```
                                         QUERY PLAN
----------------------------------------------------------------------------------------------------------
 Merge Join  (cost=0.62..1351.74 rows=8893 width=302) (actual time=0.130..45.729 rows=8897 loops=1)
   Merge Cond: (c.customerid = o.customerid)
   ->  Index Scan using customers_pkey on customers c  (cost=0.29..845.29 rows=20000 width=268) (actual time=0.032..10.950 rows=19997 loops=1)
   ->  Index Scan using ix_order_custid on orders o  (cost=0.29..345.29 rows=8893 width=30) (actual time=0.070..19.943 rows=8897 loops=1)
         Filter: (netamount > '100'::numeric)
         Rows Removed by Filter: 3103
 Planning Time: 3.843 ms
 Execution Time: 52.293 ms
```

Listing 1: merge join

```
                                         QUERY PLAN
-------------------------------------------------------------------------------------------------------
 Sort  (cost=7224521.31..7224543.54 rows=8893 width=302) (actual time=111918.890..111919.623 rows=8897 loops=1)
   Sort Key: c.customerid
   Sort Method: quicksort  Memory: 2817kB
   ->  Nested Loop  (cost=0.00..7223938.00 rows=8893 width=302) (actual time=205.686..111816.823 rows=8897 loops=1)
         Join Filter: (c.customerid = o.customerid)
         Rows Removed by Join Filter: 177931103
         ->  Seq Scan on customers c  (cost=0.00..688.00 rows=20000 width=268) (actual time=8.168..31.380 rows=20000 loops=1)
         ->  Seq Scan on orders o  (cost=0.00..250.00 rows=8893 width=30) (actual time=0.006..4.604 rows=8897 loops=20000)
               Filter: (netamount > '100'::numeric)
               Rows Removed by Filter: 3103
 Planning Time: 0.777 ms
 Execution Time: 111925.339 ms
```

Listing 2: nested loop + sort

```
                                         QUERY PLAN
------------------------------------------------------------------------------------------------------------
 Sort  (cost=1575.48..1590.32 rows=5934 width=304) (actual time=33.584..34.200 rows=5936 loops=1)
   Sort Key: o.netamount
   Sort Method: quicksort  Memory: 1816kB
   ->  Hash Join  (cost=938.00..1203.58 rows=5934 width=304) (actual time=12.335..23.709 rows=5936 loops=1)
         Hash Cond: (o.customerid = c.customerid)
         ->  Seq Scan on orders o  (cost=0.00..250.00 rows=5934 width=30) (actual time=0.034..5.769 rows=5936 loops=1)
               Filter: (netamount > '200'::numeric)
               Rows Removed by Filter: 6064
         ->  Hash  (cost=688.00..688.00 rows=20000 width=268) (actual time=12.254..12.254 rows=20000 loops=1)
               Buckets: 32768  Batches: 1  Memory Usage: 4108kB
               ->  Seq Scan on customers c  (cost=0.00..688.00 rows=20000 width=268) (actual time=0.012..5.910 rows=20000 loops=1)
 Planning Time: 1.154 ms
 Execution Time: 40.343 ms
```

Listing 3: hash join

```
                                         QUERY PLAN
---------------------------------------------------------------------------------------------------
 Seq Scan on customers c  (cost=0.00..788.00 rows=769 width=268) (actual time=0.101..10.838 rows=776 loops=1)
   Filter: ((age < 20) OR (age = 22))
   Rows Removed by Filter: 19224
 Planning Time: 0.233 ms
 Execution Time: 11.107 ms
```

Listing 4: multiple conditions in filter

```
                                         QUERY PLAN
----------------------------------------------------------------------------------------------------
 Limit  (cost=0.00..0.18 rows=10 width=30) (actual time=0.033..0.041 rows=10 loops=1)
   ->  Seq Scan on orders  (cost=0.00..220.00 rows=12000 width=30) (actual time=0.030..0.034 rows=10 loops=1)
 Planning Time: 0.154 ms
 Execution Time: 0.414 ms
```

Listing 5: limit

```
                                                        QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------
Hash Right Join  (cost=938.00..1189.51 rows=20000 width=298) (actual time=10.990..29.612 rows=23004 loops=1)
  Hash Cond: (o.customerid = c.customerid)
  -> Seq Scan on orders o  (cost=0.00..220.00 rows=12000 width=30) (actual time=0.010..1.664 rows=12000 loops=1)
  -> Hash  (cost=688.00..688.00 rows=20000 width=268) (actual time=10.940..10.940 rows=20000 loops=1)
        Buckets: 32768  Batches: 1  Memory Usage: 4108kB
        -> Seq Scan on customers c  (cost=0.00..688.00 rows=20000 width=268) (actual time=0.016..4.918 rows=20000 loops=1)
Planning Time: 0.707 ms
Execution Time: 32.227 ms
```

Listing 6: hash right join

```
                                                        QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------
Index Scan using orders_pkey on orders  (cost=0.29..2.30 rows=1 width=30) (actual time=1.361..1.366 rows=1 loops=1)
  Index Cond: (orderid = 3)
Planning Time: 0.191 ms
Execution Time: 1.673 ms
```

Listing 7: index cond

```
                                                        QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------
Hash Join  (cost=22.91..127.58 rows=974 width=500) (actual time=2.509..21.365 rows=2922 loops=1)
  Hash Cond: (a.attrelid = c.oid)
  Join Filter: has_column_privilege(c.oid, a.attnum, 'select'::text)
  -> Seq Scan on pg_attribute a  (cost=0.00..96.61 rows=3061 width=238) (actual time=0.022..1.327 rows=2922 loops=1)
  -> Hash  (cost=17.96..17.96 rows=396 width=266) (actual time=2.444..2.445 rows=396 loops=1)
        Buckets: 1024  Batches: 1  Memory Usage: 89kB
        -> Seq Scan on pg_class c  (cost=0.00..17.96 rows=396 width=266) (actual time=0.024..1.064 rows=396 loops=1)
Planning Time: 0.896 ms
Execution Time: 24.740 ms
```

Listing 8: non parenthesized join filter

```
                                                        QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------
Hash Join  (cost=142.19..179.59 rows=6 width=869) (actual time=14.330..15.259 rows=467 loops=1)
  Hash Cond: ((s.starelid = c.oid) AND (s.staattnum = a.attnum))
  -> Seq Scan on pg_statistic s  (cost=0.00..32.67 rows=467 width=369) (actual time=0.023..0.133 rows=467 loops=1)
  -> Hash  (cost=127.58..127.58 rows=974 width=504) (actual time=14.277..14.278 rows=2922 loops=1)
        Buckets: 4096 (originally 1024)  Batches: 1 (originally 1)  Memory Usage: 982kB
        -> Hash Join  (cost=22.91..127.58 rows=974 width=504) (actual time=2.217..8.851 rows=2922 loops=1)
              Hash Cond: (a.attrelid = c.oid)
              Join Filter: has_column_privilege(c.oid, a.attnum, 'select'::text)
              -> Seq Scan on pg_attribute a  (cost=0.00..96.61 rows=3061 width=238) (actual time=0.010..0.554 rows=2922 loops=1)
              -> Hash  (cost=17.96..17.96 rows=396 width=266) (actual time=2.190..2.190 rows=396 loops=1)
                    Buckets: 1024  Batches: 1  Memory Usage: 89kB
                    -> Seq Scan on pg_class c  (cost=0.00..17.96 rows=396 width=266) (actual time=0.023..0.944 rows=396 loops=1)
Planning Time: 2.122 ms
Execution Time: 18.919 ms
```

Listing 9: 'originally' in hash node

```
                                                      QUERY PLAN
---------------------------------------------------------------------------------------------------------------------
Limit  (cost=143.31..182.10 rows=6 width=401) (actual time=6.445..6.501 rows=10 loops=1)
  ->  Nested Loop Left Join  (cost=143.31..182.04 rows=6 width=401) (actual time=6.443..6.496 rows=10 loops=1)
        ->  Hash Join  (cost=143.18..180.58 rows=6 width=475) (actual time=6.412..6.425 rows=10 loops=1)
              Hash Cond: ((s.starelid = c.oid) AND (s.staattnum = a.attnum))
              ->  Seq Scan on pg_statistic s  (cost=0.00..32.67 rows=467 width=349) (actual time=0.011..0.012 rows=10 loops=1)
              ->  Hash  (cost=128.57..128.57 rows=974 width=142) (actual time=6.390..6.390 rows=2922 loops=1)
                    Buckets: 4096 (originally 1024)  Batches: 1 (originally 1)  Memory Usage: 529kB
                    ->  Hash Join  (cost=23.90..128.57 rows=974 width=142) (actual time=0.394..4.966 rows=2922 loops=1)
                          Hash Cond: (a.attrelid = c.oid)
                          Join Filter: has_column_privilege(c.oid, a.attnum, 'select'::text)
                          ->  Seq Scan on pg_attribute a  (cost=0.00..96.61 rows=3061 width=70) (actual time=0.006..1.253 rows=2922 loops=1)
                                Filter: (NOT attisdropped)
                          ->  Hash  (cost=18.95..18.95 rows=396 width=72) (actual time=0.378..0.378 rows=396 loops=1)
                                Buckets: 1024  Batches: 1  Memory Usage: 49kB
                                ->  Seq Scan on pg_class c  (cost=0.00..18.95 rows=396 width=72) (actual time=0.007..0.243 rows=396 loops=1)
                                      Filter: ((NOT relrowsecurity) OR (NOT row_security_active(oid)))
        ->  Index Scan using pg_namespace_oid_index on pg_namespace n  (cost=0.13..0.16 rows=1 width=68) (actual time=0.003..0.003 rows=1 loops=10)
              Index Cond: (oid = c.relnamespace)
Planning Time: 3.761 ms
Execution Time: 8.801 ms
```

Listing 10: left join