Amul Curd 200ml	62640.00
4	8	Amul Milk Chocolate 40G	62850.00
5	1	Amul A2 Cow Milk 1L	73100.00
6	10	Amul Dark Chocolate 150G	78400.00
7	11	Amul Chocolate Ice-Cream	85400.00
8	13	Amul Chocolate Ice-Cream	86100.00
9	7	Amul Milk Chocolate 150G	138000.00
10	22	Amul Shrikhand 50G	162360.00
11	16	Amul Butterscotch Ice-Cream	193860.00
12	23	Amul Lassi 200ml	211680.00
13	9	Amul Dark Chocolate 40G	213000.00
14	14	Amul Butterscotch Ice-Cream	221550.00
15	21	Amul Fresh Cream 25G	240825.00
16	2	Amul Cow Milk 1L	295232.00
17	15	Amul Butterscotch Ice-Cream 1L	393750.00
18	4	Amul Taaza 1L	412128.00
19	12	Amul Chocolate Ice-Cream 1L	537500.00
20	5	Amul Gold 1L	554400.00
21	17	Amul Butter 200G	805800.00
22	6	Amul Fruit N Nut Chocolate 40G	839150.00
23	18	Amul Butter Unsalted 200G	1567680.00
24	19	Amul Ghee 1L	2370000.00
25	20	Amul Cow Ghee 1L	12100000.00

c.)

	Product_ID	Product_Name	Total_Profit_in_INR
1	25	Amul Mishti Doi 200ml	7392.00
2	3	Amul Slim Trim 1L	10920.00
3	24	Amul Curd 200ml	12528.00
4	8	Amul Milk Chocolate 40G	12570.00
5	1	Amul A2 Cow Milk 1L	14620.00
6	10	Amul Dark Chocolate 150G	15680.00
7	11	Amul Chocolate Ice-Cream	17080.00
8	13	Amul Chocolate Ice-Cream	17220.00
9	7	Amul Milk Chocolate 150G	27600.00
10	22	Amul Shrikhand 50G	32472.00
11	16	Amul Butterscotch Ice-Cream	38772.00
12	23	Amul Lassi 200ml	42336.00
13	9	Amul Dark Chocolate 40G	42600.00
14	14	Amul Butterscotch Ice-Cream	44310.00
15	21	Amul Fresh Cream 25G	48165.00
16	2	Amul Cow Milk 1L	57992.00
17	15	Amul Butterscotch Ice-Cream 1L	78750.00
18	4	Amul Taaza 1L	83952.00
19	12	Amul Chocolate Ice-Cream 1L	107500.00
20	5	Amul Gold 1L	109200.00
21	17	Amul Butter 200G	161160.00
22	6	Amul Fruit N Nut Chocolate 40G	167830.00
23	18	Amul Butter Unsalted 200G	313536.00
24	19	Amul Ghee 1L	474000.00
25	20	Amul Cow Ghee 1L	2420000.00

5. What is the profit earned at each store on a quarterly basis for the year 2022 ?

Query :-

```
SELECT SPB.Store_ID, TD.Quarter, SUM(SSFT.Profit) AS 'Total Profit' INTO
#TEMP_TABLE FROM Store_Sales_Fact_Table SSFT
INNER JOIN Time_Dim TD ON SSFT.Time_ID=TD.Time_ID INNER JOIN
Store_Prod_Bridge SPB ON SSFT.Store_Prod_ID=SPB.Store_Prod_ID
WHERE TD.Year = 2022 GROUP BY SPB.Store_ID, TD.Quarter

SELECT Store_ID, Quarter, SUM([Total Profit]) AS 'Quarterly Profit' FROM
#TEMP_TABLE GROUP BY Store_ID,Quarter ORDER BY Quarter ASC
```

Output :-

	Store_ID	Quarter	Quarterly Profit
1	3	1	12910.00
2	4	1	13992.00
3	6	1	7249.00
4	9	1	10954.00
5	10	1	6048.00
6	11	1	220000.00
7	13	1	4600.00
8	14	1	16116.00
9	17	1	3550.00
10	18	1	1708.00
11	20	1	4431.00
12	21	1	2184.00
13	22	1	9100.00
14	24	1	4308.00
15	26	1	9100.00
16	27	1	1392.00
17	29	1	1708.00
18	31	1	1708.00
19	32	1	220000.00
20	35	1	3705.00
21	36	1	26128.00
22	38	1	27184.00
23	39	1	1056.00
24	4	2	2095.00
25	8	2	6048.00
26	12	2	9747.00
27	14	2	4431.00
28	16	2	6048.00
29	17	2	6048.00

	Store_ID	Quarter	Quarterly Profit
30	19	2	9100.00
31	20	2	9100.00
32	22	2	12708.00
33	29	2	99108.00
34	31	2	3550.00
35	32	2	96192.00
36	33	2	42244.00
37	34	2	3920.00
38	35	2	4308.00
39	1	3	9100.00
40	5	3	3705.00
41	6	3	17600.00
42	7	3	6526.00
43	8	3	3550.00
44	9	3	1708.00
45	13	3	7916.00
46	14	3	16116.00
47	15	3	1708.00
48	19	3	13992.00
49	22	3	53750.00
50	23	3	16116.00
51	26	3	26128.00
52	29	3	233992.00
53	32	3	220000.00
54	34	3	4431.00
55	35	3	26128.00
56	36	3	1392.00
57	37	3	7249.00
58	38	3	220000.00

	Store_ID	Quarter	Quarterly Profit
47	15	3	1708.00
48	19	3	13992.00
49	22	3	53750.00
50	23	3	16116.00
51	26	3	26128.00
52	29	3	233992.00
53	32	3	220000.00
54	34	3	4431.00
55	35	3	26128.00
56	36	3	1392.00
57	37	3	7249.00
58	38	3	220000.00
59	2	4	26128.00
60	4	4	94800.00
61	6	4	3550.00
62	8	4	3705.00
63	11	4	4308.00
64	12	4	1056.00
65	14	4	4190.00
66	16	4	5487.00
67	18	4	15399.00
68	27	4	25242.00
69	28	4	2184.00
70	31	4	3444.00
71	32	4	3705.00
72	33	4	12958.00
73	34	4	19560.00
74	36	4	9100.00
75	39	4	11250.00

6. Determine the quantities of all products produced vs the quantities of all products sold.

Query :-

```
-- Products produced
SELECT PD.Product_ID, PD.Product_Name, SUM(MFT.Quantity) AS 'Quantity
Produced (in units)' FROM Manufacturing_Fact_Table MFT INNER JOIN
Plant_Prod_Bridge PPB ON MFT.Plant_Prod_ID = PPB.Plant_Prod_ID
INNER JOIN Product_Dim PD ON PD.Product_ID = PPB.Product_ID GROUP BY
PD.Product_ID,PD.Product_Name

-- Products Sold at stores
SELECT PD.Product_ID, PD.Product_Name, SUM(SFT.Quantity) AS 'Quantity Sold (in
units)' FROM Store_Sales_Fact_Table SFT INNER JOIN Store_Prod_Bridge SPB ON
SFT.Store_Prod_ID = SPB.Store_Prod_ID
INNER JOIN Product_Dim PD ON PD.Product_ID = SPB.Product_ID GROUP BY
PD.Product_ID,PD.Product_Name

-- Products Sold to distributors
SELECT PD.Product_ID, PD.Product_Name, SUM(DFT.Quantity) AS 'Quantity Sold (in
units)' FROM Distributor_Sales_Fact_Table DFT INNER JOIN Distributor_Prod_Bridge
DPB ON DFT.Distributor_Prod_ID = DPB.Distributor_Prod_ID
INNER JOIN Product_Dim PD ON PD.Product_ID = DPB.Product_ID GROUP BY
PD.Product_ID,PD.Product_Name
```

Output :-

	Product_ID	Product_Name	Quantity Produced (in units)
1	1	Amul A2 Cow Milk 1L	14500
2	2	Amul Cow Milk 1L	27100
3	3	Amul Slim Trim 1L	7800
4	4	Amul Taaza 1L	47700
5	5	Amul Gold 1L	20000
6	6	Amul Fruit N Nut Chocolate 40G	59400
7	7	Amul Milk Chocolate 150G	6900
8	8	Amul Milk Chocolate 40G	8900
9	9	Amul Dark Chocolate 40G	19700
10	10	Amul Dark Chocolate 150G	8100
11	11	Amul Chocolate Ice-Cream	10400
12	12	Amul Chocolate Ice-Cream 1L	43000
13	13	Amul Chocolate Ice-Cream	26900
14	14	Amul Butterscotch Ice-Cream	25300
15	15	Amul Butterscotch Ice-Cream 1L	7200
16	16	Amul Butterscotch Ice-Cream	32300
17	17	Amul Butter 200G	38600
18	18	Amul Butter Unsalted 200G	49000
19	19	Amul Ghee 1L	23700
20	20	Amul Cow Ghee 1L	30000
21	21	Amul Fresh Cream 25G	28000
22	22	Amul Shrikhand 50G	21900
23	23	Amul Lassi 200ml	33600
24	24	Amul Curd 200ml	8700
25	25	Amul Mishti Doi 200ml	4500

	Product_ID	Product_Name	Quantity Sold (in units)
1	1	Amul A2 Cow Milk 1L	860
2	2	Amul Cow Milk 1L	5272
3	3	Amul Slim Trim 1L	1365
4	4	Amul Taaza 1L	7632
5	5	Amul Gold 1L	8400
6	6	Amul Fruit N Nut Chocolate 40G	33566
7	7	Amul Milk Chocolate 150G	1380
8	8	Amul Milk Chocolate 40G	2514
9	9	Amul Dark Chocolate 40G	8520
10	10	Amul Dark Chocolate 150G	784
11	11	Amul Chocolate Ice-Cream	2440
12	12	Amul Chocolate Ice-Cream 1L	4300
13	13	Amul Chocolate Ice-Cream	4305
14	14	Amul Butterscotch Ice-Cream	6330
15	15	Amul Butterscotch Ice-Cream 1L	3150
16	16	Amul Butterscotch Ice-Cream	9693
17	17	Amul Butter 200G	13430
18	18	Amul Butter Unsalted 200G	19596
19	19	Amul Ghee 1L	4740
20	20	Amul Cow Ghee 1L	22000
21	21	Amul Fresh Cream 25G	9633
22	22	Amul Shrikhand 50G	8118
23	23	Amul Lassi 200ml	10584
24	24	Amul Curd 200ml	3132
25	25	Amul Mishti Doi 200ml	1232

	Product_ID	Product_Name	Quantity Sold (in units)
1	1	Amul A2 Cow Milk 1L	10750
2	2	Amul Cow Milk 1L	19111
3	3	Amul Slim Trim 1L	4095
4	4	Amul Taaza 1L	30528
5	5	Amul Gold 1L	5600
6	6	Amul Fruit N Nut Chocolate 40G	25820
7	7	Amul Milk Chocolate 150G	3450
8	8	Amul Milk Chocolate 40G	4609
9	9	Amul Dark Chocolate 40G	9230
10	10	Amul Dark Chocolate 150G	5684
11	11	Amul Chocolate Ice-Cream	5856
12	12	Amul Chocolate Ice-Cream 1L	34400
13	13	Amul Chocolate Ice-Cream	17220
14	14	Amul Butterscotch Ice-Cream	11394
15	15	Amul Butterscotch Ice-Cream 1L	4050
16	16	Amul Butterscotch Ice-Cream	19386
17	17	Amul Butter 200G	17459
18	18	Amul Butter Unsalted 200G	24495
19	19	Amul Ghee 1L	14220
20	20	Amul Cow Ghee 1L	8000
21	21	Amul Fresh Cream 25G	15561
22	22	Amul Shrikhand 50G	7216
23	23	Amul Lassi 200ml	19656
24	24	Amul Curd 200ml	3828
25	25	Amul Mishti Doi 200ml	2816

7. Determine the top 5 suppliers that provided the highest total quantity of products in 2022.

Query :-

```
SELECT TOP 5
   Supplier_Name,
   SUM(Quantity) AS Total_Quantity
FROM Procurement_Fact_Table
JOIN Supplier_Dim ON Procurement_Fact_Table.Supplier_ID =
Supplier_Dim.Supplier_ID INNER JOIN Time_Dim TD ON
Procurement_Fact_Table.Time_ID = TD.Time_ID
```

```
WHERE TD.Year = 2022
GROUP BY Supplier_Name
ORDER BY 2 DESC;
```

Output :-

	Supplier_Name	Total_Quantity
1	Anjali Milk Suppliers	30300
2	Arti Milk Suppliers	26400
3	Geeta Milk Suppliers	26100
4	Jayant Milk Suppliers	24150
5	Rohit Milk Suppliers	18300

8. **Which plant has the highest and lowest production quantity in 2021?**

Query :-

```
SELECT TOP 1
   Plant_Prod_Bridge.Plant_ID,
   SUM(Manufacturing_Fact_Table.Quantity) AS Total_Quantity
FROM Manufacturing_Fact_Table
JOIN Plant_Prod_Bridge ON Manufacturing_Fact_Table.Plant_Prod_ID =
Plant_Prod_Bridge.Plant_Prod_ID
JOIN Time_Dim ON Manufacturing_Fact_Table.Time_ID = Time_Dim.Time_ID
WHERE Time_Dim.Year = 2021
GROUP BY Plant_Prod_Bridge.Plant_ID
ORDER BY Total_Quantity DESC; -- plant with highest production quantity


SELECT TOP 1
   Plant_Prod_Bridge.Plant_ID,
   SUM(Manufacturing_Fact_Table.Quantity) AS Total_Quantity
FROM Manufacturing_Fact_Table
JOIN Plant_Prod_Bridge ON Manufacturing_Fact_Table.Plant_Prod_ID =
Plant_Prod_Bridge.Plant_Prod_ID
JOIN Time_Dim ON Manufacturing_Fact_Table.Time_ID = Time_Dim.Time_ID
WHERE Time_Dim.Year = 2021
GROUP BY Plant_Prod_Bridge.Plant_ID
ORDER BY Total_Quantity ASC; -- plant with lowest production quantity
```

Output :-

	Plant_ID	Total_Quantity
1	4	116000

	Plant_ID	Total_Quantity
1	1	51900