Database Management Systems:

Assignment 3

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CSC 351: Database Management Systems

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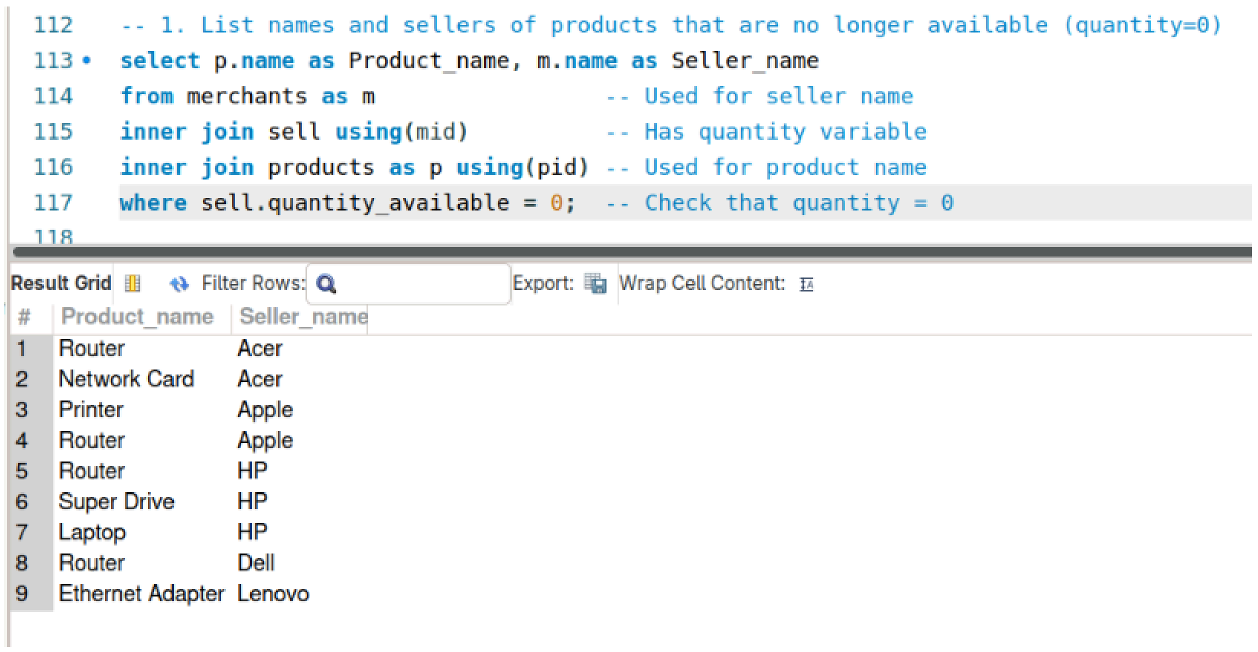
Problem 1: List names and sellers of products that are no longer available (quantity=0)

Query + Results:



```
-- 1. List names and sellers of products that are no longer available (quantity=0)
select p.name as Product_name, m.name as Seller_name
from merchants as m                  -- Used for seller name
inner join sell using(mid)           -- Has quantity variable
inner join products as p using(pid) -- Used for product name
where sell.quantity_available = 0;  -- Check that quantity = 0
```

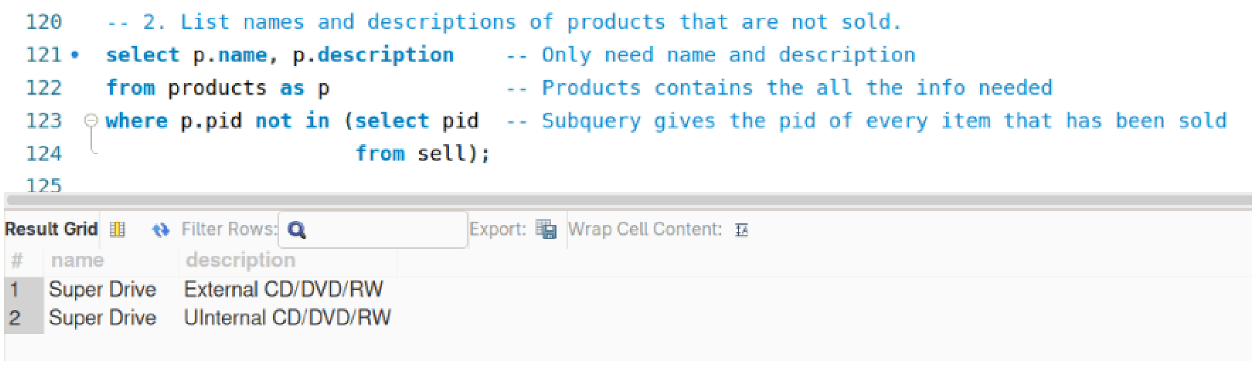
Result Grid Filter Rows: Export: Wrap Cell Content:

#	Product_name	Seller_name
1	Router	Acer
2	Network Card	Acer
3	Printer	Apple
4	Router	Apple
5	Router	HP
6	Super Drive	HP
7	Laptop	HP
8	Router	Dell
9	Ethernet Adapter	Lenovo

In this query, I first listed the name from the product name (aliased as Product_name) and the name from the merchant’s table (aliased as Seller_name). I then joined the merchants, sell, and products tables. Since I needed data from the products table and the merchants table, the only way to combine the tables was to use the sell table. This is because the sell table has both the mid and pid as foreign keys. Once I combined everything I checked which items have a quantity_available of 0.

Problem 2: List names and descriptions of products that are not sold.

Query + Results:



```
-- 2. List names and descriptions of products that are not sold.
select p.name, p.description    -- Only need name and description
from products as p              -- Products contains the all the info needed
where p.pid not in (select pid  -- Subquery gives the pid of every item that has been sold
                    from sell);
```

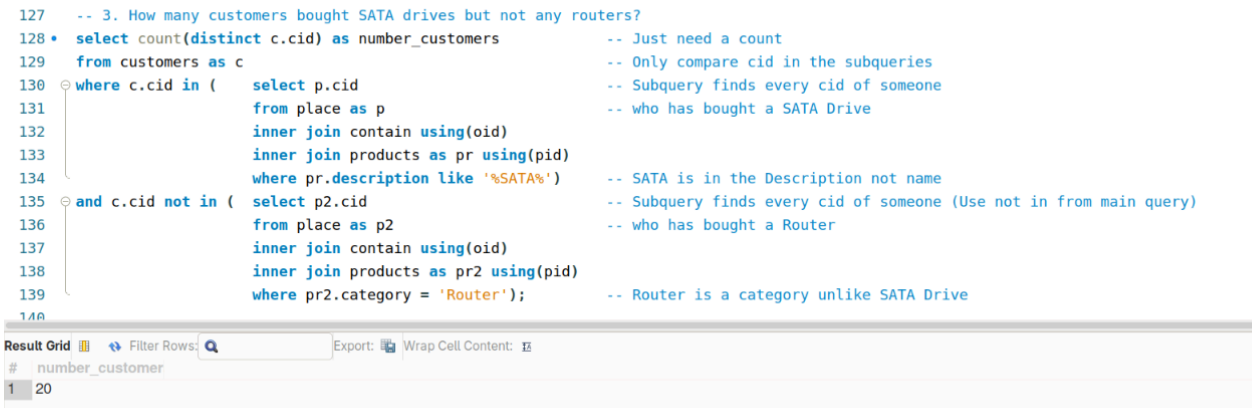
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

```
#  name         description
1  Super Drive  External CD/DVD/RW
2  Super Drive  UInternal CD/DVD/RW
```

In this query, I first selected the product name and the product description since this was the only information I needed to output. I then created a subquery that listed every product that is actively being sold by a company, which is every pid inside of the sell table. I then listed every pid which was not inside of that table.

Problem 3: How many customers bought SATA drives but not any routers?

Query + Results:



```
-- 3. How many customers bought SATA drives but not any routers?
select count(distinct c.cid) as number_customers            -- Just need a count
from customers as c                                         -- Only compare cid in the subqueries
where c.cid in (        select p.cid                        -- Subquery finds every cid of someone
                        from place as p                     -- who has bought a SATA Drive
                        inner join contain using(oid)
                        inner join products as pr using(pid)
                        where pr.description like '%SATA%') -- SATA is in the Description not name
and c.cid not in (      select p2.cid                       -- Subquery finds every cid of someone (Use not in from main query)
                        from place as p2                    -- who has bought a Router
                        inner join contain using(oid)
                        inner join products as pr2 using(pid)
                        where pr2.category = 'Router');     -- Router is a category unlike SATA Drive
```

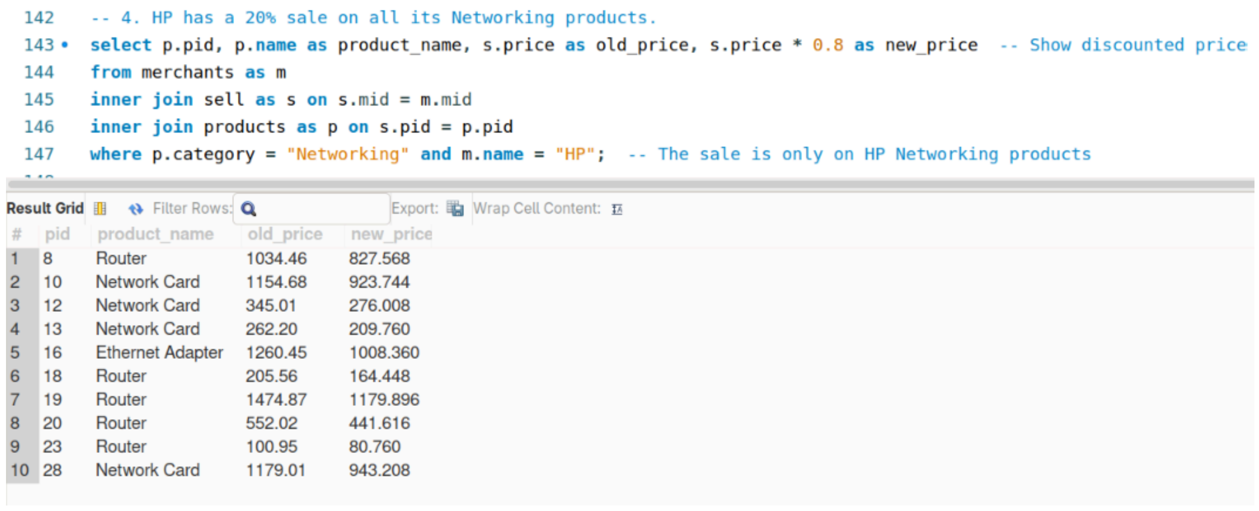
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

```
#  number_customer
1  20
```

In this query, I have “count(distinct c.cid)” as the only selection since that is what the question asks for. Also the distinct c.cid makes sure that the same person isn’t counted twice. Furthermore, I have two subqueries. The first one lists the customer id of everyone who has purchased an item with the word “SATA” inside of the description. This is because there isn’t a dedicated category for SATA drives so I had to pull that information from the description. The next subquery does a similar thing, just rather than finding “SATA” in the description it finds a product with “Router” as its category since Routers are a dedicated category. Going back to the main query, a cid only gets counted if it can be found within the SATA subquery but not found in the other subquery.

Problem 4: HP has a 20% sale on all its Networking products.

Query + Results:



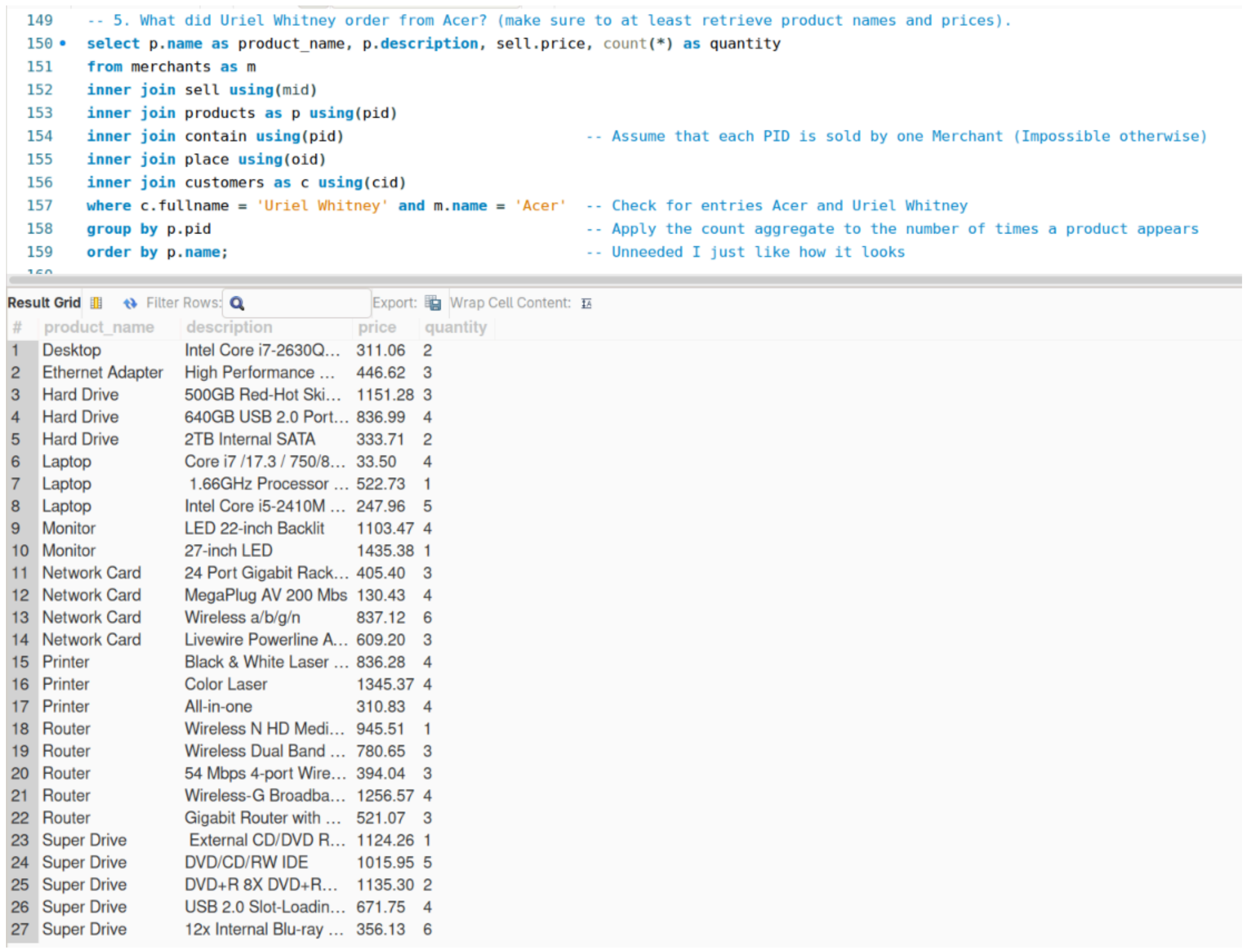
```sql
-- 4. HP has a 20% sale on all its Networking products.
select p.pid, p.name as product_name, s.price as old_price, s.price * 0.8 as new_price  -- Show discounted price
from merchants as m
inner join sell as s on s.mid = m.mid
inner join products as p on s.pid = p.pid
where p.category = "Networking" and m.name = "HP";  -- The sale is only on HP Networking products
```

#	pid	product_name	old_price	new_price
1	8	Router	1034.46	827.568
2	10	Network Card	1154.68	923.744
3	12	Network Card	345.01	276.008
4	13	Network Card	262.20	209.760
5	16	Ethernet Adapter	1260.45	1008.360
6	18	Router	205.56	164.448
7	19	Router	1474.87	1179.896
8	20	Router	552.02	441.616
9	23	Router	100.95	80.760
10	28	Network Card	1179.01	943.208

In this subquery, I interpreted it as taking the original values and saying what the discount would be if it was 20%. In the selection, I multiplied the price by 0.8 to show what the discount would be. I then joined the merchants, sell, and products table since I needed information from all of the tables. Lastly, in the “where” statement I made sure to filter only HP merchant items that are also Networking products.

Problem 5: What did Uriel Whitney order ~~from Acer~~? (make sure to at least retrieve product names and prices).

Query + Results:



```
-- 5. What did Uriel Whitney order from Acer? (make sure to at least retrieve product names and prices).
select p.name as product_name, p.description, sell.price, count(*) as quantity
from merchants as m
inner join sell using(mid)
inner join products as p using(pid)
inner join contain using(pid)                          -- Assume that each PID is sold by one Merchant (Impossible otherwise)
inner join place using(oid)
inner join customers as c using(cid)
where c.fullname = 'Uriel Whitney' and m.name = 'Acer'  -- Check for entries Acer and Uriel Whitney
group by p.pid                                         -- Apply the count aggregate to the number of times a product appears
order by p.name;                                       -- Unneeded I just like how it looks
```

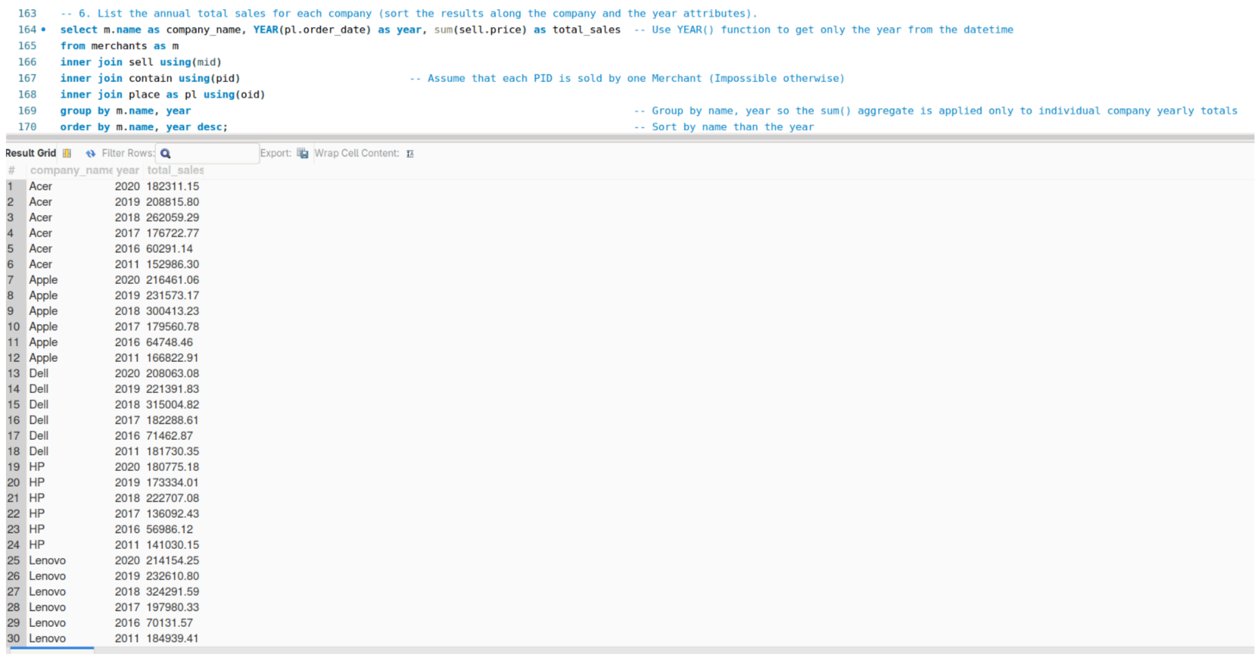
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

#	product_name	description	price	quantity
1	Desktop	Intel Core i7-2630Q...	311.06	2
2	Ethernet Adapter	High Performance ...	446.62	3
3	Hard Drive	500GB Red-Hot Ski...	1151.28	3
4	Hard Drive	640GB USB 2.0 Port...	836.99	4
5	Hard Drive	2TB Internal SATA	333.71	2
6	Laptop	Core i7 /17.3 / 750/8...	33.50	4
7	Laptop	1.66GHz Processor ...	522.73	1
8	Laptop	Intel Core i5-2410M ...	247.96	5
9	Monitor	LED 22-inch Backlit	1103.47	4
10	Monitor	27-inch LED	1435.38	1
11	Network Card	24 Port Gigabit Rack...	405.40	3
12	Network Card	MegaPlug AV 200 Mbs	130.43	4
13	Network Card	Wireless a/b/g/n	837.12	6
14	Network Card	Livewire Powerline A...	609.20	3
15	Printer	Black & White Laser ...	836.28	4
16	Printer	Color Laser	1345.37	4
17	Printer	All-in-one	310.83	4
18	Router	Wireless N HD Medi...	945.51	1
19	Router	Wireless Dual Band ...	780.65	3
20	Router	54 Mbps 4-port Wire...	394.04	3
21	Router	Wireless-G Broadba...	1256.57	4
22	Router	Gigabit Router with ...	521.07	3
23	Super Drive	External CD/DVD R...	1124.26	1
24	Super Drive	DVD/CD/RW IDE	1015.95	5
25	Super Drive	DVD+R 8X DVD+R...	1135.30	2
26	Super Drive	USB 2.0 Slot-Loadin...	671.75	4
27	Super Drive	12x Internal Blu-ray ...	356.13	6

Problem 5 is the first problem that I had to make an assumption about. I assumed that each product (pid) could only be sold by one Merchant. I made this assumption because this problem would be impossible without it, since the table “contain” doesn’t state who the customer bought it from, just that they bought the item. This causes issues because if a product is sold by two different merchants, then it would get counted twice if that product id is found inside of the table “contain”. After making that assumption, I listed all columns that I needed, and joined the respective tables. I then applied the “where” filter to assure that all products were from ‘Uriel Whitney’ and ‘Acer’. I then grouped by the product id, so I could apply the count() aggregate from the selection statement to the resulting group. Additionally, the ordering I did at the end had nothing to do with the problem, I just liked the way that it looked.

Problem 6: List the annual total sales for each company (sort the results along the company and the year attributes).

Query + Results:



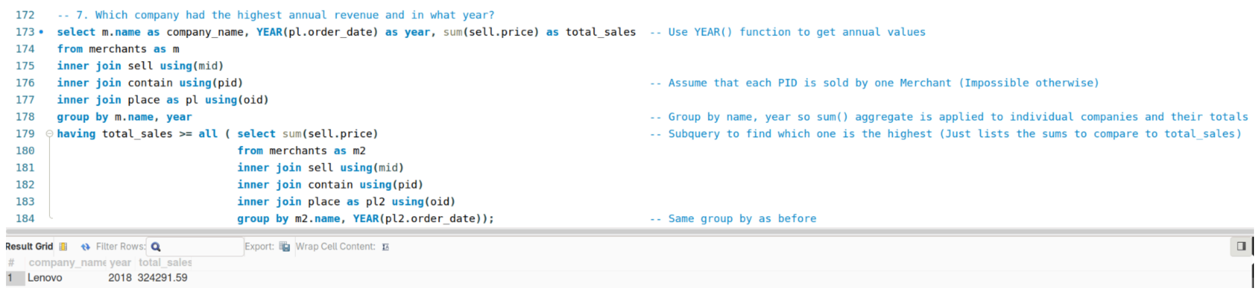
```sql
-- 6. List the annual total sales for each company (sort the results along the company and the year attributes).
select m.name as company_name, YEAR(pl.order_date) as year, sum(sell.price) as total_sales  -- Use YEAR() function to get only the year from the datetime
from merchants as m
inner join sell using(mid)
inner join contain using(pid)                             -- Assume that each PID is sold by one Merchant (Impossible otherwise)
inner join place as pl using(oid)
group by m.name, year                                                    -- Group by name, year so the sum() aggregate is applied only to individual company yearly totals
order by m.name, year desc;                                              -- Sort by name than the year
```

```
Result Grid   Filter Rows:   Export:   Wrap Cell Content:
#   company_name year  total_sales
1   Acer         2020  182311.15
2   Acer         2019  208815.80
3   Acer         2018  262059.29
4   Acer         2017  176722.77
5   Acer         2016  60291.14
6   Acer         2011  152986.30
7   Apple        2020  216461.06
8   Apple        2019  231573.17
9   Apple        2018  300413.23
10  Apple        2017  179560.78
11  Apple        2016  64748.46
12  Apple        2011  166822.91
13  Dell         2020  208063.08
14  Dell         2019  221391.83
15  Dell         2018  315004.82
16  Dell         2017  182288.61
17  Dell         2016  71462.87
18  Dell         2011  181730.35
19  HP           2020  180775.18
20  HP           2019  173334.01
21  HP           2018  222707.08
22  HP           2017  136092.43
23  HP           2016  56986.12
24  HP           2011  141030.15
25  Lenovo       2020  214154.25
26  Lenovo       2019  232610.80
27  Lenovo       2018  324291.59
28  Lenovo       2017  197980.33
29  Lenovo       2016  70131.57
30  Lenovo       2011  184939.41
```

In this problem, I made the same assumptions that I had made about the previous problem. In the selection statement I added an additional function to apply on top of the date, the YEAR() function. This function was used to extract just the date from the datetime which is in 'YYYY-MM-DD' format. This isn't an aggregate function and can be used without some sort of grouping like sum() needs. I then joined the respective tables, and then grouped by merchant name and by year. This allowed me to sort data into groups of company and year, then applying the sum() aggregation on top of the grouped data. Lastly, I ordered by merchant name and year descending.

Problem 7: Which company had the highest annual revenue and in what year?

Query + Results:



```
-- 7. Which company had the highest annual revenue and in what year?
select m.name as company_name, YEAR(pl.order_date) as year, sum(sell.price) as total_sales  -- Use YEAR() function to get annual values
from merchants as m
inner join sell using(mid)
inner join contain using(pid)                                                           -- Assume that each PID is sold by one Merchant (Impossible otherwise)
inner join place as pl using(oid)
group by m.name, year                                                                   -- Group by name, year so sum() aggregate is applied to individual companies and their totals
having total_sales >= all ( select sum(sell.price)                                      -- Subquery to find which one is the highest (Just lists the sums to compare to total_sales)
                            from merchants as m2
                            inner join sell using(mid)
                            inner join contain using(pid)
                            inner join place as pl2 using(oid)
                            group by m2.name, YEAR(pl2.order_date));                    -- Same group by as before
```

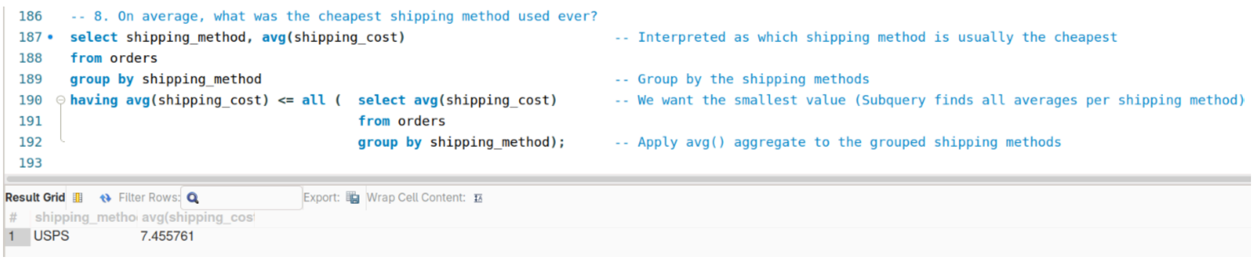
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

```
#  company_name  year  total_sales
1  Lenovo        2018  324291.59
```

In Problem 7, I made the same assumptions that I did in both 5 and 6. In this query, I used the similar attributes as question 6, with the main difference this time being the inclusion of the “having” statement. The “having” statement was used to pull the group that had the highest annual revenue. This works by including a subquery that lists just all of the revenues of each (company, year) pair. I then select the value that is greater than or equal to all of the revenues. This would result in me just having the company with the highest annual revenue and the year it was.

Problem 8: On average, what was the cheapest shipping method used ever?

Query + Results:



```
-- 8. On average, what was the cheapest shipping method used ever?
select shipping_method, avg(shipping_cost)                      -- Interpreted as which shipping method is usually the cheapest
from orders
group by shipping_method                                        -- Group by the shipping methods
having avg(shipping_cost) <= all (  select avg(shipping_cost)   -- We want the smallest value (Subquery finds all averages per shipping method)
                                    from orders
                                    group by shipping_method);  -- Apply avg() aggregate to the grouped shipping methods
```

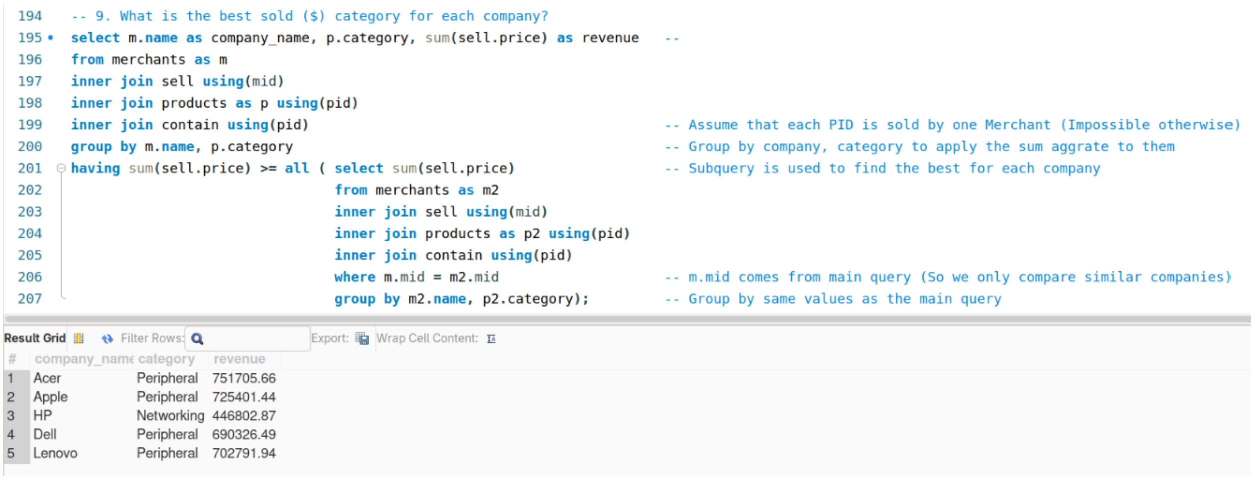
Result Grid Filter Rows: Export: Wrap Cell Content:

```
#  shipping_metho avg(shipping_cos
1  USPS           7.455761
```

In this query, I interpreted it as asking which shipping method is usually cheaper on average. As a result, I only pulled the shipping method name and the average shipping cost. I also only needed to pull from the table “orders” since it contains all of the information that I needed. I also grouped by the shipping method since I wanted to apply the average aggregate to each group. Once this was done, I used a having statement to pull the group which had the least average shipping cost by using a subquery which listed each groups’ average shipping cost and finding the group which was less than or equal to all the other groups.

Problem 9: What is the best sold ($) category for each company?

Query + Results:



```
-- 9. What is the best sold ($) category for each company?
select m.name as company_name, p.category, sum(sell.price) as revenue   --
from merchants as m
inner join sell using(mid)
inner join products as p using(pid)
inner join contain using(pid)                                   -- Assume that each PID is sold by one Merchant (Impossible otherwise)
group by m.name, p.category                                     -- Group by company, category to apply the sum aggrate to them
having sum(sell.price) >= all ( select sum(sell.price)          -- Subquery is used to find the best for each company
                                from merchants as m2
                                inner join sell using(mid)
                                inner join products as p2 using(pid)
                                inner join contain using(pid)
                                where m.mid = m2.mid            -- m.mid comes from main query (So we only compare similar companies)
                                group by m2.name, p2.category); -- Group by same values as the main query
```

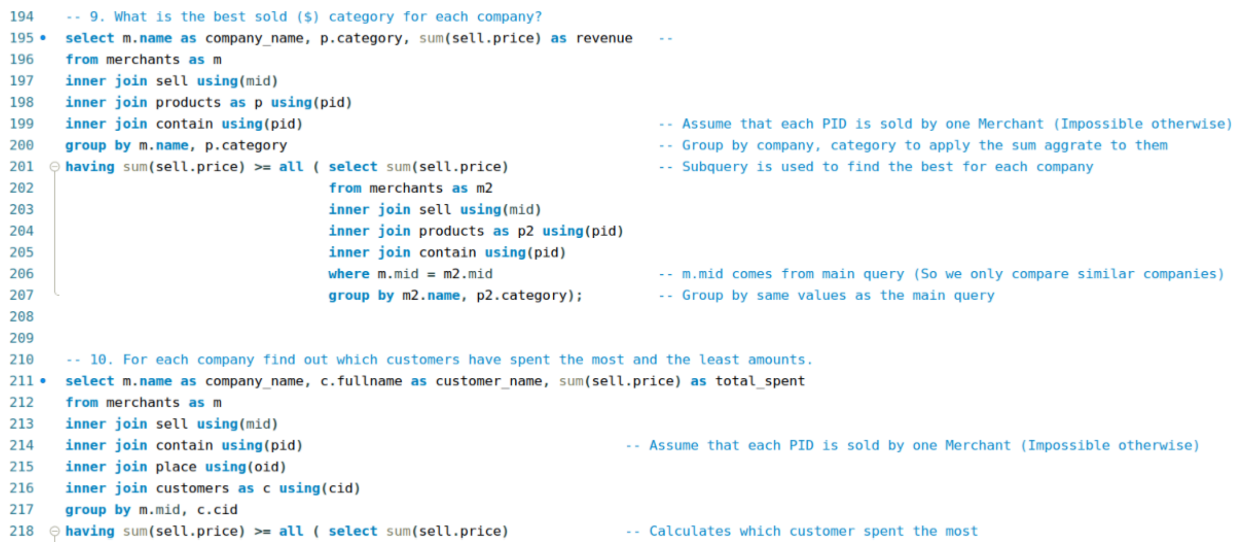
Result Grid Filter Rows: Export: Wrap Cell Content:

```
#  company_name category   revenue
1  Acer         Peripheral 751705.66
2  Apple        Peripheral 725401.44
3  HP           Networking 446802.87
4  Dell         Peripheral 690326.49
5  Lenovo       Peripheral 702791.94
```

In Problem 9, I had to make a similar assumption as problems 5, 6, and 7. In the query, I needed the merchant name, product category, and a sum for each thing sold in the category. After pulling from the respective tables, I grouped by the merchant name and the product category, so I could apply the sum aggregate to the values inside of the groups. I then added a having statement with a subquery that found the best product category for each company. The way I did this was inside of the subquery's "where" clause I made sure to add the merchant id from the main query. This would make sure that each company is only compared to itself, for example, Acer's category revenue wouldn't be compared to Apple's. Within the main query's "having" clause I then made sure that the total revenue was greater than every value inside of the subquery, giving me the product category which made the most money for each company.

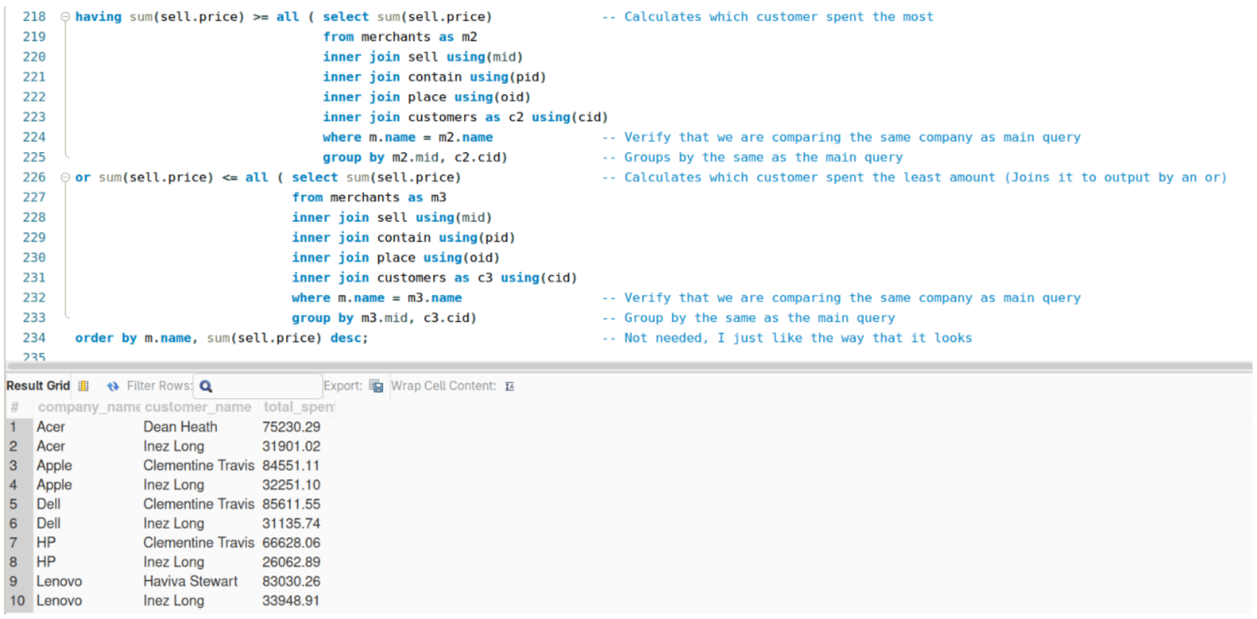
Problem 10: For each company find out which customers have spent the most and the least amounts.

Query + Results:



```
-- 9. What is the best sold ($) category for each company?
select m.name as company_name, p.category, sum(sell.price) as revenue   --
from merchants as m
inner join sell using(mid)
inner join products as p using(pid)
inner join contain using(pid)                                    -- Assume that each PID is sold by one Merchant (Impossible otherwise)
group by m.name, p.category                                      -- Group by company, category to apply the sum aggrate to them
having sum(sell.price) >= all ( select sum(sell.price)           -- Subquery is used to find the best for each company
                                from merchants as m2
                                inner join sell using(mid)
                                inner join products as p2 using(pid)
                                inner join contain using(pid)
                                where m.mid = m2.mid             -- m.mid comes from main query (So we only compare similar companies)
                                group by m2.name, p2.category);  -- Group by same values as the main query


-- 10. For each company find out which customers have spent the most and the least amounts.
select m.name as company_name, c.fullname as customer_name, sum(sell.price) as total_spent
from merchants as m
inner join sell using(mid)
inner join contain using(pid)                                -- Assume that each PID is sold by one Merchant (Impossible otherwise)
inner join place using(oid)
inner join customers as c using(cid)
group by m.mid, c.cid
having sum(sell.price) >= all ( select sum(sell.price)       -- Calculates which customer spent the most
```



```
having sum(sell.price) >= all ( select sum(sell.price)             -- Calculates which customer spent the most
                                from merchants as m2
                                inner join sell using(mid)
                                inner join contain using(pid)
                                inner join place using(oid)
                                inner join customers as c2 using(cid)
                                where m.name = m2.name             -- Verify that we are comparing the same company as main query
                                group by m2.mid, c2.cid)           -- Groups by the same as the main query
or sum(sell.price) <= all ( select sum(sell.price)                 -- Calculates which customer spent the least amount (Joins it to output by an or)
                            from merchants as m3
                            inner join sell using(mid)
                            inner join contain using(pid)
                            inner join place using(oid)
                            inner join customers as c3 using(cid)
                            where m.name = m3.name                 -- Verify that we are comparing the same company as main query
                            group by m3.mid, c3.cid)               -- Group by the same as the main query
order by m.name, sum(sell.price) desc;                             -- Not needed, I just like the way that it looks
```

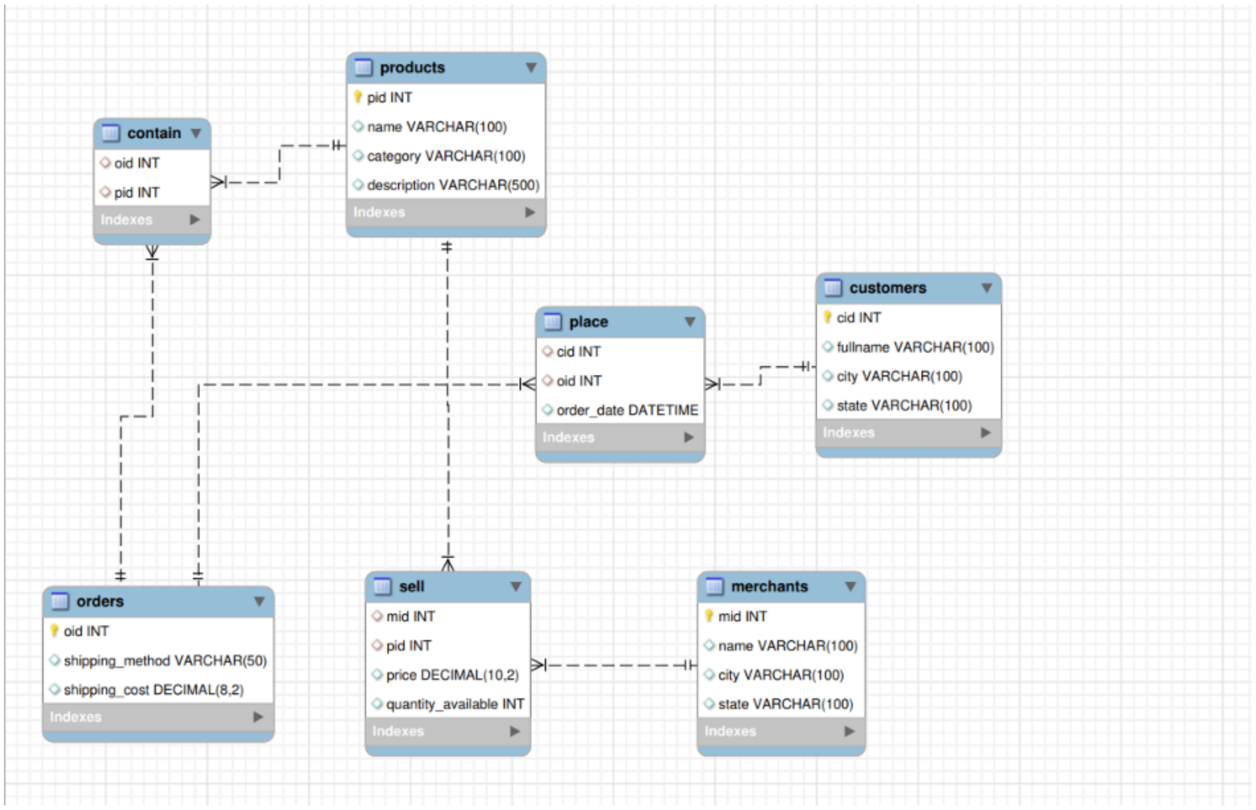
Result Grid Filter Rows: Export: Wrap Cell Content:

#	company_name	customer_name	total_spent
1	Acer	Dean Heath	75230.29
2	Acer	Inez Long	31901.02
3	Apple	Clementine Travis	84551.11
4	Apple	Inez Long	32251.10
5	Dell	Clementine Travis	85611.55
6	Dell	Inez Long	31135.74
7	HP	Clementine Travis	66628.06
8	HP	Inez Long	26062.89
9	Lenovo	Haviva Stewart	83030.26
10	Lenovo	Inez Long	33948.91

Within Problem 10, I made the same assumption as I did with problems 5, 6, 7, and 9, since I was also using the table “contain”. In this problem’s query, I pull the merchant name, customer full name, and the sum of each customer’s order costs. I then pulled from the respective queries and grouped by the merchant id and the customer id to create groups of (merchant, customer) and apply the sum aggregate to these groups. Within the having statement I have two subqueries. The first subquery finds which of the customers spent the most at that company. In this subquery, I made sure to place a where clause within that made sure to only pull the same merchant id. This would allow each statement to only compare the sums of the customers who bought things from the same company (Similar problem as problem 9). After the first subquery executes, I made sure that the current sum is greater than or equal to all of the values to find the customer with the highest total spent at that company. The second subquery does the opposite and finds the customer who spent the least at that company. It’s important to note that the two subqueries are practically the same, the only difference is the first one is greater than or equal to, and the second one is less than or equal to. The two queries are joined by an "or", so both the person who spent the least and the person who spent the most are added to the same main query result.

Appendix:

ER Diagram:


products
pid INT
name VARCHAR(100)
category VARCHAR(100)
description VARCHAR(500)
Indexes
contain
oid INT
pid INT
Indexes
customers
cid INT
fullname VARCHAR(100)
city VARCHAR(100)
state VARCHAR(100)
Indexes
place
cid INT
oid INT
order_date DATETIME
Indexes
orders
oid INT
shipping_method VARCHAR(50)
shipping_cost DECIMAL(8,2)
Indexes
sell
mid INT
pid INT
price DECIMAL(10,2)
quantity_available INT
Indexes
merchants
mid INT
name VARCHAR(100)
city VARCHAR(100)
state VARCHAR(100)
Indexes