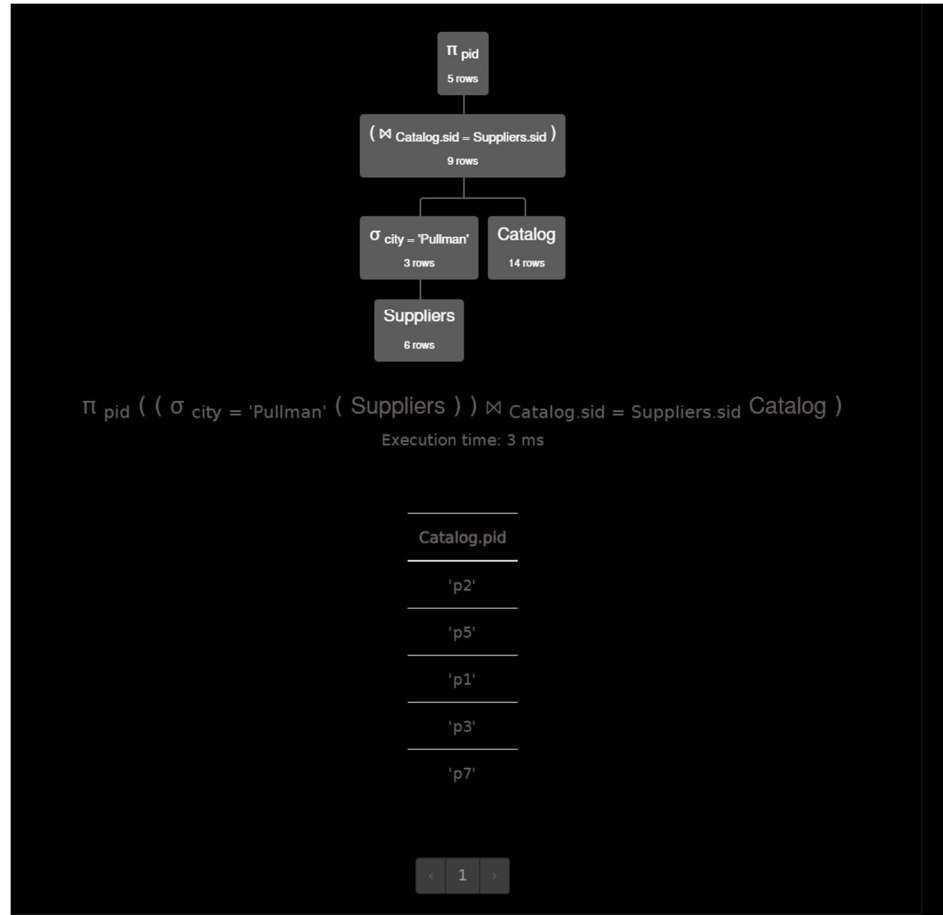


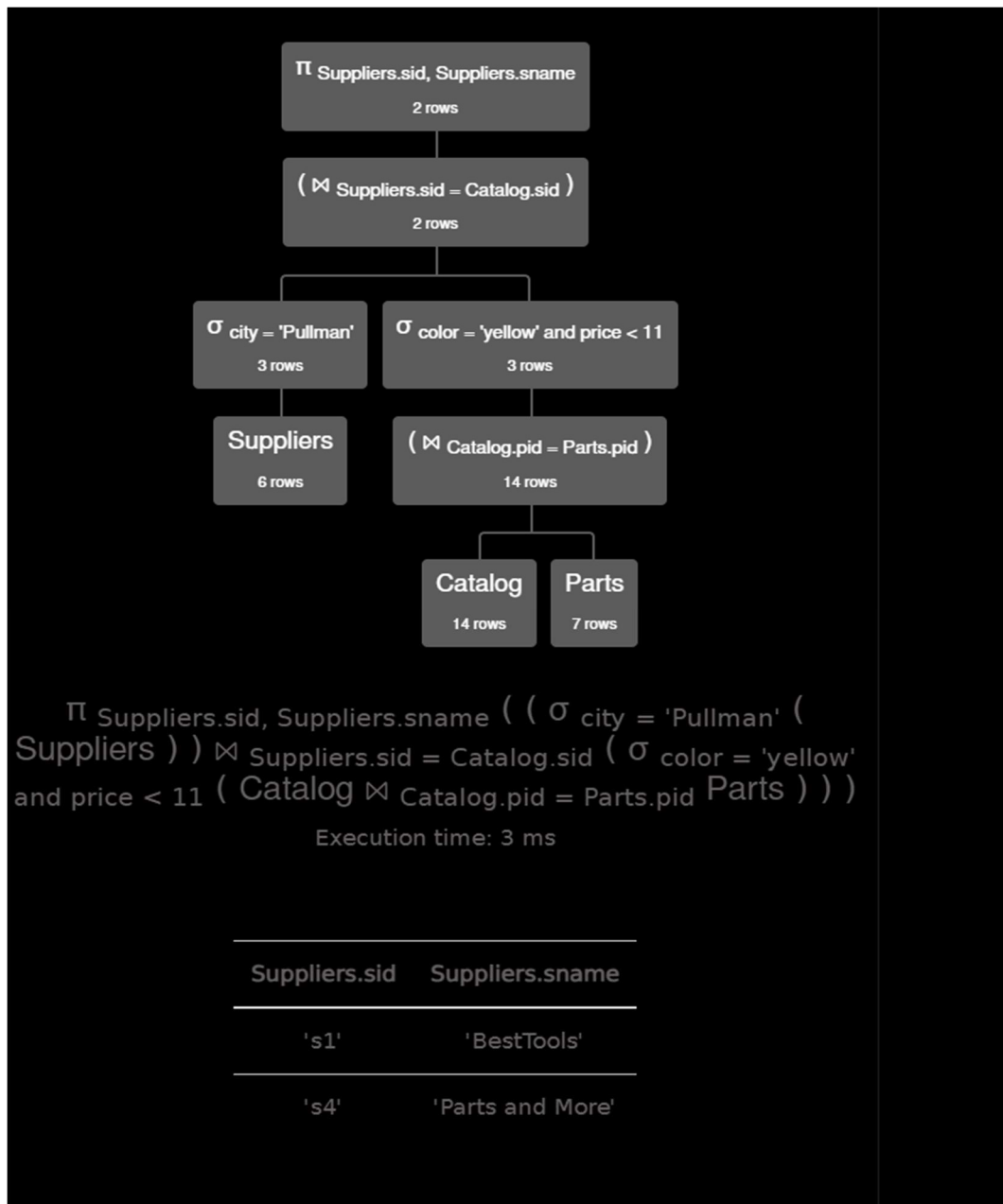
- Find all distinct parts supplied by Pullman stores. Return “pid”s of those parts.

Query $\rightarrow \pi_{pid} ((\sigma_{city = 'Pullman'}(Suppliers)) \bowtie_{Catalog.sid = Suppliers.sid} Catalog)$



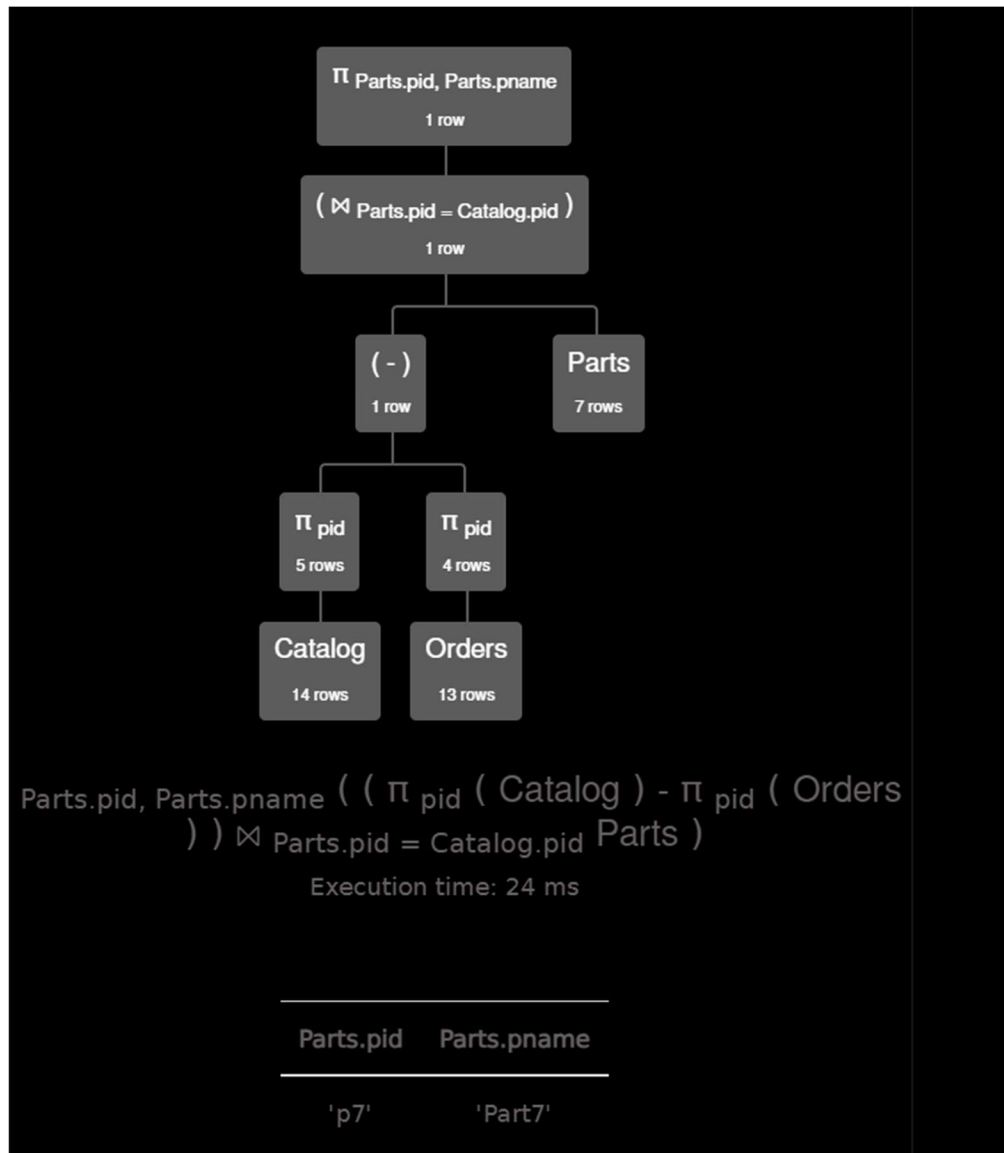
2. Find the suppliers in Pullman who supply a yellow part for less than \$11. Return “sid”s and names for those suppliers.

Query $\rightarrow \pi \text{ Suppliers.sid, Suppliers.sname } ((\sigma \text{ city} = \text{'Pullman'} (\text{Suppliers})) \bowtie \text{Suppliers.sid} = \text{Catalog.sid } (\sigma \text{ color} = \text{'yellow'} \wedge \text{price} < 11 (\text{Catalog} \bowtie \text{Catalog.pid} = \text{Parts.pid Parts})))$



3. Find all parts which are provided by some supplier (i.e., they appear in the catalog) but they were never ordered by a customer. Return the “pid”’s and names of those parts.

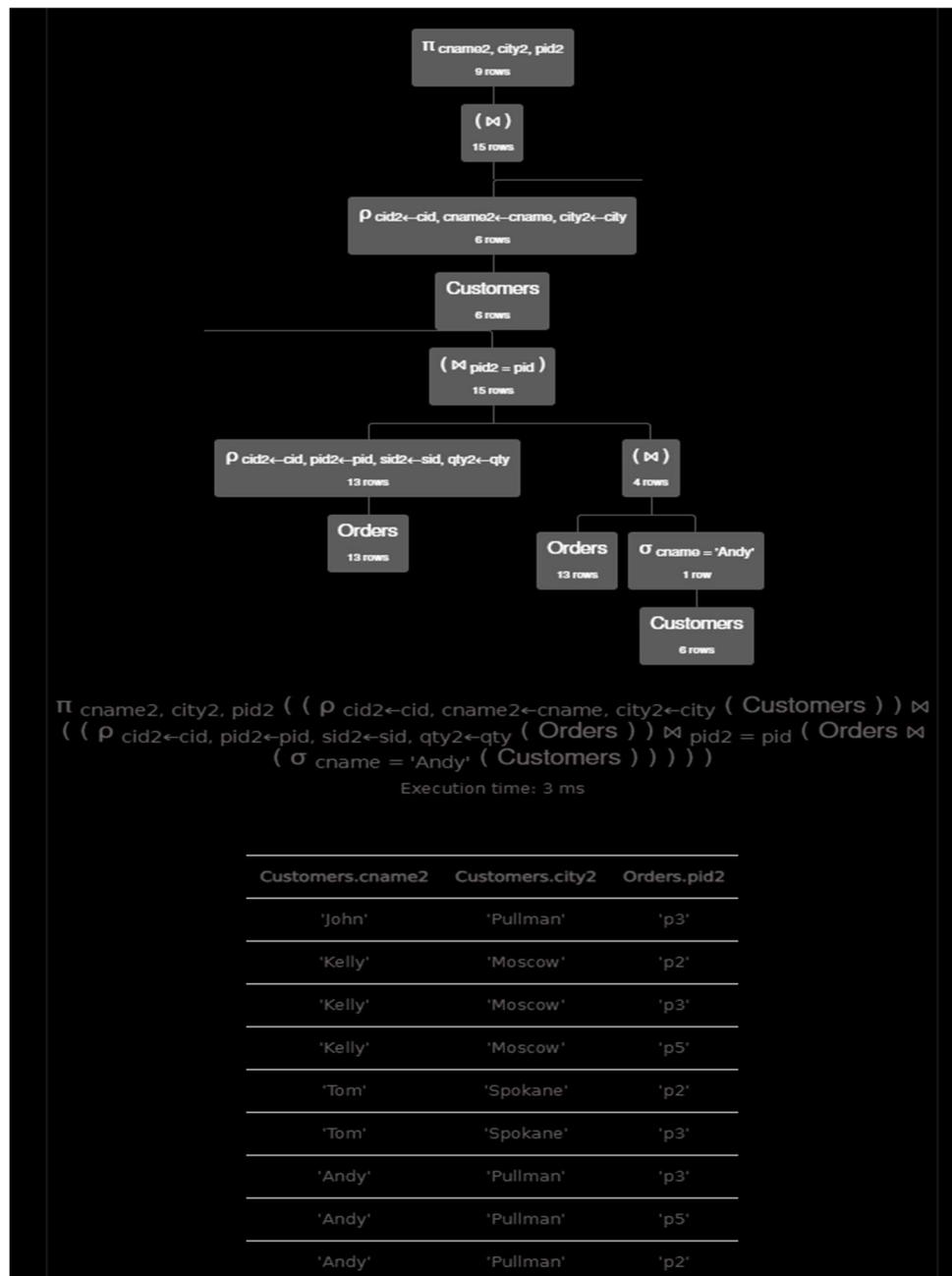
Query $\rightarrow \pi \text{ Parts.pid, Parts.pname } ((\pi \text{ pid } (\text{Catalog}) - \pi \text{ pid } (\text{Orders})) \bowtie \text{ Parts.pid } = \text{Catalog.pid } \text{Parts})$



(* I was a tad confused with this one because p6 is a part but it is not located in the Catalog or in Orders but p7 is in Catalog but not in orders so its assumed it is the only part that is in Catalog but not Ordered*)

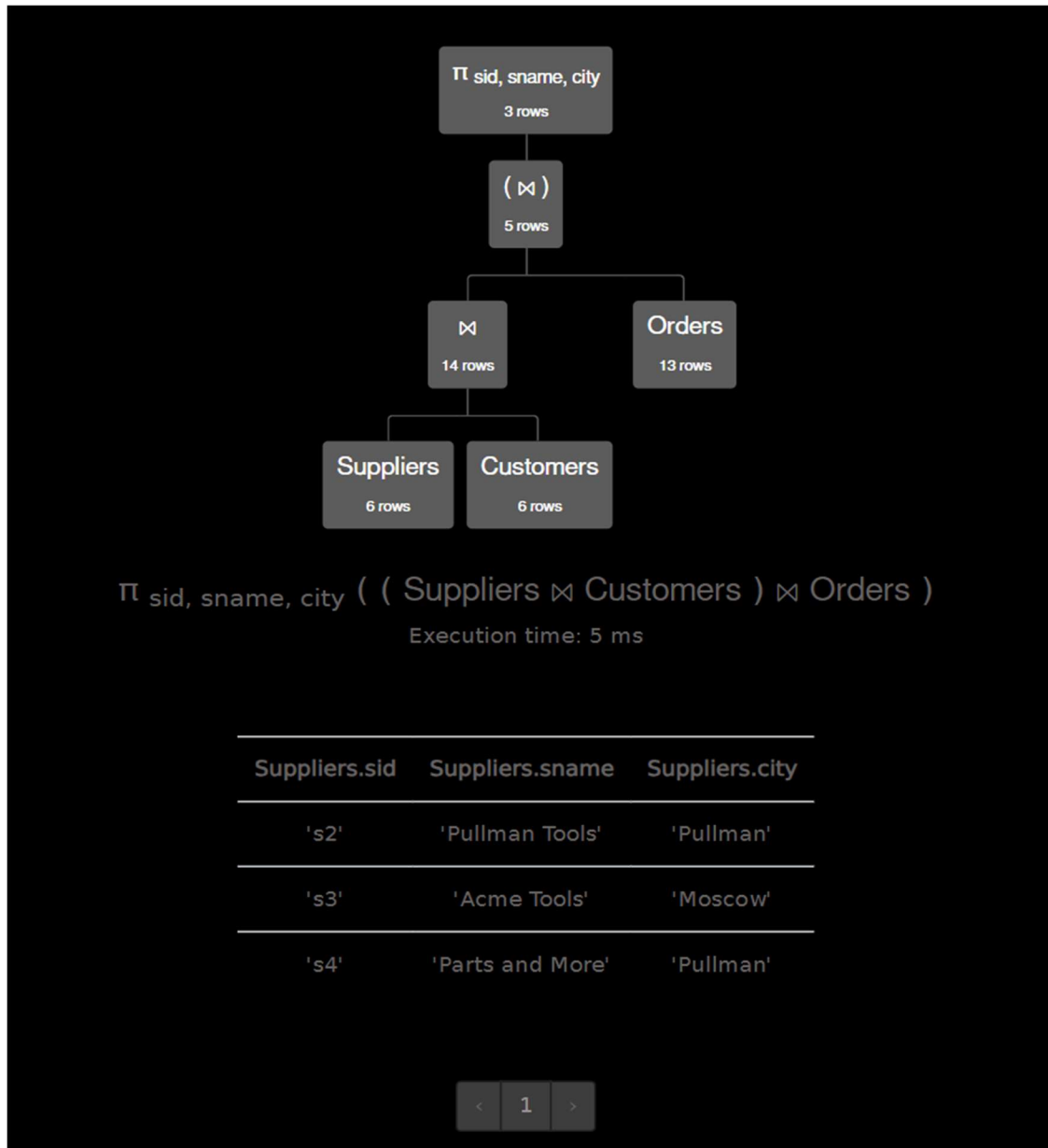
4. Find all customers who ordered one of the products that Andy ordered. Return names and cities of those customers and the “pid”s of the products they ordered.

Query $\rightarrow \pi \text{ cname2, city2, pid2} ((\rho \text{ cid2} \leftarrow \text{cid}, \text{cname2} \leftarrow \text{cname}, \text{city2} \leftarrow \text{city} (\text{Customers})) \bowtie ((\rho \text{ cid2} \leftarrow \text{cid}, \text{pid2} \leftarrow \text{pid}, \text{sid2} \leftarrow \text{sid}, \text{qty2} \leftarrow \text{qty} (\text{Orders})) \bowtie \text{pid2} = \text{pid} (\text{Orders} \bowtie (\sigma \text{ cname} = \text{'Andy'} (\text{Customers}))))))$



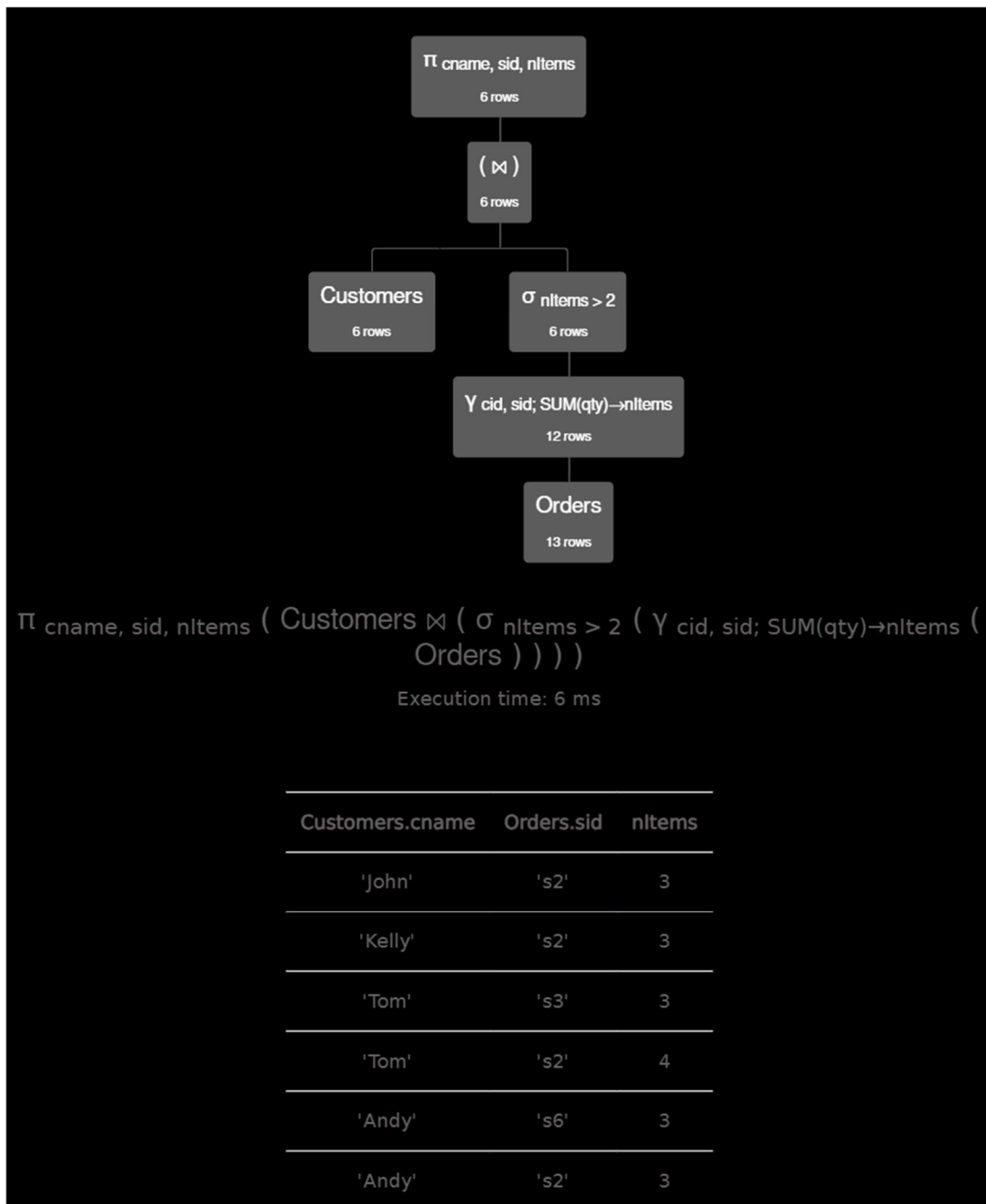
5. Find the suppliers who have received orders from customers who live in the city where that supplier is located. Return “sid”s, names, and cities of those suppliers.

Query $\rightarrow \pi_{sid, sname, city}(Suppliers \bowtie Customers \bowtie Orders)$



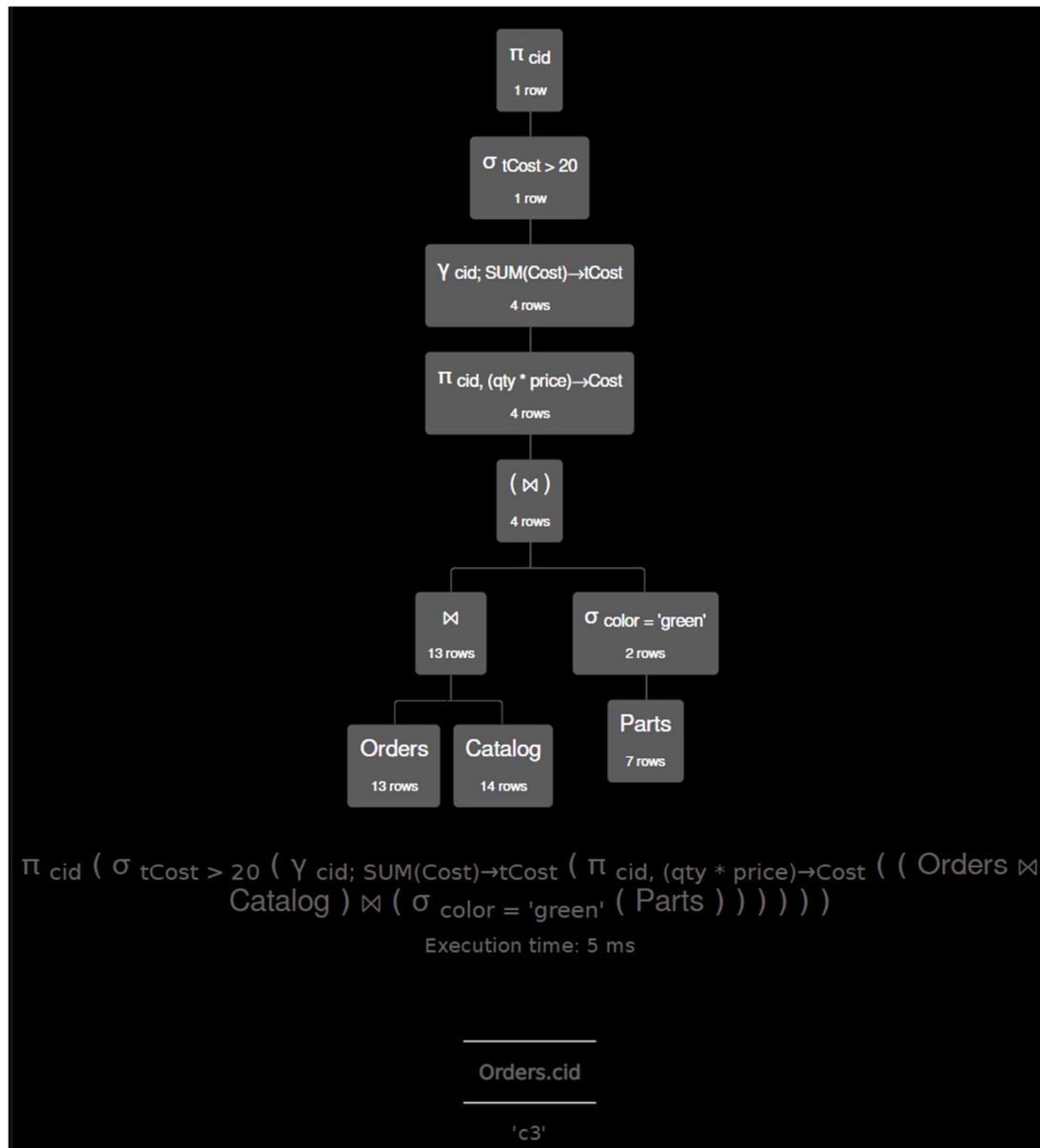
6. Find customers who ordered more than 2 items from a single supplier (i.e., sum of the quantities of all parts customer purchased from the supplier is at least 3). Return names of the customers, “sid”s of the suppliers, and number of items they ordered.

Query $\rightarrow \pi \text{ cname, sid, nItems}(\text{Customers} \bowtie (\sigma \text{ nItems} > 2 (\gamma \text{ cid, sid; SUM}(\text{qty}) \rightarrow \text{nItems}(\text{Orders}))))$



7. Find the customer “cid”s who paid more than \$20 on ‘green’ parts.

Query $\rightarrow \pi_{cid} (\sigma_{tCost > 20} (\gamma_{cid; SUM(Cost) \rightarrow tCost} (\pi_{cid, (qty * price) \rightarrow Cost} (Cost (Orders \bowtie Catalog \bowtie (\sigma_{color = 'green'} (Parts)))))))$

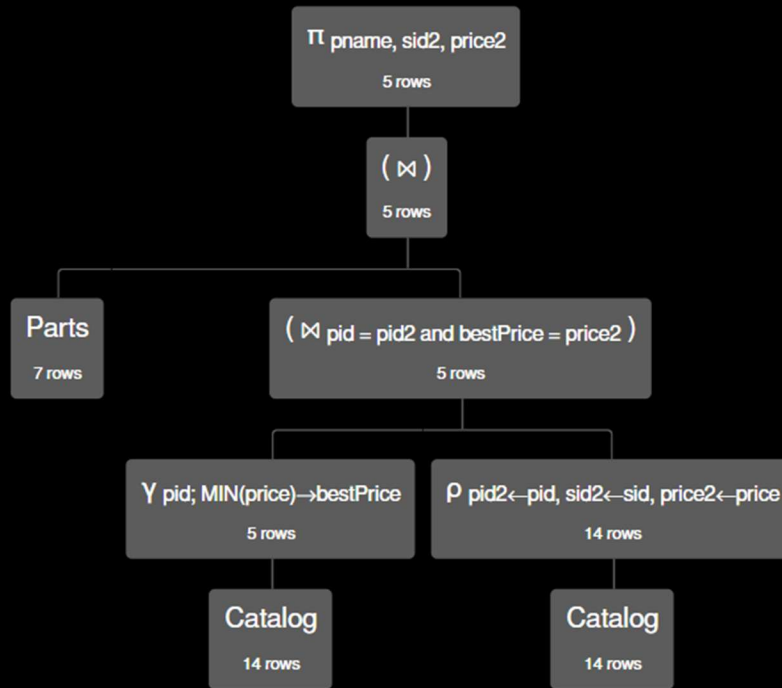


8. Find the parts which are supplied by at least 3 different suppliers. Return the “pid”s names, and colors of those parts.

Query $\rightarrow \pi_{pid, pname, color}(Parts \bowtie (\sigma_{nSuppliers > 2}(\gamma_{pi}, COUNT(sid) \rightarrow nSuppliers(\pi_{pid, sid}(Catalog)))))$

9. For each part in the catalog find the supplier that offers the lowest price; give the part name, supplier “sid” and the price supplier sells the part for.

Query $\rightarrow \gamma \pi_{pname, sid2, price2} (Parts \bowtie (\gamma_{pid; MIN(price) \rightarrow bestPrice(Catalog)} \bowtie_{pid = pid2 \wedge bestPrice = price2} (\rho_{pid2 \leftarrow pid, sid2 \leftarrow sid, price2 \leftarrow price(Catalog))}))$



$\pi_{pname, sid2, price2} (Parts \bowtie (\gamma_{pid; MIN(price) \rightarrow bestPrice} (Catalog) \bowtie_{pid = pid2 \wedge bestPrice = price2} (\rho_{pid2 \leftarrow pid, sid2 \leftarrow sid, price2 \leftarrow price} (Catalog))))$
 Execution time: 6 ms

Parts.pname	Catalog.sid2	Catalog.price2
'Part1'	's2'	48
'Part2'	's2'	20
'Part3'	's4'	15
'Part5'	's3'	9
'Part7'	's3'	33

10. Find the number of suppliers in each city.

Query $\rightarrow \gamma \text{ city; COUNT(sid)} \rightarrow \text{nSuppliers}(\text{Suppliers})$

