

Original query

```
-> Limit: 50 row(s) (actual time=89139..89139 rows=50 loops=1)
    -> Sort: avg_rating_amazon DESC (actual time=89139..89139 rows=50 loops=1)
        -> Table scan on <temporary> (cost=2.5..2.5 rows=0) (actual time=89139..89139 rows=538 loops=1)
            -> Temporary table (cost=0..0 rows=0) (actual time=89139..89139 rows=538 loops=1)
                -> Window aggregate: rank() OVER (PARTITION BY pb.genre ORDER BY `avg(perfect_books.total_ratings)` desc ) (actual time=89136..89138 rows=538 loops=1)
                    -> Filter: (`count(distinct amazon_books.title)` >= 2) (actual time=89136..89137 rows=538 loops=1)
                        -> Sort: pb.genre, `avg(perfect_books.total_ratings)` DESC (actual time=89136..89137 rows=2922 loops=1)
                            -> Stream results (actual time=89069..89127 rows=2922 loops=1)
                                -> Group aggregate: count(distinct amazon_books.title), avg(perfect_books.total_ratings), avg(tmp_field), count(distinct amazon_books.title), avg(amazon_books.rating), avg(perfect_books.rating) (actual time=89069..89121 rows=2922 loops=1)
                                    -> Sort: pb.genre, pb.author (actual time=89069..89075 rows=10950 loops=1)
                                        -> Stream results (cost=10666 rows=675) (actual time=38.2..89000 rows=10950 loops=1)
                                            -> Filter: ((pb.title = ab.title) and (pb.author = ab.author)) (cost=10666 rows=675) (actual time=29.6..175 rows=10950 loops=1)
                                                -> Inner hash join (<hash>(pb.title)=<hash>(ab.title)), (<hash>(pb.author)=<hash>(ab.author)) (cost=10666 rows=675) (actual time=29.6..147 rows=10950 loops=1)
                                                    -> Filter: (ab.price is not null) (cost=1.96 rows=68.7) (actual time=0.0327..20.7 rows=7928 loops=1)
                                                        -> Table scan on ab (cost=1.96 rows=7630) (actual time=0.0313..18.1 rows=7928 loops=1)
                                                            -> Hash
                                                                -> Filter: ((pb.rating >= 4) and (pb.total_ratings > 100)) (cost=1039 rows=1092) (actual time=0.0834..19.9 rows=7342 loops=1)
                                                                    -> Table scan on pb (cost=1039 rows=9827) (actual time=0.0774..17.5 rows=10000 loops=1)
-> Select #2 (subquery in projection; dependent)
    -> Aggregate: count(0) (cost=386 rows=1) (actual time=8.09..8.09 rows=1 loops=10950)
        -> Filter: ((apb.author = pb.author) and (apb.rating > 4.5)) (cost=370 rows=164) (actual time=6.66..8.08 rows=1.34 loops=10950)
            -> Table scan on apb (cost=370 rows=4932) (actual time=0.0125..6.9 rows=4846 loops=10950)
```

- Загальний час виконання: 89 139 мс

- Кількість викликів підзапиту: 10 950

- Тимчасові таблиці: так

- Тип доступу: повне сканування

- Індeksi не використовуються

Step 1 refactor

```
-> Limit: 50 row(s) (actual time=319..319 rows=50 loops=1)
  -> Sort: avg_rating_amazon DESC (actual time=319..319 rows=50 loops=1)
    -> Table scan on <temporary> (cost=2.5..2.5 rows=0) (actual
time=318..318 rows=538 loops=1)
      -> Temporary table (cost=0..0 rows=0) (actual time=318..318
rows=538 loops=1)
        -> Window aggregate: rank() OVER (PARTITION BY b.genre ORDER
BY `avg(perfect_books.total_ratings)` desc ) (actual time=314..318 rows=538
loops=1)
          -> Filter: (`count(distinct amazon_books.title)` >= 2)
(actual time=314..315 rows=538 loops=1)
            -> Sort: b.genre, `avg(perfect_books.total_ratings)`
DESC (actual time=314..315 rows=2922 loops=1)
              -> Stream results (actual time=239..304
rows=2922 loops=1)
                -> Group aggregate: count(distinct
amazon_books.title), avg(perfect_books.total_ratings), avg(price),
count(distinct amazon_books.title), avg(amazon_books.amazon_rating),
avg(perfect_books.perfect_rating), max(tmp_field) (actual time=239..298
rows=2922 loops=1)
                  -> Sort: b.genre, b.author (actual
time=239..246 rows=10950 loops=1)
                    -> Stream results (cost=198421
rows=0) (actual time=53.5..205 rows=10950 loops=1)
                      -> Nested loop left join
(cost=198421 rows=0) (actual time=53.4..175 rows=10950 loops=1)
                        -> Filter: ((pb.title =
ab.title) and (pb.author = ab.author)) (cost=10666 rows=675) (actual
time=30.8..116 rows=10950 loops=1)
                          -> Inner hash join
(<hash>(pb.title)=<hash>(ab.title)), (<hash>(pb.author)=<hash>(ab.author))
(cost=10666 rows=675) (actual time=30.8..96.7 rows=10950 loops=1)
                            -> Filter: (ab.price
is not null) (cost=1.96 rows=68.7) (actual time=0.0269..17.8 rows=7928
loops=1)
                              -> Table scan on
ab (cost=1.96 rows=7630) (actual time=0.0256..16.7 rows=7928 loops=1)
                                -> Hash
                                  -> Filter:
((pb.rating >= 4) and (pb.total_ratings > 100)) (cost=1039 rows=1092)
(actual time=0.0836..20.9 rows=7342 loops=1)
                                    -> Table scan
on pb (cost=1039 rows=9827) (actual time=0.0781..18.2 rows=10000 loops=1)
                                      -> Index lookup on ps using
<auto_key0> (author=pb.author) (cost=0.25..2.5 rows=10) (actual
time=0.0049..0.00503 rows=0.23 loops=10950)
                                          -> Materialize CTE
popular_stats (cost=0..0 rows=0) (actual time=22.7..22.7 rows=2267 loops=1)
                                            -> Table scan on
<temporary> (actual time=17..17.6 rows=2267 loops=1)
                                              -> Aggregate
using temporary table (actual time=17..17 rows=2267 loops=1)
                                                -> Filter:
(amazon_popular_books.rating > 4.5) (cost=517 rows=1644) (actual
time=0.015..8.64 rows=3745 loops=1)
                                                  -> Table
scan on amazon_popular_books (cost=517 rows=4932) (actual time=0.014..7.9
rows=4846 loops=1)
```

- Загальний час виконання: 319 мс
- Кількість викликів підзапиту: 1 (використовується СТЕ один раз)
- Тимчасові таблиці: так
- Тип доступу: повне сканування
- Індeksi не використовуються

Step 3 indexing

```
-> Limit: 50 row(s) (actual time=1392..1392 rows=50 loops=1)
    -> Sort: avg_rating_amazon DESC (actual time=1392..1392 rows=50 loops=1)
        -> Table scan on <temporary> (cost=2.5..2.5 rows=0) (actual
time=1391..1391 rows=538 loops=1)
            -> Temporary table (cost=0..0 rows=0) (actual time=1391..1391
rows=538 loops=1)
                -> Window aggregate: rank() OVER (PARTITION BY b.genre ORDER
BY `avg(perfect_books.total_ratings)` desc ) (actual time=1388..1390
rows=538 loops=1)
                    -> Filter: (`count(distinct amazon_books.title)` >= 2)
(actual time=1388..1389 rows=538 loops=1)
                        -> Sort: b.genre, `avg(perfect_books.total_ratings)`
DESC (actual time=1388..1389 rows=2922 loops=1)
                            -> Stream results (actual time=1322..1379
rows=2922 loops=1)
                                -> Group aggregate: count(distinct
amazon_books.title), avg(perfect_books.total_ratings),
avg(perfect_books.perfect_rating), avg(amazon_books.amazon_rating),
avg(price), count(distinct amazon_books.title), max(tmp_field) (actual
time=1322..1374 rows=2922 loops=1)
                                    -> Sort: b.genre, b.author (actual
time=1322..1328 rows=10950 loops=1)
                                        -> Stream results (cost=94173
rows=871322) (actual time=19.4..1283 rows=10950 loops=1)
                                            -> Nested loop left join
(cost=94173 rows=871322) (actual time=19.4..1246 rows=10950 loops=1)
                                                -> Nested loop inner join
(cost=5713 rows=530) (actual time=0.173..1181 rows=10950 loops=1)
                                                    -> Filter: ((ab.price is
not null) and (ab.author is not null)) (cost=819 rows=6867) (actual
time=0.0766..19.2 rows=7928 loops=1)
                                                        -> Table scan on ab
(cost=819 rows=7630) (actual time=0.0741..17 rows=7928 loops=1)
                                                            -> Filter: ((pb.rating >=
4) and (pb.total_ratings > 100) and (pb.title = ab.title)) (cost=0.509
rows=0.0772) (actual time=0.065..0.146 rows=1.38 loops=7928)
                                                                -> Index lookup on pb
using idx_perfect_author_genre (author=ab.author), with index condition:
(pb.author = ab.author) (cost=0.509 rows=2.04) (actual time=0.00872..0.132
rows=29.6 loops=7928)
                                                                    -> Index lookup on ps using
<auto_key0> (author=pb.author) (cost=846..849 rows=10) (actual
time=0.00531..0.00544 rows=0.23 loops=10950)
                                                                        -> Materialize CTE
popular_stats (cost=846..846 rows=1644) (actual time=19.2..19.2 rows=2267
loops=1)
                                                                            -> Group aggregate:
count(0) (cost=682 rows=1644) (actual time=0.0355..11.2 rows=2267 loops=1)
```

```

-> Filter:
(amazon_popular_books.rating > 4.5) (cost=517 rows=1644) (actual
time=0.0227..8.74 rows=3745 loops=1)
-> Covering
index scan on amazon_popular_books using idx_popular_authot_rating (cost=517
rows=4932) (actual time=0.0215..7.95 rows=4846 loops=1)

```

- Загальний час виконання: 1392 мс
- Кількість викликів підзапиту: 1 (використовується СТЕ один раз)
- Тимчасові таблиці: так
- Тип доступу: індекси
- Індекси використані: idx_perfect_author_genre, idx_popular_author_rating

Step 3 Joins

```

-> Limit: 50 row(s) (actual time=1329..1329 rows=50 loops=1)
-> Sort: avg_rating_amazon DESC (actual time=1329..1329 rows=50 loops=1)
-> Table scan on <temporary> (cost=2.5..2.5 rows=0) (actual
time=1328..1329 rows=538 loops=1)
-> Temporary table (cost=0..0 rows=0) (actual time=1328..1328
rows=538 loops=1)
-> Window aggregate: rank() OVER (PARTITION BY b.genre ORDER
BY `avg(perfect_books.total_ratings)` desc ) (actual time=1326..1328
rows=538 loops=1)
-> Filter: (`count(distinct amazon_books.title)` >= 2)
(actual time=1326..1327 rows=538 loops=1)
-> Sort: b.genre, `avg(perfect_books.total_ratings)`
DESC (actual time=1326..1327 rows=2922 loops=1)
-> Stream results (actual time=1263..1318
rows=2922 loops=1)
-> Group aggregate: count(distinct
amazon_books.title), avg(perfect_books.total_ratings),
avg(perfect_books.perfect_rating), avg(amazon_books.amazon_rating),
avg(price), count(distinct amazon_books.title), max(tmp_field) (actual
time=1263..1313 rows=2922 loops=1)
-> Sort: b.genre, b.author (actual
time=1263..1269 rows=10950 loops=1)
-> Stream results (cost=94173
rows=871322) (actual time=15.8..1231 rows=10950 loops=1)
-> Nested loop left join
(cost=94173 rows=871322) (actual time=15.8..1196 rows=10950 loops=1)
-> Nested loop inner join
(cost=5713 rows=530) (actual time=0.108..1136 rows=10950 loops=1)
-> Filter: ((ab.price is
not null) and (ab.author is not null)) (cost=819 rows=6867) (actual
time=0.0606..19.2 rows=7928 loops=1)
-> Table scan on ab
(cost=819 rows=7630) (actual time=0.0588..17.3 rows=7928 loops=1)
-> Filter: ((pb.rating >=
4) and (pb.total_ratings > 100) and (pb.title = ab.title)) (cost=0.509
rows=0.0772) (actual time=0.0624..0.14 rows=1.38 loops=7928)
-> Index lookup on pb
using idx_perfect_author_genre (author=ab.author), with index condition:
(pb.author = ab.author) (cost=0.509 rows=2.04) (actual time=0.00756..0.127
rows=29.6 loops=7928)

```

```

-> Index lookup on ps using
<auto_key0> (author=pb.author) (cost=846..849 rows=10) (actual
time=0.00482..0.00495 rows=0.23 loops=10950)
-> Materialize CTE
popular_stats (cost=846..846 rows=1644) (actual time=15.6..15.6 rows=2267
loops=1)
-> Group aggregate:
count(0) (cost=682 rows=1644) (actual time=0.0281..10 rows=2267 loops=1)
-> Filter:
(amazon_popular_books.rating > 4.5) (cost=517 rows=1644) (actual
time=0.0148..7.74 rows=3745 loops=1)
-> Covering
index scan on amazon_popular_books using idx_popular_authot_rating (cost=517
rows=4932) (actual time=0.0141..7 rows=4846 loops=1)

```

- Загальний час виконання: 1329 мс
- Кількість викликів підзапиту: 1 (використовується СТЕ один раз)
- Тимчасові таблиці: так
- Тип доступу: індекси
- Індекси використані: idx_perfect_author_genre, idx_popular_author_rating

Step 4 index hints

```

-> Limit: 50 row(s) (actual time=373..373 rows=50 loops=1)
-> Sort: avg_rating_amazon DESC (actual time=373..373 rows=50 loops=1)
-> Table scan on <temporary> (cost=2.5..2.5 rows=0) (actual
time=372..372 rows=538 loops=1)
-> Temporary table (cost=0..0 rows=0) (actual time=372..372
rows=538 loops=1)
-> Window aggregate: rank() OVER (PARTITION BY b.genre ORDER
BY `avg(perfect_books.total_ratings)` desc ) (actual time=369..371 rows=538
loops=1)
-> Filter: (`count(distinct amazon_books.title)` >= 2)
(actual time=369..370 rows=538 loops=1)
-> Sort: b.genre, `avg(perfect_books.total_ratings)`
DESC (actual time=369..370 rows=2922 loops=1)
-> Stream results (actual time=304..360
rows=2922 loops=1)
-> Group aggregate: count(distinct
amazon_books.title), avg(perfect_books.total_ratings),
avg(perfect_books.perfect_rating), avg(amazon_books.amazon_rating),
avg(price), count(distinct amazon_books.title), max(tmp_field) (actual
time=304..354 rows=2922 loops=1)
-> Sort: b.genre, b.author (actual
time=304..309 rows=10950 loops=1)
-> Stream results (cost=749768
rows=7.35e+6) (actual time=17.1..274 rows=10950 loops=1)
-> Nested loop left join
(cost=749768 rows=7.35e+6) (actual time=17.1..243 rows=10950 loops=1)
-> Nested loop inner join
(cost=3949 rows=4469) (actual time=0.188..189 rows=10950 loops=1)
-> Filter:
((pb.total_ratings > 100) and (pb.title is not null) and (pb.author is not
null)) (cost=2211 rows=3725) (actual time=0.118..37.3 rows=7342 loops=1)
-> Index range scan
on pb using idx_perfect_rating over (4 <= rating), with index condition:

```

```

(pb.rating >= 4) (cost=2211 rows=4913) (actual time=0.114..34.4 rows=9250
loops=1)
                                -> Filter: ((pb.title =
ab.title) and (pb.author = ab.author) and (ab.price is not null))
(cost=0.333 rows=1.2) (actual time=0.0134..0.0202 rows=1.49 loops=7342)
                                -> Index lookup on ab
using idx_amazon_books_title_author (title=pb.title, author=pb.author)
(cost=0.333 rows=1.33) (actual time=0.0119..0.0173 rows=1.5 loops=7342)
                                -> Index lookup on ps using
<auto_key0> (author=pb.author) (cost=2055..2058 rows=10) (actual
time=0.00446..0.00458 rows=0.23 loops=10950)
                                -> Materialize CTE
popular_stats (cost=2055..2055 rows=1644) (actual time=16.9..16.9 rows=2267
loops=1)
                                -> Group aggregate:
count(0) (cost=1891 rows=1644) (actual time=0.029..10.1 rows=2267 loops=1)
                                -> Filter:
(amazon_popular_books.rating > 4.5) (cost=1726 rows=1644) (actual
time=0.0165..7.77 rows=3745 loops=1)
                                -> Covering
index scan on amazon_popular_books using idx_popular_authot_rating
(cost=1726 rows=4932) (actual time=0.0155..7.06 rows=4846 loops=1)

```

- Загальний час виконання: 373 мс
- Кількість викликів підзапиту: 1 (використовується СТЕ один раз)
- Тимчасові таблиці: так
- Тип доступу: індекси
- Індекси використані: idx_perfect_rating, idx_popular_author_rating, idx_amazon_books_title_author