Database Technologies

UE19CS344

6th Semester, Academic Year 2021-22

Week #8: Multi-table joins

(A4)

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About the tables involved in join:

```
dbt519=# select count(cid) from buyers;
 count
-------
  1023
(1 row)

dbt519=# select count(cid) from other_info;
 count
-------
  1116
(1 row)

dbt519=# select count(cid) from buyers_address;
 count
-------
   876
(1 row)

dbt519=# select count(cid) from ph_no_customers;
 count
-------
  1023
(1 row)
```

```
dbt519=# select count(distinct cid) from buyers;
 count
-------
  1023
(1 row)

dbt519=# select count(distinct cid) from other_info;
 count
-------
   685
(1 row)

dbt519=# select count(distinct cid) from buyers_address;
 count
-------
   588
(1 row)

dbt519=# select count(distinct cid) from ph_no_customers;
 count
-------
  1023
(1 row)
```

```
dbt519=# \d buyers;
                    Table "public.buyers"
  Column  |         Type          | Collation | Nullable | Default
----------+-----------------------+-----------+----------+---------
 cid      | integer               |           | not null |
 username | character varying(20) |           |          |
 email    | character varying(30) |           |          |
 password | character varying(20) |           |          |
Indexes:
    "buyers_pkey" PRIMARY KEY, btree (cid)
Referenced by:
    TABLE "buyers_address" CONSTRAINT "buyers_address_cid_fkey" FOREIGN KEY (cid) REFERENCES buyers(cid)
    TABLE "other_info" CONSTRAINT "other_info_cid_fkey" FOREIGN KEY (cid) REFERENCES buyers(cid)
    TABLE "ph_no_customers" CONSTRAINT "ph_no_customers_cid_fkey" FOREIGN KEY (cid) REFERENCES buyers(cid)

dbt519=# \d other_info;
                   Table "public.other_info"
   Column   |         Type          | Collation | Nullable | Default
------------+-----------------------+-----------+----------+---------
 cid        | integer               |           |          |
 age        | integer               |           |          |
 occupation | character varying(20) |           |          |
Foreign-key constraints:
    "other_info_cid_fkey" FOREIGN KEY (cid) REFERENCES buyers(cid)

dbt519=# \d ph_no_customers;
                  Table "public.ph_no_customers"
    Column    |         Type          | Collation | Nullable | Default
--------------+-----------------------+-----------+----------+---------
 cid          | integer               |           |          |
 phone_number | character varying(10) |           |          |
Foreign-key constraints:
    "ph_no_customers_cid_fkey" FOREIGN KEY (cid) REFERENCES buyers(cid)

dbt519=# \d buyers_address;
                 Table "public.buyers_address"
 Column  |         Type          | Collation | Nullable | Default
---------+-----------------------+-----------+----------+---------
 cid     | integer               |           |          |
 address | character varying(40) |           |          |
Foreign-key constraints:
    "buyers_address_cid_fkey" FOREIGN KEY (cid) REFERENCES buyers(cid)
```

Summary: 4 tables => 4! permutations => 24 permutations

1,2,3,4 indicates the position of table in multi-table join query. Eg: buyers = 2, other_info = 4, buyers_addresses = 1, ph_no_customers = 3 indicates the query:

select * from

buyers_address natural join *buyers* natural join *ph_no_customers* natural join *other_info*;

#	buyers	other_info	buyers_address	ph_no_customers	Execution Speed(ms)
1	1	2	3	4	12.192
2	1	2	4	3	11.517
3	1	3	2	4	11.55
4	1	3	4	2	12.484
5	1	4	2	3	12.275
6	1	4	3	2	12.275
7	2	1	3	4	12.668
8	2	1	4	3	13
9	2	3	1	4	11.707
10	2	3	4	1	11.985
11	2	4	1	3	12.509
12	2	4	3	1	12.417
13	3	1	2	4	12.237
14	3	1	4	2	13.138
15	3	2	1	4	11.451
16	3	2	4	1	12.372
17	3	4	1	2	12.332
18	3	4	2	1	12.418
19	4	1	2	3	13.648
20	4	1	3	2	13.058
21	4	2	1	3	12.824
22	4	2	3	1	11.015
23	4	3	1	2	11.593
24	4	3	2	1	11.351

Screenshots:

1. explain analyze select * from buyers natural join other_info natural join buyers_address natural join ph_no_customers;

```
                                                              QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=9.175..11.844 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.022..0.501 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=9.131..9.142 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=4.923..7.193 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.012..0.441 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=4.889..4.897 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 79kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=1.302..3.202 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.023..0.434 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=1.254..1.258 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 76kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.009..0.486 rows=1023 loops=1)
 Planning Time: 3.796 ms
 Execution Time: 12.192 ms
(18 rows)
```

2. explain analyze select * from buyers natural join other_info natural join ph_no_customers natural join buyers_address;

```
                                                              QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=8.640..11.180 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.022..0.531 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=8.595..8.604 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=4.615..6.903 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.012..0.442 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=4.584..4.590 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 79kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=1.214..3.135 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.023..0.471 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=1.169..1.172 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 76kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.010..0.446 rows=1023 loops=1)
 Planning Time: 3.135 ms
 Execution Time: 11.517 ms
(18 rows)
```

3. explain analyze select * from buyers natural join buyers_address natural join other_info natural join ph_no_customers;

```
                                                              QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=8.639..11.209 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.021..0.532 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=8.597..8.607 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=4.603..6.889 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.012..0.444 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=4.572..4.579 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 79kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=1.208..3.086 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.022..0.430 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=1.165..1.168 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 76kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.009..0.443 rows=1023 loops=1)
 Planning Time: 3.256 ms
 Execution Time: 11.550 ms
(18 rows)
```

4. explain analyze select * from buyers natural join buyers_address natural join ph_no_customers natural join other_info;

```
                                                              QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=9.559..12.139 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.023..0.511 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=9.513..9.524 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=4.802..7.530 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.013..0.518 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=4.767..4.775 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 79kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=1.407..3.314 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.024..0.436 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=1.359..1.362 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 76kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.010..0.495 rows=1023 loops=1)
 Planning Time: 3.010 ms
 Execution Time: 12.484 ms
(18 rows)
```

5. explain analyze select * from buyers natural join ph_no_customers natural join other_info natural join buyers_address;

```
                                                              QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=9.221..11.918 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.025..0.537 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=9.170..9.182 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=4.745..7.318 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.013..0.504 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=4.708..4.717 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 79kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=1.258..3.243 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.025..0.456 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=1.206..1.211 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 76kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.010..0.461 rows=1023 loops=1)
 Planning Time: 3.253 ms
 Execution Time: 12.275 ms
(18 rows)
```

6. explain analyze select * from buyers natural join ph_no_customers natural join buyers_address natural join other_info;

```
                                                              QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=8.950..11.894 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.023..0.575 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=8.900..8.916 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=4.678..7.173 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.012..0.467 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=4.644..4.657 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 79kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=1.278..3.206 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.024..0.475 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=1.230..1.236 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 76kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.010..0.456 rows=1023 loops=1)
 Planning Time: 2.923 ms
 Execution Time: 12.275 ms
(18 rows)
```

7. explain analyze select * from other_info natural join buyers natural join buyers_address natural join ph_no_customers;

```
                                                                   QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=9.780..12.323 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.023..0.490 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=9.733..9.743 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 94kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=5.565..7.954 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.013..0.475 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=5.532..5.539 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 80kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=2.268..4.070 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.023..0.426 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.219..2.222 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 78kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.018..0.841 rows=1023 loops=1)
 Planning Time: 3.394 ms
 Execution Time: 12.668 ms
(18 rows)
```

8. explain analyze select * from other_info natural join buyers natural join ph_no_customers natural join buyers_address;

```
                                                                   QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=9.928..12.612 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.025..0.531 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=9.879..9.891 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 94kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=5.853..8.160 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.013..0.451 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=5.818..5.827 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 80kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=2.422..4.289 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.025..0.444 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.373..2.376 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 78kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.018..0.891 rows=1023 loops=1)
 Planning Time: 3.268 ms
 Execution Time: 13.000 ms
(18 rows)
```

9. explain analyze select * from other_info natural join buyers_address natural join buyers natural join ph_no_customers;

```
                                                                   QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=97.79..142.70 rows=1404 width=67) (actual time=7.355..11.366 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers_address.cid)
   ->  Hash Join  (cost=32.02..53.12 rows=1116 width=51) (actual time=2.264..4.587 rows=1116 loops=1)
         Hash Cond: (other_info.cid = buyers.cid)
         ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.022..0.490 rows=1116 loops=1)
         ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.213..2.216 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 78kB
               ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.018..0.842 rows=1023 loops=1)
   ->  Hash  (cost=54.82..54.82 rows=876 width=28) (actual time=5.041..5.045 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 62kB
         ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.826..3.772 rows=876 loops=1)
               Hash Cond: (buyers_address.cid = ph_no_customers.cid)
               ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.027..0.452 rows=876 loops=1)
               ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.761..1.763 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 56kB
                     ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.015..0.695 rows=1023 loops=1)
 Planning Time: 3.263 ms
 Execution Time: 11.707 ms
(18 rows)
```

10. explain analyze select * from other_info natural join buyers_address natural join ph_no_customers natural join buyers;

```
                                                              QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=97.79..142.70 rows=1404 width=67) (actual time=7.367..11.629 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers_address.cid)
   ->  Hash Join  (cost=32.02..53.12 rows=1116 width=51) (actual time=2.306..4.829 rows=1116 loops=1)
         Hash Cond: (other_info.cid = buyers.cid)
         ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.026..0.601 rows=1116 loops=1)
         ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.247..2.251 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 78kB
               ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.020..0.843 rows=1023 loops=1)
   ->  Hash  (cost=54.82..54.82 rows=876 width=28) (actual time=5.040..5.045 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 62kB
         ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=2.039..3.849 rows=876 loops=1)
               Hash Cond: (buyers_address.cid = ph_no_customers.cid)
               ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.034..0.447 rows=876 loops=1)
               ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.981..1.983 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 56kB
                     ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.016..0.766 rows=1023 loops=1)
 Planning Time: 2.955 ms
 Execution Time: 11.985 ms
(18 rows)
```

11. explain analyze select * from other_info natural join ph_no_customers natural join buyers natural join buyers_address;

```
                                                              QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=9.643..12.164 rows=1001 loops=1)
   Hash Cond: (other_info.cid = ph_no_customers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.022..0.489 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=9.599..9.608 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 94kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=5.586..7.842 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.012..0.443 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=5.554..5.561 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 80kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=2.308..4.113 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.023..0.425 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.263..2.265 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 78kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.017..0.860 rows=1023 loops=1)
 Planning Time: 3.177 ms
 Execution Time: 12.509 ms
(18 rows)
```

12. explain analyze select * from other_info natural join ph_no_customers natural join buyers_address natural join buyers;

```
                                                              QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=97.79..132.64 rows=1404 width=67) (actual time=7.863..12.067 rows=1001 loops=1)
   Hash Cond: (other_info.cid = ph_no_customers.cid)
   ->  Hash Join  (cost=32.02..53.12 rows=1116 width=51) (actual time=2.337..4.769 rows=1116 loops=1)
         Hash Cond: (other_info.cid = buyers.cid)
         ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.022..0.506 rows=1116 loops=1)
         ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.285..2.289 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 78kB
               ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.016..0.876 rows=1023 loops=1)
   ->  Hash  (cost=54.82..54.82 rows=876 width=28) (actual time=5.477..5.483 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 62kB
         ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.930..4.143 rows=876 loops=1)
               Hash Cond: (buyers_address.cid = ph_no_customers.cid)
               ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.030..0.510 rows=876 loops=1)
               ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.882..1.884 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 56kB
                     ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.015..0.743 rows=1023 loops=1)
 Planning Time: 2.964 ms
 Execution Time: 12.417 ms
(18 rows)
```

13. explain analyze select * from buyers_address natural join buyers natural join other_info natural join ph_no_customers;

```
                                                            QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=96.09..134.74 rows=956 width=67) (actual time=8.360..11.897 rows=1001 loops=1)
   Hash Cond: (buyers_address.cid = buyers.cid)
   ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.810..3.749 rows=876 loops=1)
         Hash Cond: (buyers_address.cid = ph_no_customers.cid)
         ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.034..0.471 rows=876 loops=1)
         ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.749..1.752 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 56kB
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.019..0.693 rows=1023 loops=1)
   ->  Hash  (cost=53.12..53.12 rows=1116 width=51) (actual time=6.521..6.526 rows=1116 loops=1)
         Buckets: 2048  Batches: 1  Memory Usage: 112kB
         ->  Hash Join  (cost=32.02..53.12 rows=1116 width=51) (actual time=2.297..4.566 rows=1116 loops=1)
               Hash Cond: (other_info.cid = buyers.cid)
               ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.013..0.476 rows=1116 loops=1)
               ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.266..2.268 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 78kB
                     ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.013..0.811 rows=1023 loops=1)
 Planning Time: 3.460 ms
 Execution Time: 12.237 ms
(18 rows)
```

14. explain analyze select * from buyers_address natural join buyers natural join ph_no_customers natural join other_info;

```
                                                            QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=96.09..134.74 rows=956 width=67) (actual time=9.216..12.785 rows=1001 loops=1)
   Hash Cond: (buyers_address.cid = buyers.cid)
   ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.863..3.816 rows=876 loops=1)
         Hash Cond: (buyers_address.cid = ph_no_customers.cid)
         ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.034..0.480 rows=876 loops=1)
         ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.802..1.804 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 56kB
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.018..0.699 rows=1023 loops=1)
   ->  Hash  (cost=53.12..53.12 rows=1116 width=51) (actual time=7.314..7.319 rows=1116 loops=1)
         Buckets: 2048  Batches: 1  Memory Usage: 112kB
         ->  Hash Join  (cost=32.02..53.12 rows=1116 width=51) (actual time=2.306..5.085 rows=1116 loops=1)
               Hash Cond: (other_info.cid = buyers.cid)
               ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.014..0.561 rows=1116 loops=1)
               ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.270..2.272 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 78kB
                     ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.013..0.843 rows=1023 loops=1)
 Planning Time: 2.976 ms
 Execution Time: 13.138 ms
(18 rows)
```

15. explain analyze select * from buyers_address natural join other_info natural join buyers natural join ph_no_customers;

```
                                                            QUERY PLAN
-----------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=97.79..142.70 rows=1404 width=67) (actual time=7.098..11.113 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers_address.cid)
   ->  Hash Join  (cost=32.02..53.12 rows=1116 width=51) (actual time=2.286..4.635 rows=1116 loops=1)
         Hash Cond: (other_info.cid = buyers.cid)
         ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.024..0.500 rows=1116 loops=1)
         ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.172..2.175 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 78kB
               ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.017..0.803 rows=1023 loops=1)
   ->  Hash  (cost=54.82..54.82 rows=876 width=28) (actual time=4.789..4.793 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 62kB
         ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.774..3.607 rows=876 loops=1)
               Hash Cond: (buyers_address.cid = ph_no_customers.cid)
               ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.035..0.439 rows=876 loops=1)
               ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.723..1.725 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 56kB
                     ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.015..0.678 rows=1023 loops=1)
 Planning Time: 3.464 ms
 Execution Time: 11.451 ms
(18 rows)
```

16. explain analyze select * from buyers_address natural join other_info natural join ph_no_customers natural join buyers;

```
                                                                  QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=97.79..142.70 rows=1404 width=67) (actual time=7.304..12.011 rows=1001 loops=1)
   Hash Cond: (other_info.cid = buyers_address.cid)
   ->  Hash Join  (cost=32.02..53.12 rows=1116 width=51) (actual time=2.286..5.032 rows=1116 loops=1)
         Hash Cond: (other_info.cid = buyers.cid)
         ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.021..0.563 rows=1116 loops=1)
         ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.237..2.241 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 78kB
               ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.017..0.820 rows=1023 loops=1)
   ->  Hash  (cost=54.82..54.82 rows=876 width=28) (actual time=4.997..5.003 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 62kB
         ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.754..3.762 rows=876 loops=1)
               Hash Cond: (buyers_address.cid = ph_no_customers.cid)
               ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.026..0.468 rows=876 loops=1)
               ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.715..1.717 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 56kB
                     ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.014..0.674 rows=1023 loops=1)
 Planning Time: 2.911 ms
 Execution Time: 12.372 ms
(18 rows)
```

17. explain analyze select * from buyers_address natural join ph_no_customers natural join buyers natural join other_info;

```
                                                                  QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=96.09..134.74 rows=956 width=67) (actual time=8.501..11.989 rows=1001 loops=1)
   Hash Cond: (buyers_address.cid = buyers.cid)
   ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.959..3.877 rows=876 loops=1)
         Hash Cond: (buyers_address.cid = ph_no_customers.cid)
         ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.036..0.499 rows=876 loops=1)
         ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.896..1.898 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 56kB
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.020..0.783 rows=1023 loops=1)
   ->  Hash  (cost=53.12..53.12 rows=1116 width=51) (actual time=6.511..6.517 rows=1116 loops=1)
         Buckets: 2048  Batches: 1  Memory Usage: 112kB
         ->  Hash Join  (cost=32.02..53.12 rows=1116 width=51) (actual time=2.269..4.576 rows=1116 loops=1)
               Hash Cond: (other_info.cid = buyers.cid)
               ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.015..0.506 rows=1116 loops=1)
               ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.235..2.237 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 78kB
                     ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.013..0.856 rows=1023 loops=1)
 Planning Time: 2.935 ms
 Execution Time: 12.332 ms
(18 rows)
```

18. explain analyze select * from buyers_address natural join ph_no_customers natural join other_info natural join buyers;

```
                                                                  QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=108.49..137.41 rows=1404 width=67) (actual time=8.197..12.058 rows=1001 loops=1)
   Hash Cond: (buyers_address.cid = ph_no_customers.cid)
   ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=2.215..4.353 rows=876 loops=1)
         Hash Cond: (buyers_address.cid = buyers.cid)
         ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.034..0.523 rows=876 loops=1)
         ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.156..2.160 rows=1023 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 78kB
               ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.017..0.797 rows=1023 loops=1)
   ->  Hash  (cost=62.52..62.52 rows=1116 width=31) (actual time=5.944..5.950 rows=1116 loops=1)
         Buckets: 2048  Batches: 1  Memory Usage: 88kB
         ->  Hash Join  (cost=29.02..62.52 rows=1116 width=31) (actual time=1.820..4.254 rows=1116 loops=1)
               Hash Cond: (other_info.cid = ph_no_customers.cid)
               ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.012..0.502 rows=1116 loops=1)
               ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.790..1.792 rows=1023 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 56kB
                     ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.013..0.722 rows=1023 loops=1)
 Planning Time: 2.900 ms
 Execution Time: 12.418 ms
(18 rows)
```

19. explain analyze select * from ph_no_customers natural join buyers natural join other_info natural join buyers_address;

```
                                                            QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=10.102..13.263 rows=1001 loops=1)
   Hash Cond: (other_info.cid = ph_no_customers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.023..0.606 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=10.053..10.063 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=5.717..8.223 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.013..0.488 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=5.683..5.690 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 80kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=2.335..4.211 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.024..0.439 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.286..2.289 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 78kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.018..0.842 rows=1023 loops=1)
 Planning Time: 3.052 ms
 Execution Time: 13.648 ms
(18 rows)
```

20. explain analyze select * from ph_no_customers natural join buyers natural join buyers_address natural join other_info;

```
                                                            QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=9.751..12.690 rows=1001 loops=1)
   Hash Cond: (other_info.cid = ph_no_customers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.021..0.552 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=9.704..9.716 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=5.539..7.958 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.012..0.492 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=5.507..5.515 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 80kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=2.211..4.063 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.023..0.463 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.167..2.170 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 78kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.016..0.797 rows=1023 loops=1)
 Planning Time: 3.029 ms
 Execution Time: 13.058 ms
(18 rows)
```

21. explain analyze select * from ph_no_customers natural join other_info natural join buyers natural join buyers_address;

```
                                                            QUERY PLAN
------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=98.81..130.72 rows=956 width=67) (actual time=9.938..12.480 rows=1001 loops=1)
   Hash Cond: (other_info.cid = ph_no_customers.cid)
   ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.024..0.491 rows=1116 loops=1)
   ->  Hash  (cost=87.86..87.86 rows=876 width=63) (actual time=9.889..9.898 rows=876 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 93kB
         ->  Hash Join  (cost=59.04..87.86 rows=876 width=63) (actual time=5.589..8.049 rows=876 loops=1)
               Hash Cond: (ph_no_customers.cid = buyers.cid)
               ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.012..0.489 rows=1023 loops=1)
               ->  Hash  (cost=48.09..48.09 rows=876 width=48) (actual time=5.556..5.562 rows=876 loops=1)
                     Buckets: 1024  Batches: 1  Memory Usage: 80kB
                     ->  Hash Join  (cost=32.02..48.09 rows=876 width=48) (actual time=2.243..4.108 rows=876 loops=1)
                           Hash Cond: (buyers_address.cid = buyers.cid)
                           ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.028..0.437 rows=876 loops=1)
                           ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.192..2.196 rows=1023 loops=1)
                                 Buckets: 1024  Batches: 1  Memory Usage: 78kB
                                 ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.020..0.813 rows=1023 loops=1)
 Planning Time: 3.332 ms
 Execution Time: 12.828 ms
(18 rows)
```

22. explain analyze select * from ph_no_customers natural join other_info natural join buyers_address natural join buyers;

```
                                                                QUERY PLAN
---------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=97.79..132.22 rows=956 width=67) (actual time=6.745..10.670 rows=1001 loops=1)
   Hash Cond: (ph_no_customers.cid = buyers.cid)
   ->  Hash Join  (cost=65.77..97.68 rows=956 width=44) (actual time=4.478..6.948 rows=1001 loops=1)
         Hash Cond: (other_info.cid = ph_no_customers.cid)
         ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.014..0.496 rows=1116 loops=1)
         ->  Hash  (cost=54.82..54.82 rows=876 width=28) (actual time=4.444..4.450 rows=876 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 62kB
               ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.366..3.250 rows=876 loops=1)
                     Hash Cond: (buyers_address.cid = ph_no_customers.cid)
                     ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.023..0.431 rows=876 loops=1)
                     ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.323..1.326 rows=1023 loops=1)
                           Buckets: 1024  Batches: 1  Memory Usage: 55kB
                           ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.011..0.495 rows=1023 loops=1)
   ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.248..2.250 rows=1023 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 78kB
         ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.027..0.831 rows=1023 loops=1)
 Planning Time: 2.890 ms
 Execution Time: 11.015 ms
(18 rows)
```

23. explain analyze select * from ph_no_customers natural join buyers_address natural join buyers natural join other_info;

```
                                                                QUERY PLAN
---------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=97.79..132.22 rows=956 width=67) (actual time=7.337..11.177 rows=1001 loops=1)
   Hash Cond: (ph_no_customers.cid = buyers.cid)
   ->  Hash Join  (cost=65.77..97.68 rows=956 width=44) (actual time=4.787..7.208 rows=1001 loops=1)
         Hash Cond: (other_info.cid = ph_no_customers.cid)
         ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.017..0.496 rows=1116 loops=1)
         ->  Hash  (cost=54.82..54.82 rows=876 width=28) (actual time=4.748..4.755 rows=876 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 62kB
               ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.586..3.563 rows=876 loops=1)
                     Hash Cond: (buyers_address.cid = ph_no_customers.cid)
                     ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.025..0.487 rows=876 loops=1)
                     ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.538..1.541 rows=1023 loops=1)
                           Buckets: 1024  Batches: 1  Memory Usage: 55kB
                           ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.013..0.610 rows=1023 loops=1)
   ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.515..2.516 rows=1023 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 78kB
         ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.052..1.003 rows=1023 loops=1)
 Planning Time: 4.972 ms
 Execution Time: 11.593 ms
(18 rows)
```

24. explain analyze select * from ph_no_customers natural join buyers_address natural join other_info natural join buyers;

```
                                                                QUERY PLAN
---------------------------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=97.79..132.22 rows=956 width=67) (actual time=7.049..10.973 rows=1001 loops=1)
   Hash Cond: (ph_no_customers.cid = buyers.cid)
   ->  Hash Join  (cost=65.77..97.68 rows=956 width=44) (actual time=4.649..7.115 rows=1001 loops=1)
         Hash Cond: (other_info.cid = ph_no_customers.cid)
         ->  Seq Scan on other_info  (cost=0.00..18.16 rows=1116 width=16) (actual time=0.014..0.515 rows=1116 loops=1)
         ->  Hash  (cost=54.82..54.82 rows=876 width=28) (actual time=4.612..4.619 rows=876 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 62kB
               ->  Hash Join  (cost=29.02..54.82 rows=876 width=28) (actual time=1.216..3.359 rows=876 loops=1)
                     Hash Cond: (buyers_address.cid = ph_no_customers.cid)
                     ->  Seq Scan on buyers_address  (cost=0.00..13.76 rows=876 width=13) (actual time=0.023..0.483 rows=876 loops=1)
                     ->  Hash  (cost=16.23..16.23 rows=1023 width=15) (actual time=1.173..1.176 rows=1023 loops=1)
                           Buckets: 1024  Batches: 1  Memory Usage: 55kB
                           ->  Seq Scan on ph_no_customers  (cost=0.00..16.23 rows=1023 width=15) (actual time=0.012..0.444 rows=1023 loops=1)
   ->  Hash  (cost=19.23..19.23 rows=1023 width=35) (actual time=2.379..2.380 rows=1023 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 78kB
         ->  Seq Scan on buyers  (cost=0.00..19.23 rows=1023 width=35) (actual time=0.026..0.877 rows=1023 loops=1)
 Planning Time: 2.901 ms
 Execution Time: 11.351 ms
(18 rows)
```