Project Demo

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Schema Schemers

Introduction

Current standard SQL does not allow for users to compare aggregates or groups within a single query using GROUP BY. This project extends SQL to allow users to utilize groups in multiple ways within a single query to avoid unnecessary nested queries or joins.

Agenda

01

Project Architecture

02

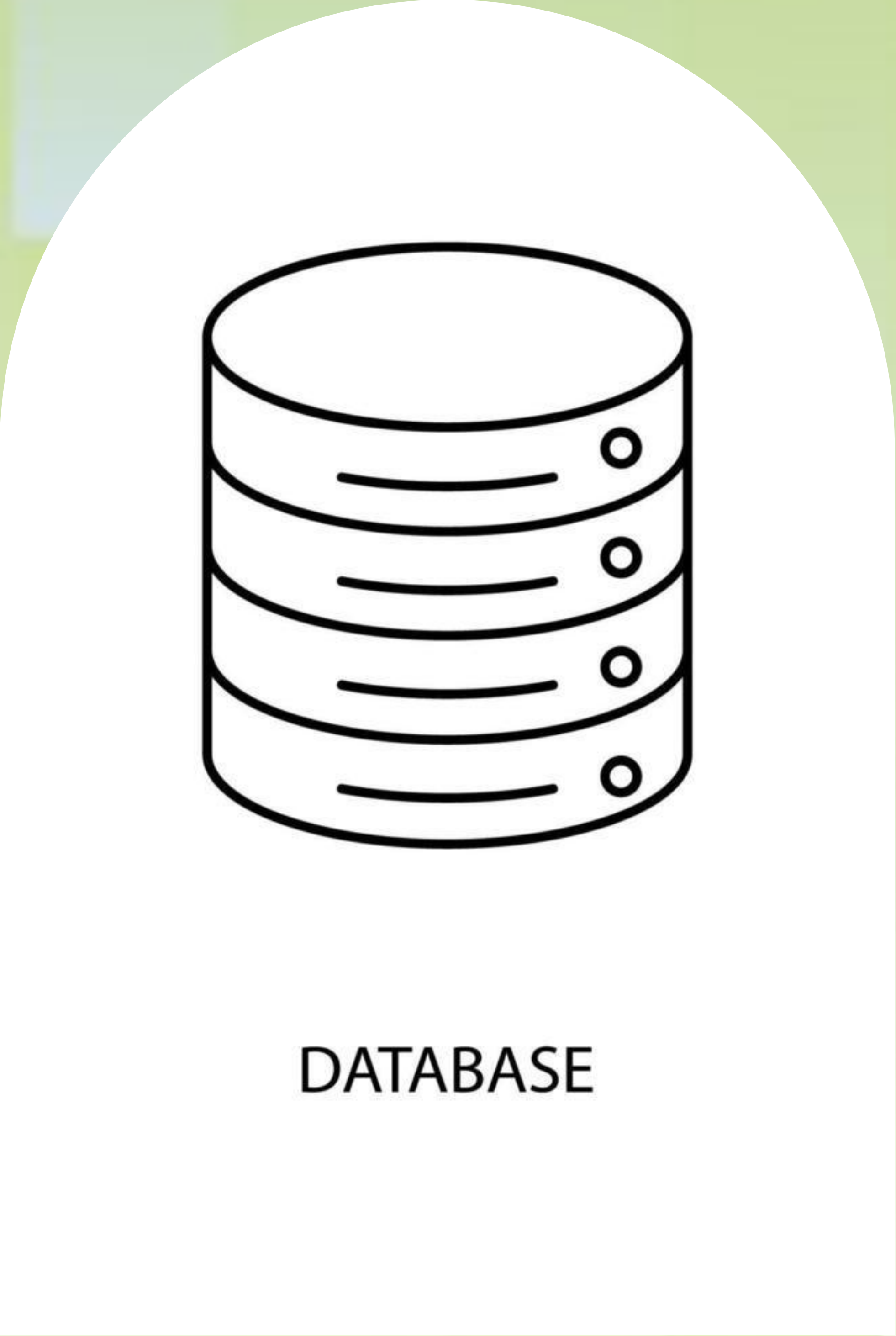
Tools and Methodology

03

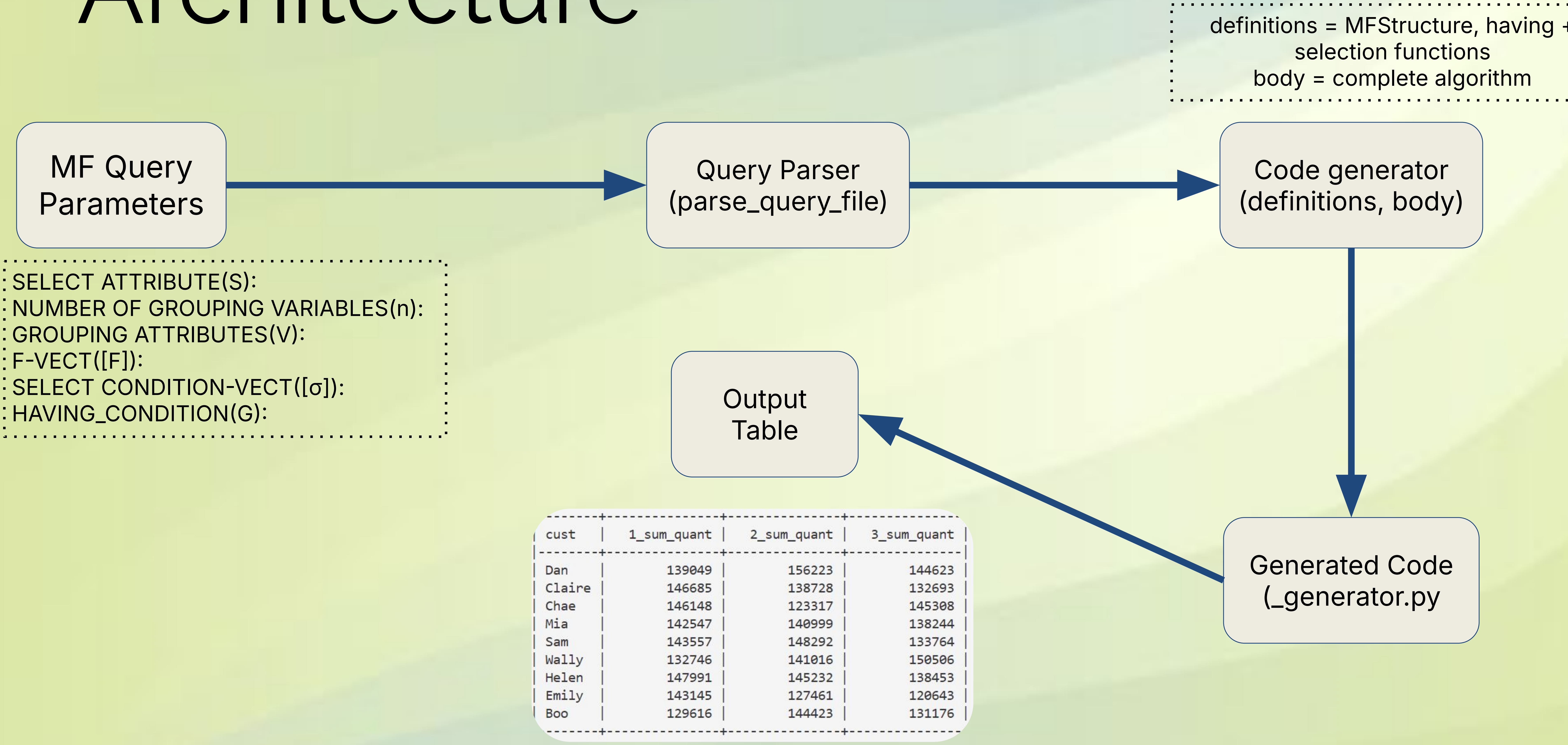
Limitations

04

Demo



Architecture



definitions = MFStructure, having +
selection functions
body = complete algorithm
MF Query Parameters
Query Parser (parse_query_file)
Code generator (definitions, body)
Output Table
Generated Code (_generator.py

SELECT ATTRIBUTE(S):
NUMBER OF GROUPING VARIABLES(n):
GROUPING ATTRIBUTES(V):
F-VECT([F]):
SELECT CONDITION-VECT([σ]):
HAVING_CONDITION(G):

```
--------+-------------+-------------+-------------
 cust   | 1_sum_quant | 2_sum_quant | 3_sum_quant |
|-------+-------------+-------------+-------------|
| Dan    |      139049 |      156223 |      144623 |
| Claire |      146685 |      138728 |      132693 |
| Chae   |      146148 |      123317 |      145308 |
| Mia    |      142547 |      140999 |      138244 |
| Sam    |      143557 |      148292 |      133764 |
| Wally  |      132746 |      141016 |      150506 |
| Helen  |      147991 |      145232 |      138453 |
| Emily  |      143145 |      127461 |      120643 |
| Boo    |      129616 |      144423 |      131176 |
--------+-------------+-------------+-------------
```

Tools and Methodology

Queries are presented by each different phi attribute. Looking like:

```
SELECT ATTRIBUTE(S):
cust, 1_sum_quant
NUMBER OF GROUPING VARIABLES(V):
2
GROUPING ATTRIBUTES(V):
cust
F-VECT([F]):
1_sum_quant, 1_avg_quant
2_avg_quant
SELECT CONDITION-VECT([σ]):
1.state=’NY’
2.state=’NJ’
HAVING_CONDITION(G):
0
```

Our entire code is done within python and reads in an input text file if provided by user. Our code utilizes different python libraries/modules:

psycopg2

This allows python to work with the databases in postgres

Tabulate

Allows our queries to present a table for comparison purposes.

re Library

to differentiate the different aggregates and patterns

Limitations

Dependent Aggregates that haven't occurred yet

There is no error checking for if a user presents 1.quant > 2_sum_quant in the pred list

Does not support table joins

Takes the output of select statement for queries - no way to tell if a query needs a join unless input by user in future

Attributes for aggregates

Does not do auto-joins for queries such as "get dates of max quantities", where duplicates can occur

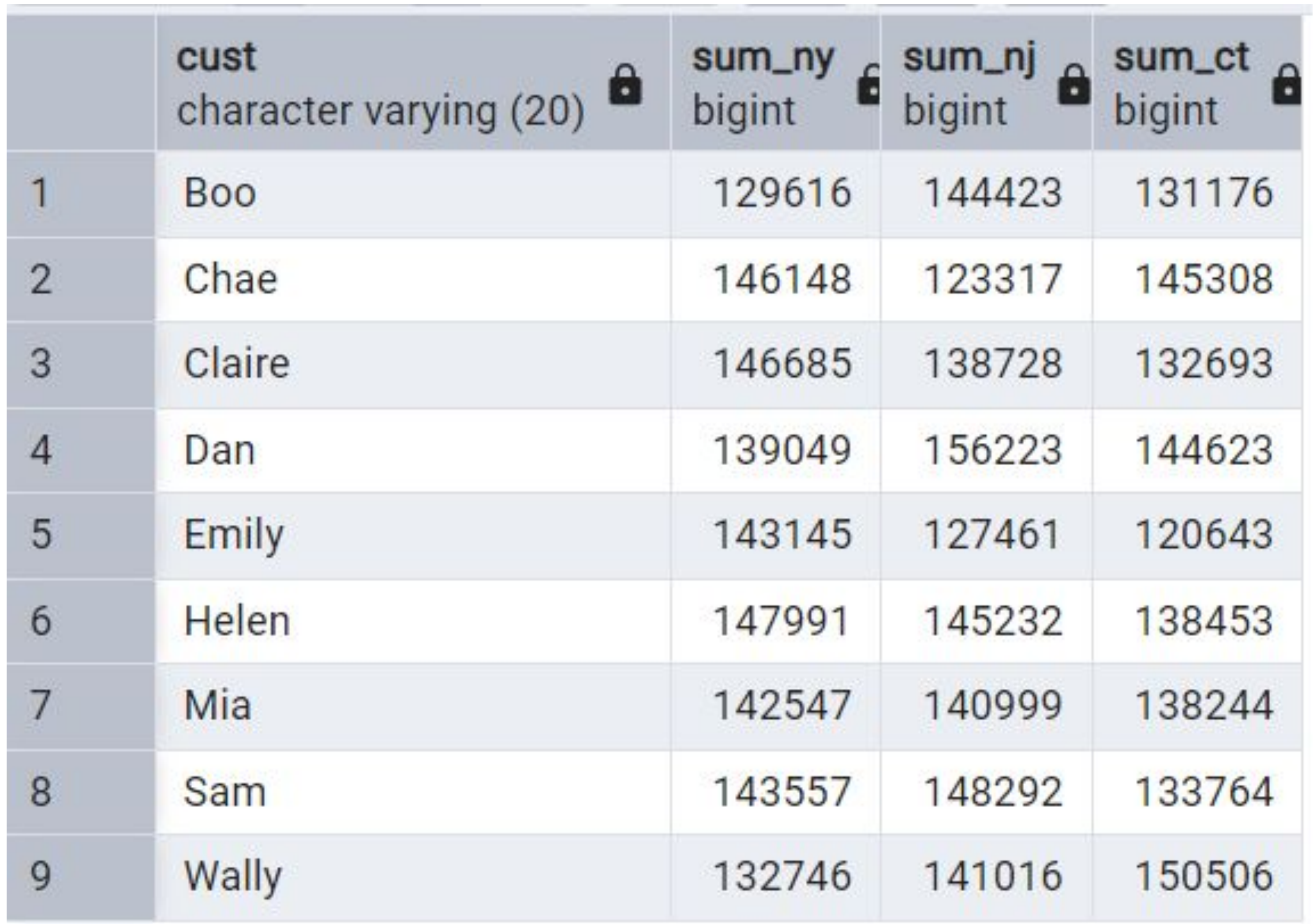
DEMO!!!

Query 1: For each customer, get the sum of their purchases made in NY, NJ and CT

Query

```
SELECT c.cust, ny.sum_ny, nj.sum_nj, ct.sum_ct
FROM (SELECT DISTINCT cust FROM sales) c
LEFT JOIN
   (SELECT cust, SUM(quant) AS sum_ny
    FROM sales WHERE state = 'NY'
    GROUP BY cust) ny ON c.cust = ny.cust
LEFT JOIN
   (SELECT cust, SUM(quant) AS sum_nj
    FROM sales WHERE state = 'NJ'
    GROUP BY cust) nj ON c.cust = nj.cust
LEFT JOIN
   (SELECT cust, SUM(quant) AS sum_ct
    FROM sales WHERE state = 'CT'
    GROUP BY cust) ct ON c.cust = ct.cust;
```

Output (pgAdmin)



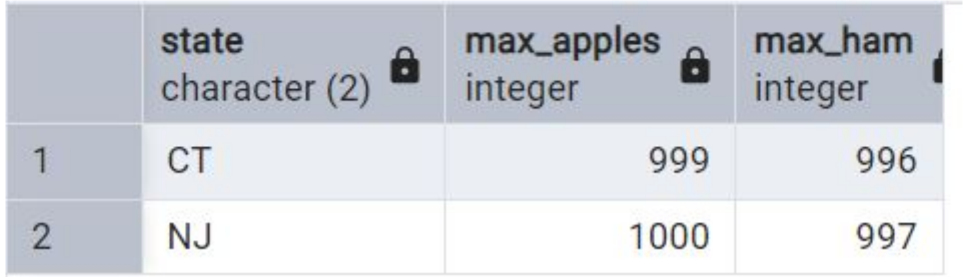
	cust character varying (20)	sum_ny bigint	sum_nj bigint	sum_ct bigint
1	Boo	129616	144423	131176
2	Chae	146148	123317	145308
3	Claire	146685	138728	132693
4	Dan	139049	156223	144623
5	Emily	143145	127461	120643
6	Helen	147991	145232	138453
7	Mia	142547	140999	138244
8	Sam	143557	148292	133764
9	Wally	132746	141016	150506

Query 2: For each state, get the max number of sales for Apples and Ham when max apples > max ham

Query

```
WITH apple_sales AS (
   SELECT state, MAX(quant) AS max_apples
   FROM sales WHERE prod = 'Apple' GROUP BY state
),
ham_sales AS (
   SELECT state, MAX(quant) AS max_ham
   FROM sales WHERE prod = 'Ham' GROUP BY state
)
SELECT apple_sales.state, max_apples, max_ham
FROM apple_sales NATURAL JOIN ham_sales
WHERE max_apples > max_ham;
```

Output



	state character (2)	max_apples integer	max_ham integer
1	CT	999	996
2	NJ	1000	997

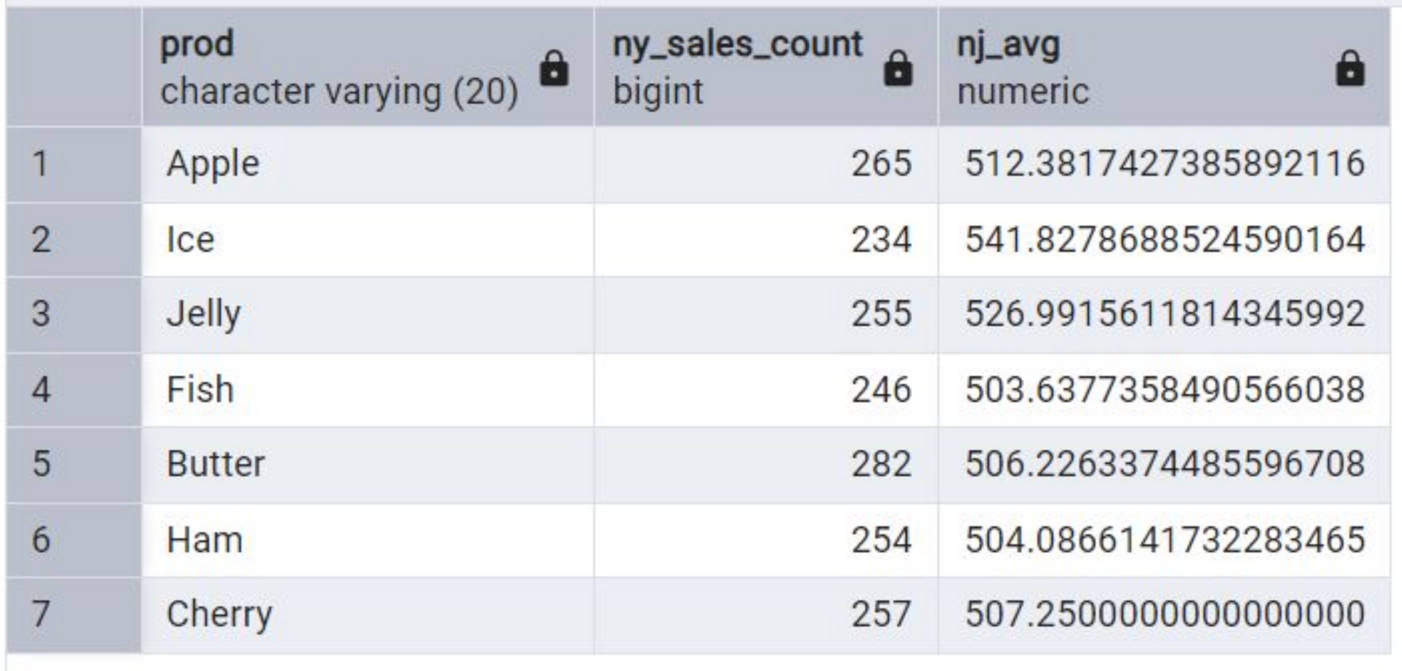
Query 3: For each product, get count of sales in NY, average sales in NJ, and only show its value if the sales NJ average is > 500

Query

```
WITH ny_counts AS (
   SELECT prod, COUNT(*) AS ny_sales_count
   FROM sales WHERE state = 'NY' GROUP BY prod
),

nj_avgs AS (
   SELECT prod, AVG(quant) AS nj_avg
   FROM sales WHERE state = 'NJ' GROUP BY prod
)
SELECT ny_counts.prod, ny_sales_count, nj_avg
FROM ny_counts NATURAL JOIN nj_avgs
WHERE nj_avgs.nj_avg > 500
```

Output



	prod character varying (20)	ny_sales_count bigint	nj_avg numeric
1	Apple	265	512.3817427385892116
2	Ice	234	541.8278688524590164
3	Jelly	255	526.9915611814345992
4	Fish	246	503.6377358490566038
5	Butter	282	506.2263374485596708
6	Ham	254	504.0866141732283465
7	Cherry	257	507.2500000000000000

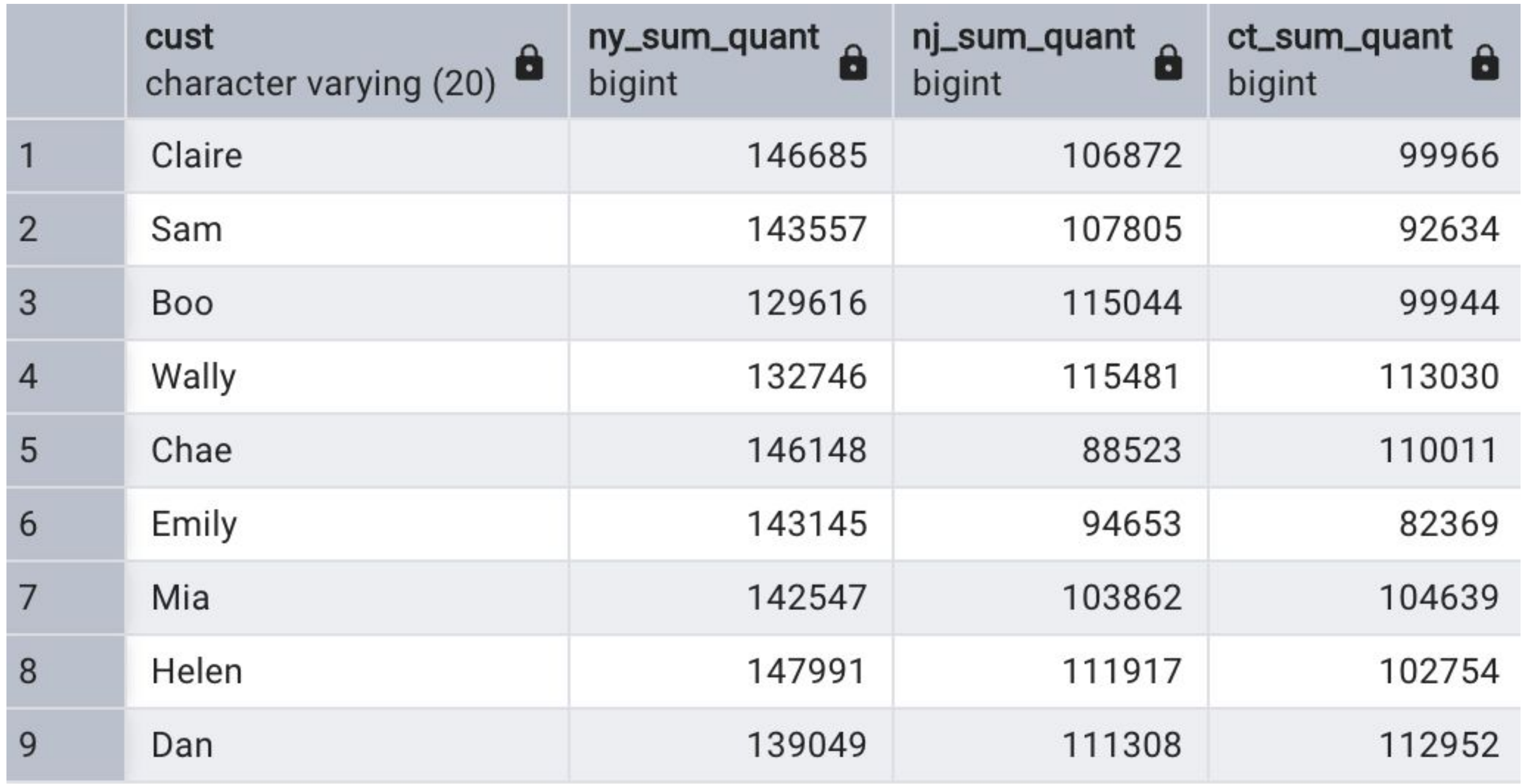
Query 4: Find the sum of quantity for each cust in NY, NJ, and CT where NJ and CT quantities are larger than NY average quantity

Query

```
WITH q1 AS (
      SELECT cust, SUM(quant) as NY_sum_quant, AVG(quant) as NY_avg_quant
      FROM sales
      WHERE state = 'NY'
      GROUP BY cust
),
q2 AS (
      SELECT sales.cust, NY_sum_quant, SUM(sales.quant) as NJ_sum_quant
      FROM sales, q1
      WHERE sales.cust = q1.cust AND sales.state = 'NJ' AND sales.quant >
q1.NY_avg_quant
      GROUP BY sales.cust, q1.NY_sum_quant
)

SELECT sales.cust, q1.NY_sum_quant, q2.NJ_sum_quant, SUM(sales.quant) as
CT_sum_quant
FROM sales, q2, q1
WHERE sales.cust = q1.cust AND sales.cust = q2.cust AND sales.state = 'CT' AND
sales.quant > q1.NY_avg_quant
GROUP BY sales.cust, q1.NY_sum_quant, q2.NJ_sum_quant
```

Output



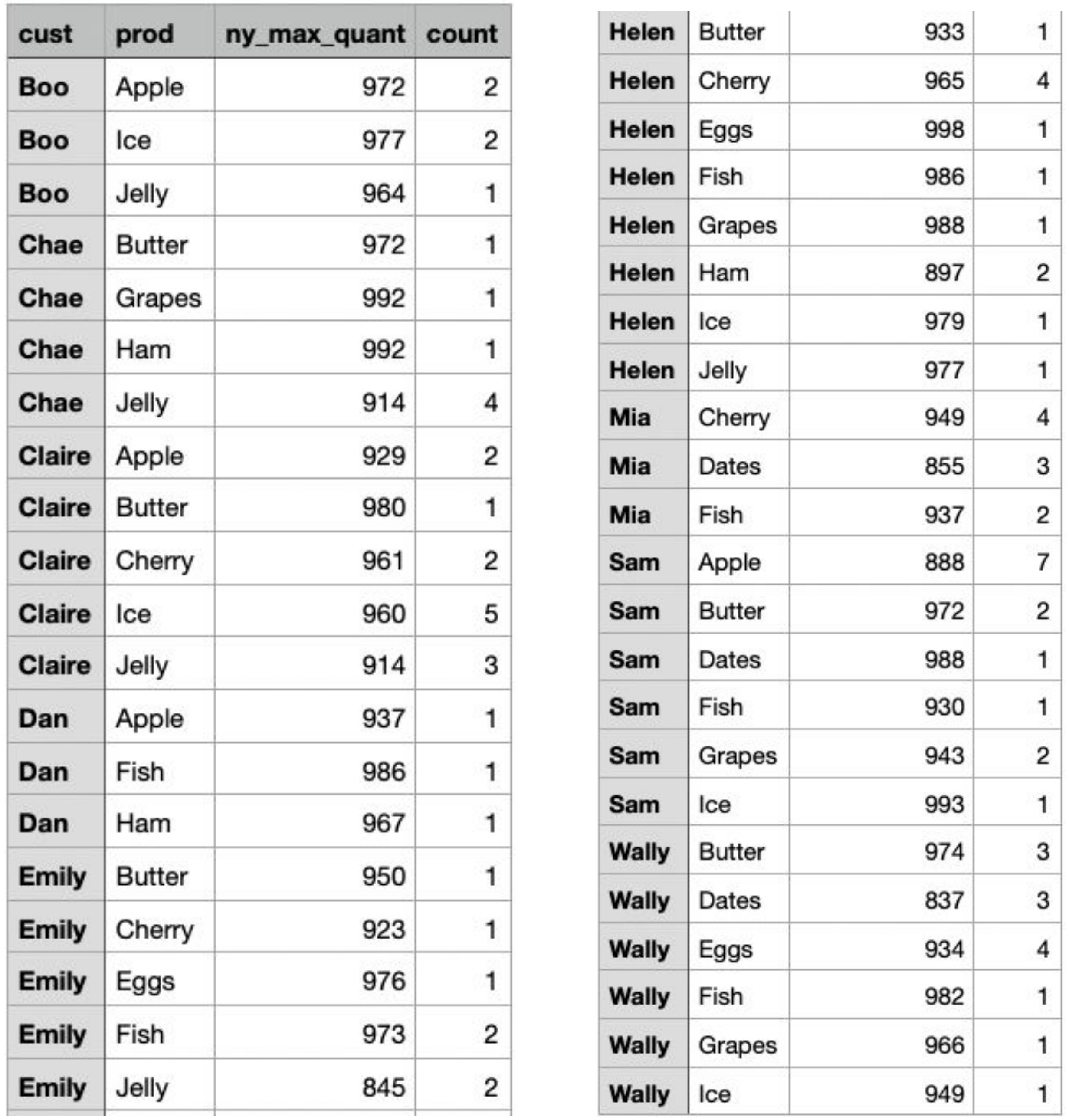
	cust character varying (20)	ny_sum_quant bigint	nj_sum_quant bigint	ct_sum_quant bigint
1	Claire	146685	106872	99966
2	Sam	143557	107805	92634
3	Boo	129616	115044	99944
4	Wally	132746	115481	113030
5	Chae	146148	88523	110011
6	Emily	143145	94653	82369
7	Mia	142547	103862	104639
8	Helen	147991	111917	102754
9	Dan	139049	111308	112952

Query 5: For each customer and product find the max quantity for NY and the number of sales that are greater than NY’s max for sales in NJ

Query

```
WITH q1 AS (
     SELECT cust, prod, MAX(quant) as ny_max_quant
     FROM sales
     WHERE state = 'NY'
     GROUP BY cust, prod
)
SELECT sales.cust, sales.prod, q1.ny_max_quant,
COUNT(sales.quant)
FROM sales, q1
WHERE state = 'NJ' AND sales.cust = q1.cust AND
sales.prod = q1.prod AND sales.quant >
q1.ny_max_quant
GROUP BY sales.cust, sales.prod, q1.ny_max_quant
```

Output



cust	prod	ny_max_quant	count
Boo	Apple	972	2
Boo	Ice	977	2
Boo	Jelly	964	1
Chae	Butter	972	1
Chae	Grapes	992	1
Chae	Ham	992	1
Chae	Jelly	914	4
Claire	Apple	929	2
Claire	Butter	980	1
Claire	Cherry	961	2
Claire	Ice	960	5
Claire	Jelly	914	3
Dan	Apple	937	1
Dan	Fish	986	1
Dan	Ham	967	1
Emily	Butter	950	1
Emily	Cherry	923	1
Emily	Eggs	976	1
Emily	Fish	973	2
Emily	Jelly	845	2
Helen	Butter	933	1
Helen	Cherry	965	4
Helen	Eggs	998	1
Helen	Fish	986	1
Helen	Grapes	988	1
Helen	Ham	897	2
Helen	Ice	979	1
Helen	Jelly	977	1
Mia	Cherry	949	4
Mia	Dates	855	3
Mia	Fish	937	2
Sam	Apple	888	7
Sam	Butter	972	2
Sam	Dates	988	1
Sam	Fish	930	1
Sam	Grapes	943	2
Sam	Ice	993	1
Wally	Butter	974	3
Wally	Dates	837	3
Wally	Eggs	934	4
Wally	Fish	982	1
Wally	Grapes	966	1
Wally	Ice	949	1