Introdução

Este relatório documenta a execução das etapas solicitadas, incluindo criação de tabelas, elaboração de consultas SQL e sintonia de desempenho. Os resultados são apresentados por etapa, com comandos SQL e planos de execução.

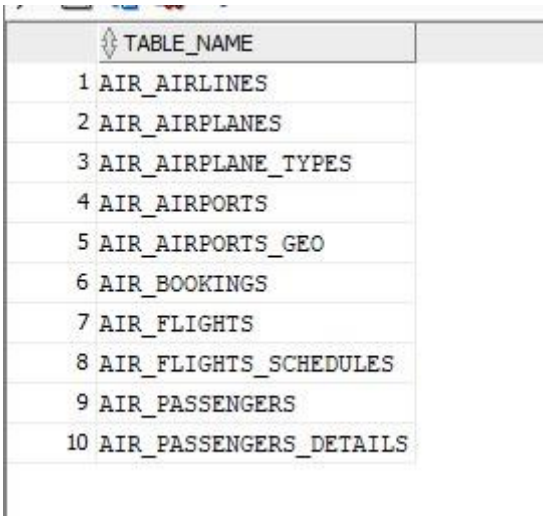
Etapa 1 - Criação das Tabelas sem Otimização

As tabelas foram criadas copiando do esquema 'ARRUDA' sem estruturas otimizadas.

Comandos SQL Executados:

```
SELECT
  'create table ' || table_name || ' as select * from arruda.' || table_name || ';'
FROM
  all_tables
WHERE
    owner = 'ARRUDA'
    AND table_name LIKE 'AIR_%';
```

Resultados:



	TABLE_NAME
1	AIR_AIRLINES
2	AIR_AIRPLANES
3	AIR_AIRPLANE_TYPES
4	AIR_AIRPORTS
5	AIR_AIRPORTS_GEO
6	AIR_BOOKINGS
7	AIR_FLIGHTS
8	AIR_FLIGHTS_SCHEDULES
9	AIR_PASSENGERS
10	AIR_PASSENGERS_DETAILS

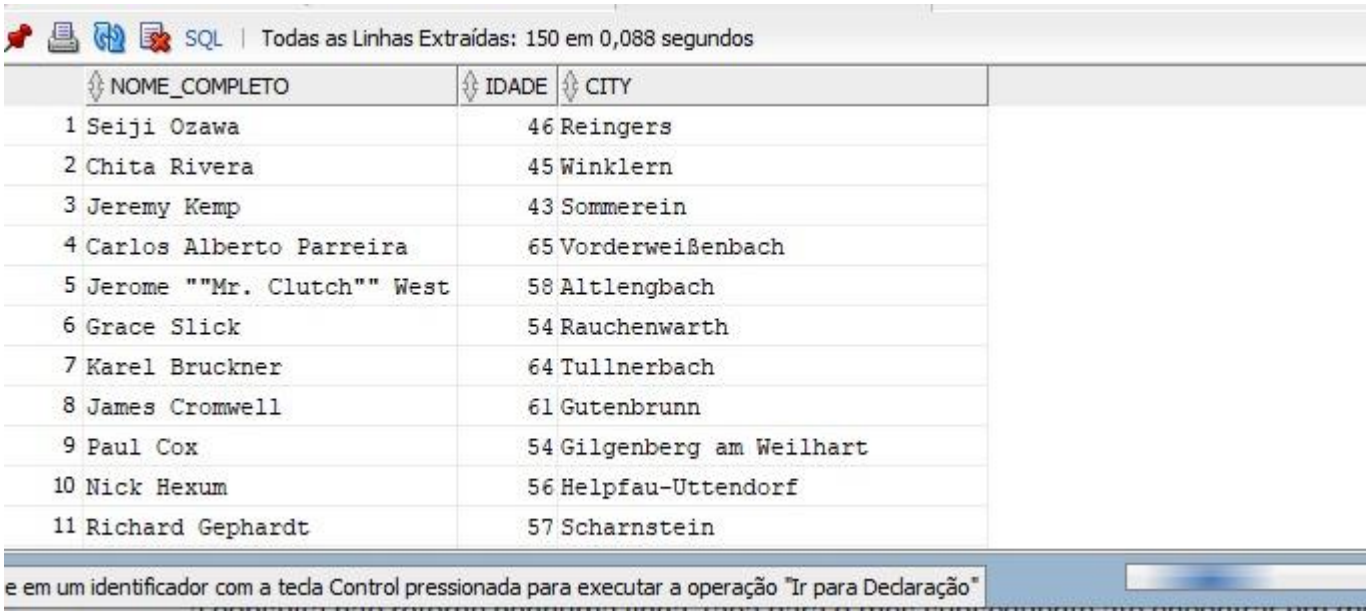
Etapa 2 - Elaboração das Consultas SQL

As consultas foram elaboradas e executadas, retornando os números de linhas sugeridos.

Consulta 1

```
SELECT
   p.firstname || ' ' || p.lastname AS nome_completo,
   TRUNC(MONTHS_BETWEEN(SYSDATE, pd.birthdate)/12) AS idade,
   pd.city
FROM
   air_passengers p
JOIN
   air_passengers_details pd ON p.passenger_id = pd.passenger_id
WHERE
   pd.sex = 'w'
   AND pd.birthdate <= ADD_MONTHS(SYSDATE, -40*12)  -- Mais de 40 anos (Dica 1)
   AND pd.country = 'BRAZIL';
```

Resultados:



	NOME_COMPLETO	IDADE	CITY
1	Seiji Ozawa	46	Reingers
2	Chita Rivera	45	Winklern
3	Jeremy Kemp	43	Sommerein
4	Carlos Alberto Parreira	65	Vorderweißenbach
5	Jerome ""Mr. Clutch"" West	58	Altlengbach
6	Grace Slick	54	Rauchenwarth
7	Karel Bruckner	64	Tullnerbach
8	James Cromwell	61	Gutenbrunn
9	Paul Cox	54	Gilgenberg am Weilhart
10	Nick Hexum	56	Helpfau-Uttendorf
11	Richard Gephardt	57	Scharnstein

Consulta 2

Comando SQL:

```
SELECT
   al.airline_name AS companhia_aerea,
   ap.airplane_id,
   apt.name AS tipo_aeronave,
```

```
    f.flightno AS numero_voo
FROM
    air_flights f
JOIN
    air_airlines al ON f.airline_id = al.airline_id
JOIN
    air_airplanes ap ON f.airplane_id = ap.airplane_id
JOIN
    air_airplane_types apt ON ap.airplane_type_id = apt.airplane_type_id
JOIN
    air_airports dep ON f.from_airport_id = dep.airport_id
JOIN
    air_airports arr ON f.to_airport_id = arr.airport_id
WHERE
    f.airline_id = 12;-- Brazil Airlines
```

Resultados:

Resultado da Consulta

SQL | Todas as Linhas Extraídas: 12 em 0,02 segundos

	COMPANHIA_AEREA	AIRPLANE_ID	TIPO_AERONAVE	NUMERO_VOO
1	Brazil Airlines	612	Airbus A380	BR2105
2	Brazil Airlines	671	Airbus A330	BR8009
3	Brazil Airlines	635	Airbus A330	BR6957
4	Brazil Airlines	643	Boeing 767	BR2146
5	Brazil Airlines	669	Fokker 100	BR2464
6	Brazil Airlines	632	Fokker 100	BR2253
7	Brazil Airlines	678	Bombardier Q Series	BR8451
8	Brazil Airlines	609	Bombardier Q Series	BR6957
9	Brazil Airlines	622	Airbus-A320-Familie	BR8073
10	Brazil Airlines	615	Embraer-ERJ-145-Familie	BR2253
11	Brazil Airlines	652	Boeing 777	BR8352
12	Brazil Airlines	638	Boeing 737	BR6989

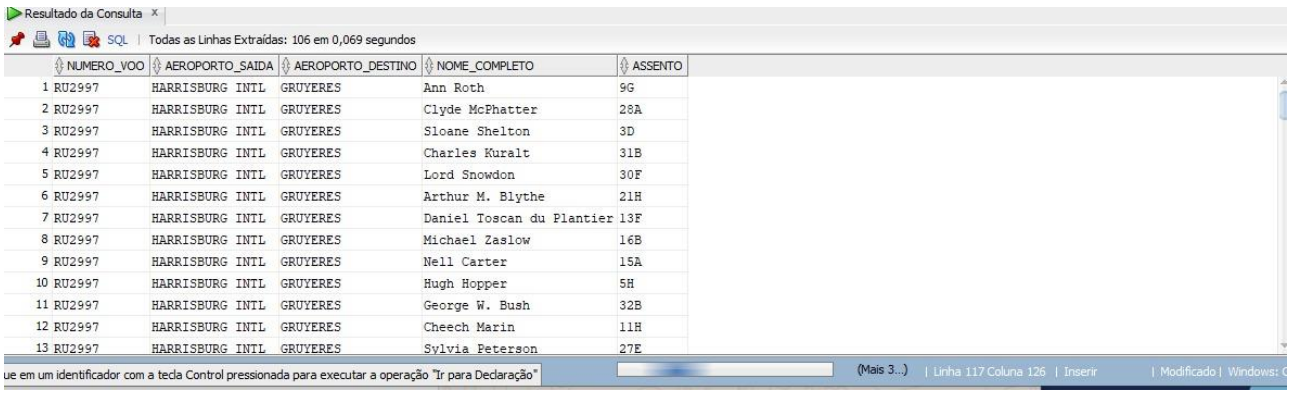
ue em um identificador com a tecla Control pressionada para executar a operação "Ir para Declaração"

Consulta 3

Comando SQL:

```
SELECT
   f.flightno AS numero_voo,
   dep.name AS aeroporto_saida,
   arr.name AS aeroporto_destino,
   p.firstname || ' ' || p.lastname AS nome_completo,
   b.seat AS assento
FROM
   air_flights f
JOIN
   air_bookings b ON f.flight_id = b.flight_id
JOIN
   air_passengers p ON b.passenger_id = p.passenger_id
JOIN
   air_airports dep ON f.from_airport_id = dep.airport_id
JOIN
   air_airports arr ON f.to_airport_id = arr.airport_id
WHERE
   f.departure BETWEEN TO_DATE('25-MAR-2023', 'DD-MON-YYYY') AND TO_DATE('25-MAR-2023', 'DD-MON-YYYY') + 1 - (1/(24*60*60));
```

Resultados:


Resultado da Consulta

Todas as Linhas Extraídas: 106 em 0,069 segundos

	NUMERO_VOO	AEROPORTO_SAIDA	AEROPORTO_DESTINO	NOME_COMPLETO	ASSENTO
1	RU2997	HARRISBURG INTL	GRUYERES	Ann Roth	9G
2	RU2997	HARRISBURG INTL	GRUYERES	Clyde McPhatter	28A
3	RU2997	HARRISBURG INTL	GRUYERES	Sloane Shelton	3D
4	RU2997	HARRISBURG INTL	GRUYERES	Charles Kuralt	31B
5	RU2997	HARRISBURG INTL	GRUYERES	Lord Snowdon	30F
6	RU2997	HARRISBURG INTL	GRUYERES	Arthur M. Blythe	21H
7	RU2997	HARRISBURG INTL	GRUYERES	Daniel Toscan du Plantier	13F
8	RU2997	HARRISBURG INTL	GRUYERES	Michael Zaslow	16B
9	RU2997	HARRISBURG INTL	GRUYERES	Nell Carter	15A
10	RU2997	HARRISBURG INTL	GRUYERES	Hugh Hopper	5H
11	RU2997	HARRISBURG INTL	GRUYERES	George W. Bush	32B
12	RU2997	HARRISBURG INTL	GRUYERES	Cheech Marin	11H
13	RU2997	HARRISBURG INTL	GRUYERES	Sylvia Peterson	27E

ue em um identificador com a tecla Control pressionada para executar a operação "Ir para Declaração"

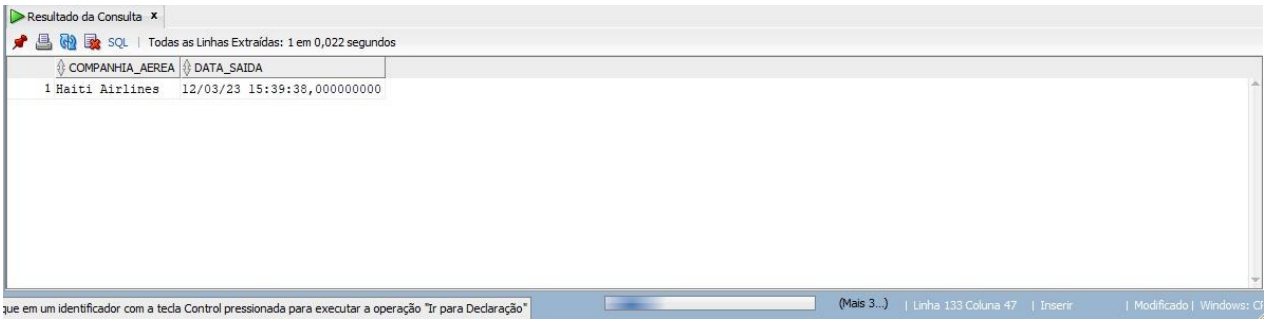
(Mais 3...) | Linha 117 Coluna 126 | Inserir | Modificado | Windows:

Consulta 4

Comando SQL:

```
SELECT
   al.airline_name AS companhia_aerea,
   f.departure AS data_saida
FROM
   air_flights f
JOIN
   air_airlines al ON f.airline_id = al.airline_id
JOIN
   air_airports arr ON f.to_airport_id = arr.airport_id
WHERE
   arr.iata IN ('JFK', 'LGA', 'EWR')
   AND TO_CHAR(f.departure, 'MON') = 'MAR'
   AND TO_CHAR(f.departure, 'YYYY') = '2023';
```

Resultados:



Consulta 5

Comando SQL:

```
SELECT
   f.flightno AS numero_voo,
   b.booking_id AS id_reserva,
   p.firstname || ' ' || p.lastname AS nome_passageiro,
   b.seat AS assento
FROM
   air_bookings b
JOIN
```

air_flights f ON b.flight_id = f.flight_id -- Join no cluster, espera-se HASH JOIN

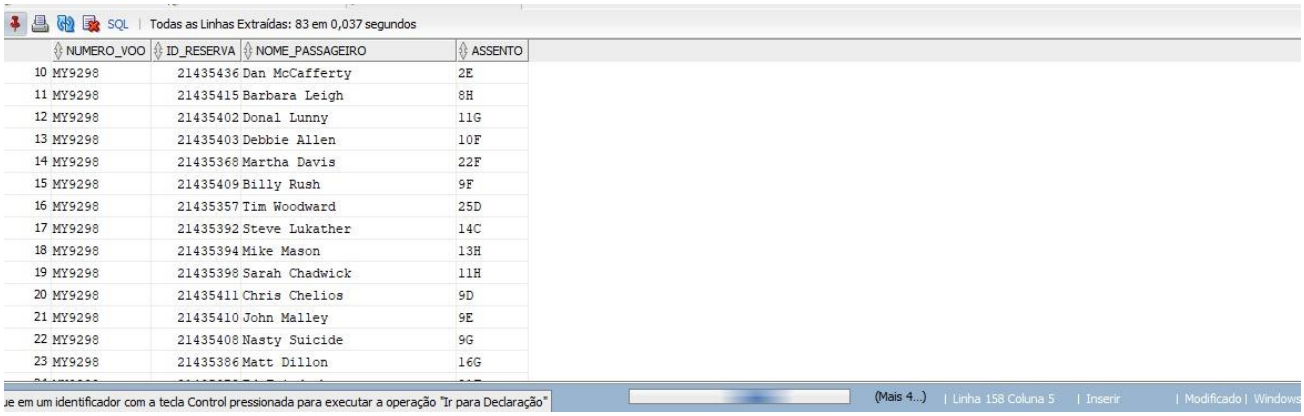
JOIN

air_passengers p ON b.passenger_id = p.passenger_id -- Tabela fora do cluster

WHERE

f.departure BETWEEN TO_DATE('02-OUT-2020', 'DD-MON-YYYY') AND TO_DATE('02-OUT-2020', 'DD-MON-YYYY') + 1 - (1/(24*60*60)); -- Outubro de 2020

Resultados:

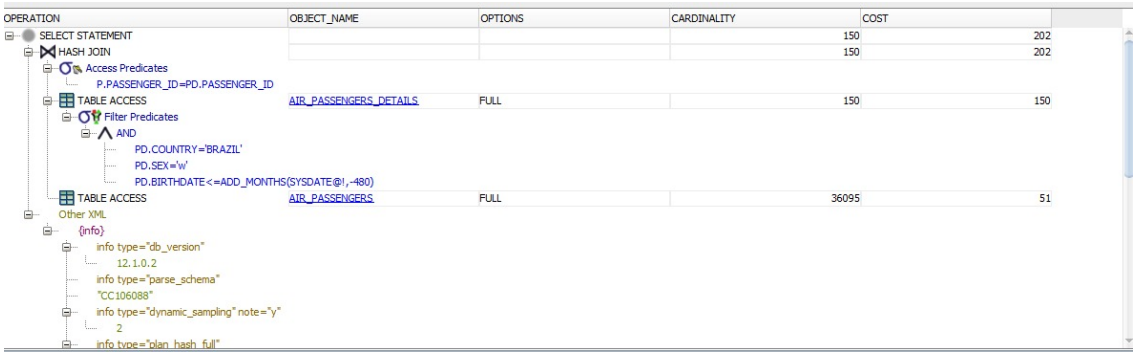


	NUMERO_VOO	ID_RESERVA	NOME_PASSAGEIRO	ASSENTO
10	MY9298	21435436	Dan McCafferty	2E
11	MY9298	21435415	Barbara Leigh	8H
12	MY9298	21435402	Donal Lunny	11G
13	MY9298	21435403	Debbie Allen	10F
14	MY9298	21435368	Martha Davis	22F
15	MY9298	21435409	Billy Rush	9F
16	MY9298	21435357	Tim Woodward	25D
17	MY9298	21435392	Steve Lukather	14C
18	MY9298	21435394	Mike Mason	13H
19	MY9298	21435398	Sarah Chadwick	11H
20	MY9298	21435411	Chris Chelios	9D
21	MY9298	21435410	John Malley	9E
22	MY9298	21435408	Nasty Suicide	9G
23	MY9298	21435386	Matt Dillon	16G

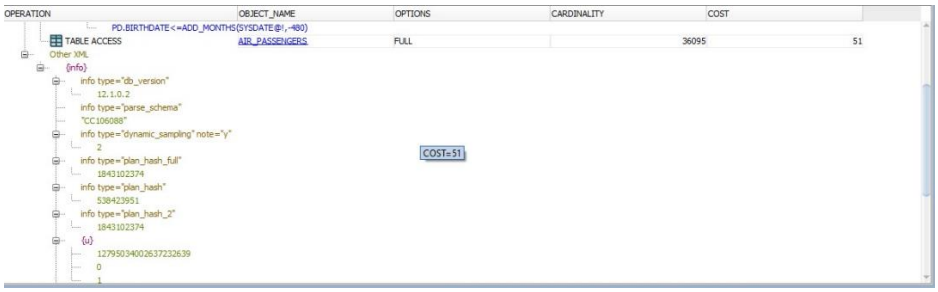
Etapa 3 - Sintonia de Desempenho (Sem Otimização)

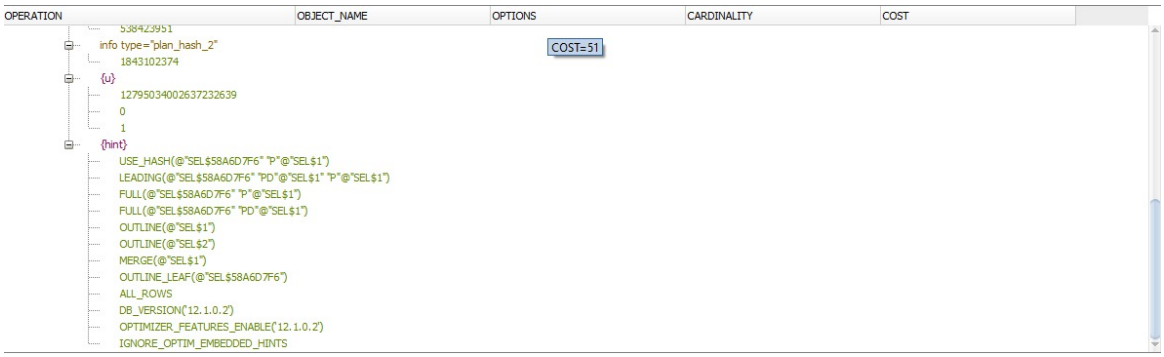
Planos de execução capturados sem estruturas otimizadas.

Consulta 1

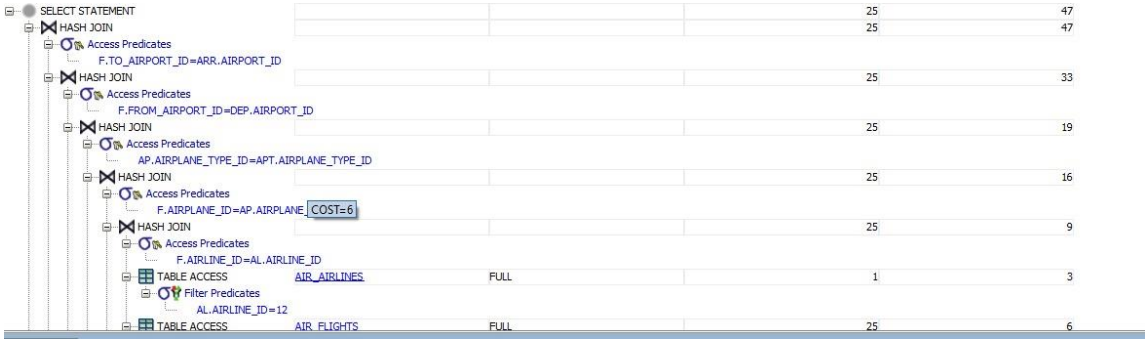


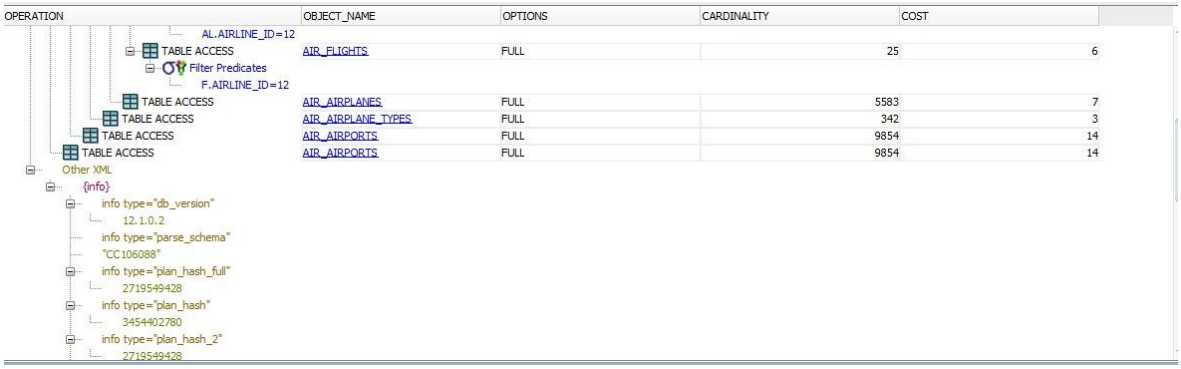
OPERATION	OBJECT_NAME	OPTIONS	CARDINALITY	COST
SELECT STATEMENT			150	202
HASH JOIN			150	202
Access Predicates				
P.PASSENGER_ID=PD.PASSENGER_ID				
TABLE ACCESS	AIR_PASSENGERS_DETAILS	FULL	150	150
Filter Predicates				
AND				
PD.COUNTRY='BRAZIL'				
PD.SEX='M'				
PD.BIRTHDATE<=ADD_MONTHS(SYSDATE@!,-480)				
TABLE ACCESS	AIR_PASSENGERS	FULL	36095	51
Other XML				
{info}				
info type="db_version"				
12.1.0.2				
info type="parse_schema"				
"CC106088"				
info type="dynamic_sampling" note="y"				
2				
info type="plan_hash_full"				

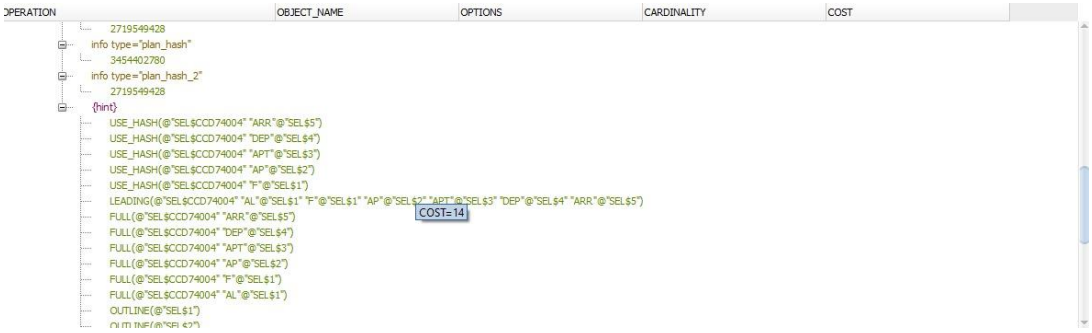


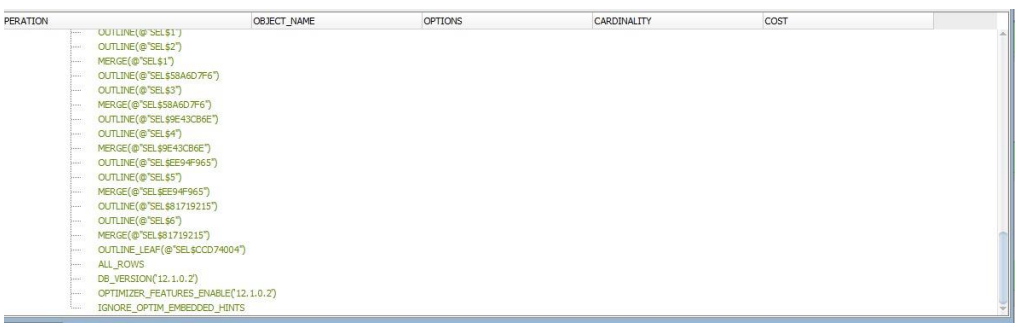

OPERATION
OBJECT_NAME
OPTIONS
CARDINALITY
COST
538423951
info type="plan_hash_2"
1843102374
{u}
12795034002637232639
0
1
{hint}
USE_HASH(@"SEL$58A6D7F6" "P"@"SEL$1")
LEADING(@"SEL$58A6D7F6" "PD"@"SEL$1" "P"@"SEL$1")
FULL(@"SEL$58A6D7F6" "P"@"SEL$1")
FULL(@"SEL$58A6D7F6" "PD"@"SEL$1")
OUTLINE(@"SEL$1")
OUTLINE(@"SEL$2")
MERGE(@"SEL$1")
OUTLINE_LEAF(@"SEL$58A6D7F6")
ALL_ROWS
DB_VERSION('12.1.0.2')
OPTIMIZER_FEATURES_ENABLE('12.1.0.2')
IGNORE_OPTIM_EMBEDDED_HINTS
COST=51

Consulta 2

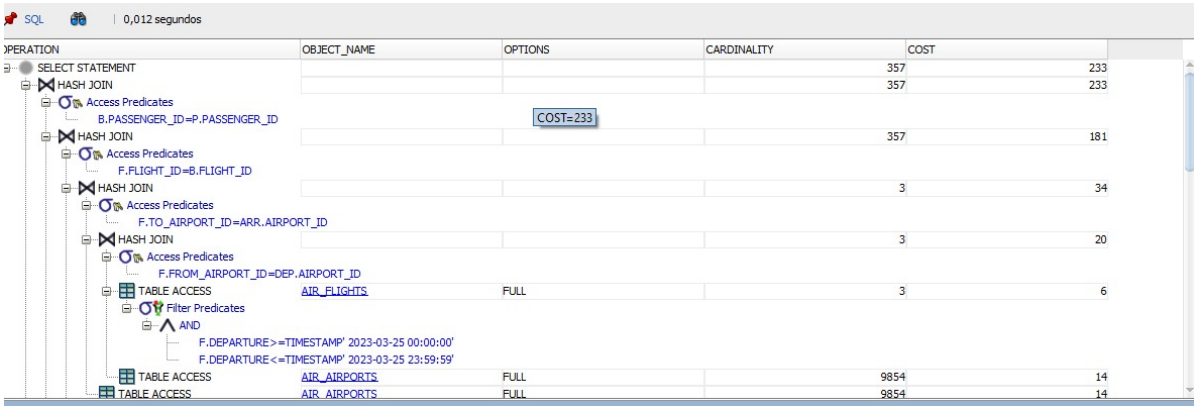

SELECT STATEMENT
HASH JOIN
Access Predicates
F.TO_AIRPORT_ID=ARR.AIRPORT_ID
HASH JOIN
Access Predicates
F.FROM_AIRPORT_ID=DEP.AIRPORT_ID
HASH JOIN
Access Predicates
AP.AIRPLANE_TYPE_ID=APT.AIRPLANE_TYPE_ID
HASH JOIN
Access Predicates
F.AIRPLANE_ID=AP.AIRPLANE
HASH JOIN
Access Predicates
F.AIRLINE_ID=AL.AIRLINE_ID
TABLE ACCESS AIR_AIRLINES FULL
Filter Predicates
AL.AIRLINE_ID=12
TABLE ACCESS AIR_FLIGHTS FULL
25 47
25 47
25 33
25 19
25 16
25 9
1 3
25 6
COST=6

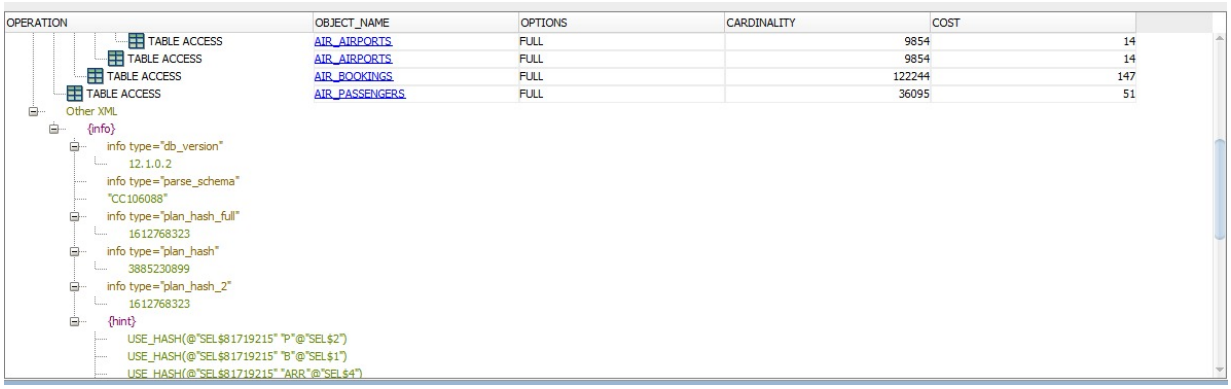

OPERATION
OBJECT_NAME
OPTIONS
CARDINALITY
COST
AL.AIRLINE_ID=12
TABLE ACCESS AIR_FLIGHTS FULL 25 6
Filter Predicates
F.AIRLINE_ID=12
TABLE ACCESS AIR_AIRPLANES FULL 5583 7
TABLE ACCESS AIR_AIRPLANE_TYPES FULL 342 3
TABLE ACCESS AIR_AIRPORTS FULL 9854 14
TABLE ACCESS AIR_AIRPORTS FULL 9854 14
Other XML
{info}
info type="db_version"
12.1.0.2
info type="parse_schema"
"CC106088"
info type="plan_hash_full"
2719549428
info type="plan_hash"
3454402780
info type="plan_hash_2"
2719549428


OBJECT_NAME
OPTIONS
CARDINALITY
COST
2719549428
info type="plan_hash"
3454402780
info type="plan_hash_2"
2719549428
{hint}
USE_HASH(@"SEL$CCD74004" "ARR"@"SEL$5")
USE_HASH(@"SEL$CCD74004" "DEP"@"SEL$4")
USE_HASH(@"SEL$CCD74004" "APT"@"SEL$3")
USE_HASH(@"SEL$CCD74004" "AP"@"SEL$2")
USE_HASH(@"SEL$CCD74004" "F"@"SEL$1")
LEADING(@"SEL$CCD74004" "AL"@"SEL$1" "F"@"SEL$1" "AP"@"SEL$2" "APT"@"SEL$3" "DEP"@"SEL$4" "ARR"@"SEL$5")
FULL(@"SEL$CCD74004" "ARR"@"SEL$5")
FULL(@"SEL$CCD74004" "DEP"@"SEL$4")
FULL(@"SEL$CCD74004" "APT"@"SEL$3")
FULL(@"SEL$CCD74004" "AP"@"SEL$2")
FULL(@"SEL$CCD74004" "F"@"SEL$1")
FULL(@"SEL$CCD74004" "AL"@"SEL$1")
OUTLINE(@"SEL$1")
COST=14

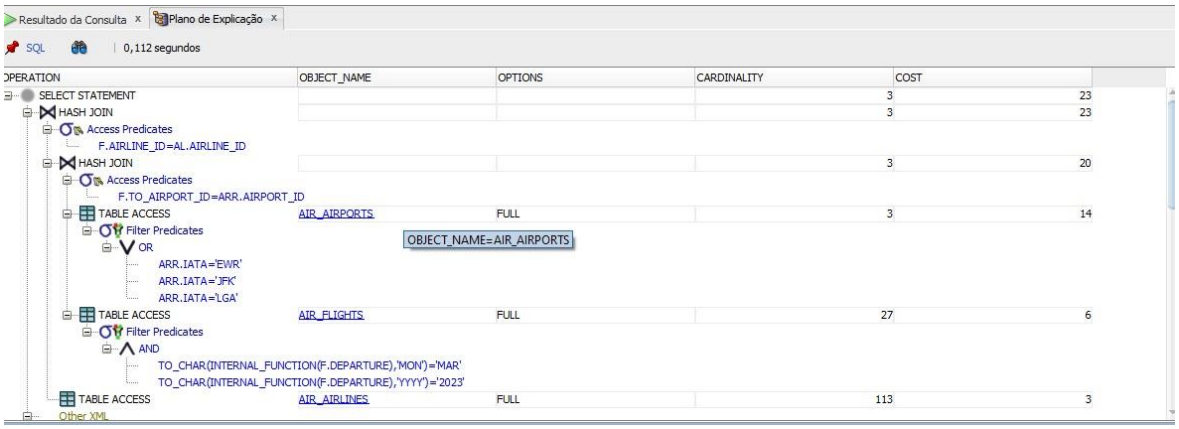

OBJECT_NAME
OPTIONS
CARDINALITY
COST
OUTLINE(@"SEL$2")
MERGE(@"SEL$1")
OUTLINE(@"SEL$58A6D7F6")
OUTLINE(@"SEL$3")
MERGE(@"SEL$58A6D7F6")
OUTLINE(@"SEL$9E43CB6E")
OUTLINE(@"SEL$4")
MERGE(@"SEL$9E43CB6E")
OUTLINE(@"SEL$EE94F965")
OUTLINE(@"SEL$5")
MERGE(@"SEL$EE94F965")
OUTLINE(@"SEL$81719215")
OUTLINE(@"SEL$6")
MERGE(@"SEL$81719215")
OUTLINE_LEAF(@"SEL$CCD74004")
ALL_ROWS
DB_VERSION('12.1.0.2')
OPTIMIZER_FEATURES_ENABLE('12.1.0.2')
IGNORE_OPTIM_EMBEDDED_HINTS

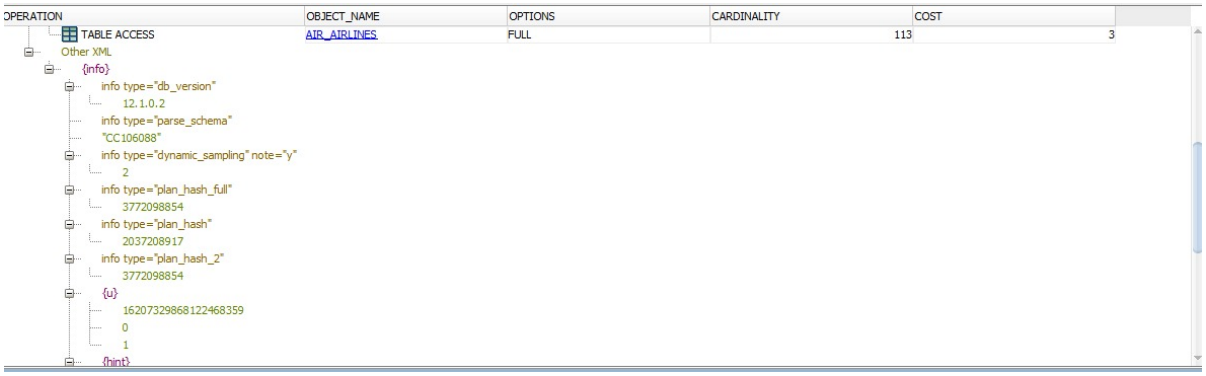
Consulta 3



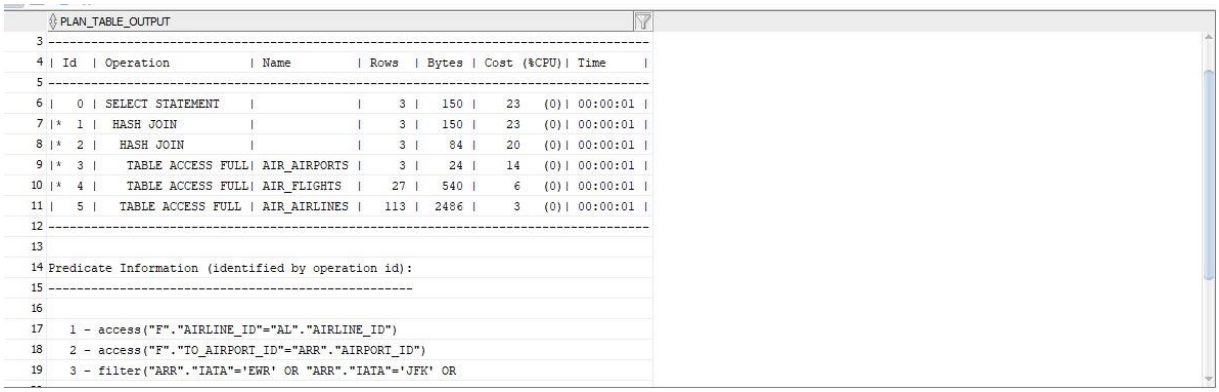


Consulta 4





Consulta 5



Etapa 4 - Sintonia de Desempenho (Com Otimização)

Estruturas criadas e planos capturados após otimização.

Consulta 1

Comandos DDL:

ALTER TABLE air_passengers ADD CONSTRAINT pk_air_passengers PRIMARY KEY (passenger_id);

ALTER TABLE air_passengers_details ADD CONSTRAINT fk_apd_passenger FOREIGN KEY (passenger_id) REFERENCES air_passengers(passenger_id);

CREATE INDEX idx_apd_country_sex_birth ON air_passengers_details(country, sex, birthdate);

```
CREATE INDEX idx_apd_passenger_id ON air_passengers_details(passenger_id);

ANALYZE TABLE air_passengers COMPUTE STATISTICS;

ANALYZE TABLE air_passengers_details COMPUTE STATISTICS;
```

	TABLE_NAME
1	AIR_AIRLINES
2	AIR_AIRPLANES
3	AIR_AIRPLANE_TYPES
4	AIR_AIRPORTS
5	AIR_AIRPORTS_GEO
6	AIR_BOOKINGS
7	AIR_FLIGHTS
8	AIR_FLIGHTS_SCHEDULES
9	AIR_PASSENGERS
10	AIR_PASSENGERS_DETAILS

Tarefa concluída em 1,951 segundos

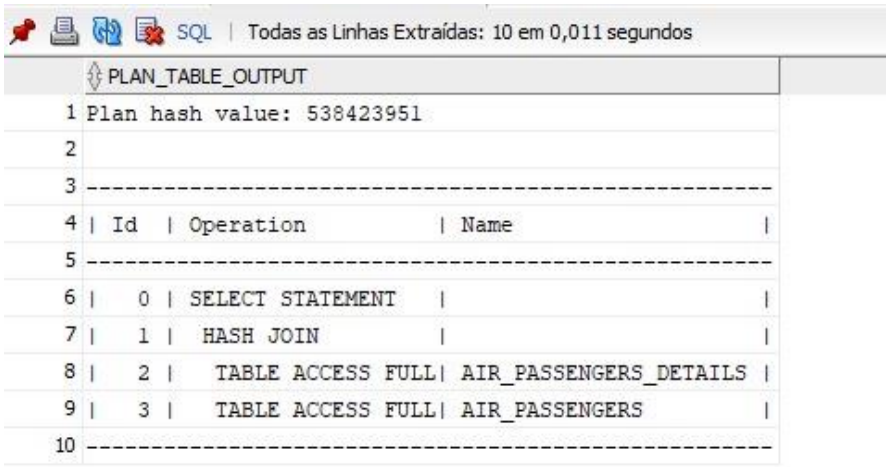
```
Procedimento PL/SQL concluído com sucesso.
```

	PLAN_TABLE_OUTPUT
1	Plan hash value: 538423951
2	
3	--
4	| Id | Operation | Name |
5	--
6	| 0 | SELECT STATEMENT | |
7	| 1 | HASH JOIN | |
8	| 2 | TABLE ACCESS FULL| AIR_PASSENGERS_DETAILS |
9	| 3 | TABLE ACCESS FULL| AIR_PASSENGERS |
10	--

SQL | Todas as Linhas Extraídas: 150 em 0,017 segundos

	NOME_COMPLETO	IDADE	CITY
145	Jason Kapono	70	Rohr im Burgenland
146	Michael Randall Lovan	50	Kurzschwarza
147	Niklas Nordgren	58	Merkendorf
148	Andre Brown	62	Waidegg
149	Ryan Caldwell	50	Lipizach
150	Brannon Condren	43	Bösendürnbach


```
Explicado.

Decorrido: 00:00:00.007
```



	PLAN_TABLE_OUTPUT
1	Plan hash value: 538423951
2	
3	--
4	| Id | Operation | Name |
5	--
6	| 0 | SELECT STATEMENT | |
7	| 1 | HASH JOIN | |
8	| 2 | TABLE ACCESS FULL| AIR_PASSENGERS_DETAILS |
9	| 3 | TABLE ACCESS FULL| AIR_PASSENGERS |
10	--

Consulta 2

Comandos DDL:

ALTER TABLE air_airlines ADD CONSTRAINT pk_air_airlines PRIMARY KEY (airline_id);

ALTER TABLE air_airplanes ADD CONSTRAINT pk_air_airplanes PRIMARY KEY (airplane_id);

ALTER TABLE air_airplane_types ADD CONSTRAINT pk_air_airplane_types PRIMARY KEY (airplane_type_id);

ALTER TABLE air_airports ADD CONSTRAINT pk_air_airports PRIMARY KEY (airport_id);

ALTER TABLE air_flights ADD CONSTRAINT pk_air_flights PRIMARY KEY (flight_id);

ALTER TABLE air_flights ADD CONSTRAINT uk_air_flights_flightno UNIQUE (flightno);

ALTER TABLE air_flights ADD CONSTRAINT fk_flights_airline FOREIGN KEY (airline_id) REFERENCES air_airlines(airline_id);

ALTER TABLE air_flights ADD CONSTRAINT fk_flights_airplane FOREIGN KEY (airplane_id) REFERENCES air_airplanes(airplane_id);

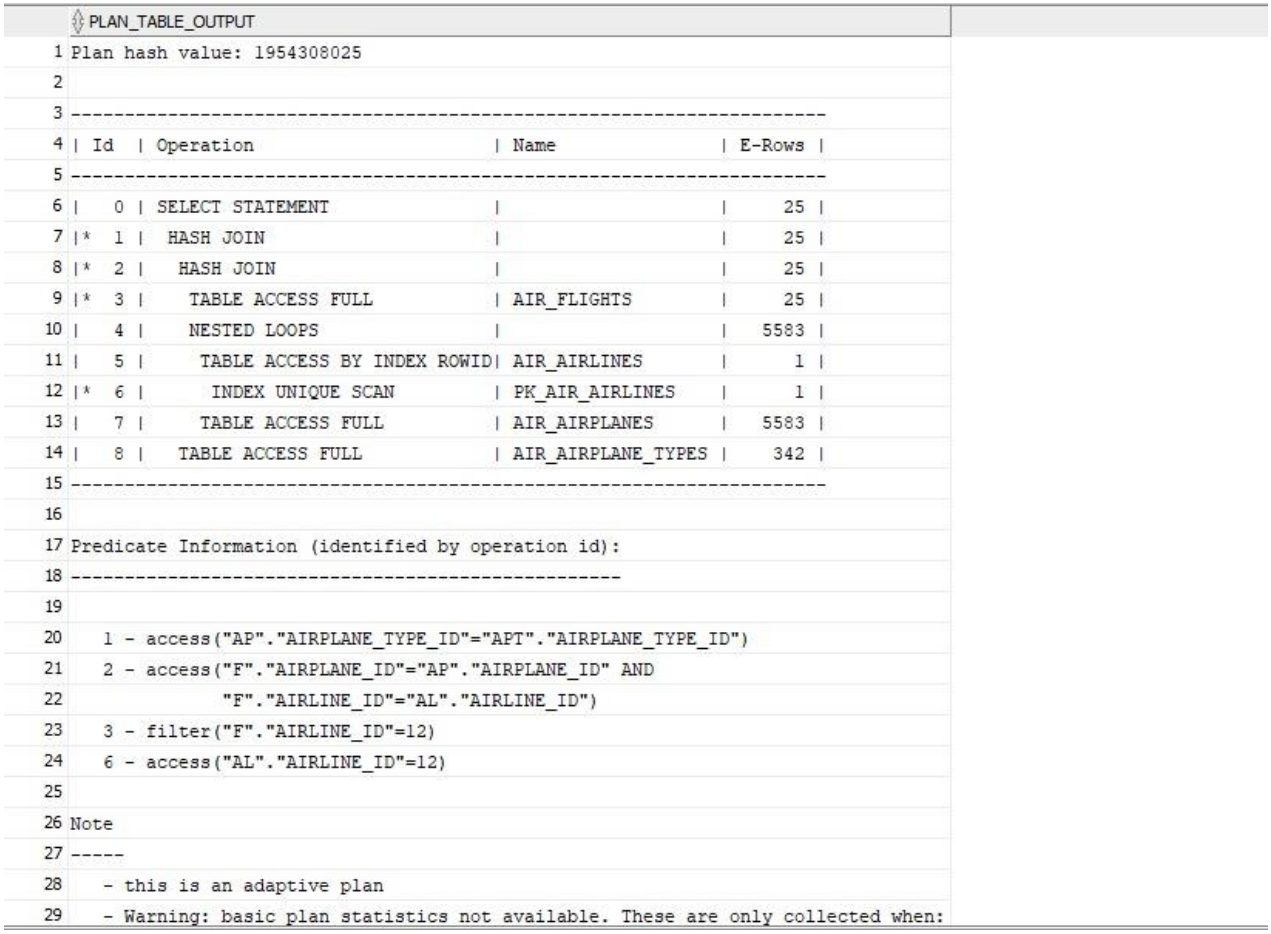
ALTER TABLE air_flights ADD CONSTRAINT fk_flights_from_airport FOREIGN KEY (from_airport_id) REFERENCES air_airports(airport_id);

ALTER TABLE air_flights ADD CONSTRAINT fk_flights_to_airport FOREIGN KEY (to_airport_id) REFERENCES air_airports(airport_id);

```
ALTER TABLE air_airplanes ADD CONSTRAINT fk_airplanes_type FOREIGN KEY
(airplane_type_id) REFERENCES air_airplane_types(airplane_type_id);

CREATE INDEX idx_flights_airline_id ON air_flights(airline_id);

CREATE INDEX idx_flights_from_airport ON air_flights(from_airport_id);

CREATE INDEX idx_flights_to_airport ON air_flights(to_airport_id);

CREATE INDEX idx_airplanes_type_id ON air_airplanes(airplane_type_id);

ANALYZE TABLE air_flights COMPUTE STATISTICS;

ANALYZE TABLE air_airlines COMPUTE STATISTICS;

ANALYZE TABLE air_airplanes COMPUTE STATISTICS;

ANALYZE TABLE air_airplane_types COMPUTE STATISTICS;

ANALYZE TABLE air_airports COMPUTE STATISTICS;
```

```
PLAN_TABLE_OUTPUT
Plan hash value: 3454402780

-----------------------------------------------------
| Id  | Operation              | Name               |
-----------------------------------------------------
|   0 | SELECT STATEMENT       |                    |
|   1 |  HASH JOIN             |                    |
|   2 |   HASH JOIN            |                    |
|   3 |    HASH JOIN           |                    |
|   4 |     HASH JOIN          |                    |
|   5 |      HASH JOIN         |                    |
|   6 |       TABLE ACCESS FULL| AIR_AIRLINES       |
|   7 |       TABLE ACCESS FULL| AIR_FLIGHTS        |
|   8 |      TABLE ACCESS FULL | AIR_AIRPLANES      |
|   9 |     TABLE ACCESS FULL  | AIR_AIRPLANE_TYPES |
|  10 |    TABLE ACCESS FULL   | AIR_AIRPORTS       |
|  11 |   TABLE ACCESS FULL    | AIR_AIRPORTS       |
-----------------------------------------------------
```

```
12 linhas selecionadas.

Decorrido: 00:00:00.023
```



```
PLAN_TABLE_OUTPUT
Plan hash value: 1954308025

-------------------------------------------------------------------------------
| Id  | Operation                     | Name               | E-Rows |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT              |                    |     25 |
|*  1 |  HASH JOIN                    |                    |     25 |
|*  2 |   HASH JOIN                   |                    |     25 |
|*  3 |    TABLE ACCESS FULL          | AIR_FLIGHTS        |     25 |
|   4 |    NESTED LOOPS               |                    |   5583 |
|   5 |     TABLE ACCESS BY INDEX ROWID| AIR_AIRLINES       |      1 |
|*  6 |      INDEX UNIQUE SCAN        | PK_AIR_AIRLINES    |      1 |
|   7 |     TABLE ACCESS FULL         | AIR_AIRPLANES      |   5583 |
|   8 |   TABLE ACCESS FULL           | AIR_AIRPLANE_TYPES |    342 |
-------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   1 - access("AP"."AIRPLANE_TYPE_ID"="APT"."AIRPLANE_TYPE_ID")
   2 - access("F"."AIRPLANE_ID"="AP"."AIRPLANE_ID" AND
              "F"."AIRLINE_ID"="AL"."AIRLINE_ID")
   3 - filter("F"."AIRLINE_ID"=12)
   6 - access("AL"."AIRLINE_ID"=12)

Note
-----
   - this is an adaptive plan
   - Warning: basic plan statistics not available. These are only collected when:
```

```
12 linhas selecionadas.

Decorrido: 00:00:00.022
```

Consulta 3

Comandos DDL:

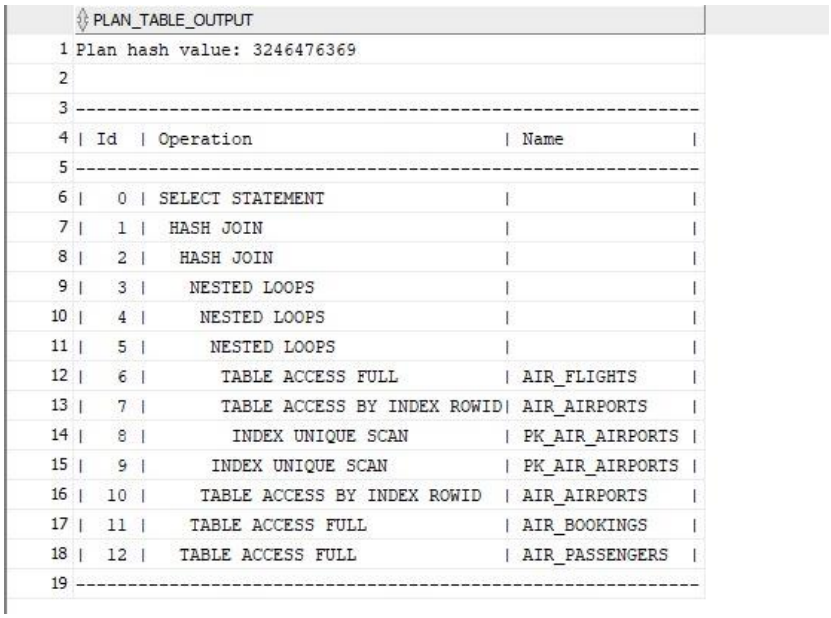
CREATE INDEX idx_bookings_flight ON air_bookings(flight_id);

CREATE INDEX idx_bookings_passenger ON air_bookings(passenger_id);

CREATE INDEX idx_flights_departure ON air_flights(departure);

ANALYZE TABLE air_bookings COMPUTE STATISTICS;

ANALYZE TABLE air_flights COMPUTE STATISTICS;



	PLAN_TABLE_OUTPUT
1	Plan hash value: 3246476369
2	
3	--
4	| Id | Operation | Name |
5	--
6	| 0 | SELECT STATEMENT | |
7	| 1 | HASH JOIN | |
8	| 2 | HASH JOIN | |
9	| 3 | NESTED LOOPS | |
10	| 4 | NESTED LOOPS | |
11	| 5 | NESTED LOOPS | |
12	| 6 | TABLE ACCESS FULL | AIR_FLIGHTS |
13	| 7 | TABLE ACCESS BY INDEX ROWID | AIR_AIRPORTS |
14	| 8 | INDEX UNIQUE SCAN | PK_AIR_AIRPORTS |
15	| 9 | INDEX UNIQUE SCAN | PK_AIR_AIRPORTS |
16	| 10 | TABLE ACCESS BY INDEX ROWID | AIR_AIRPORTS |
17	| 11 | TABLE ACCESS FULL | AIR_BOOKINGS |
18	| 12 | TABLE ACCESS FULL | AIR_PASSENGERS |
19	--

```
106 linhas selecionadas.

Decorrido: 00:00:00.083
```

```
106 linhas selecionadas.

Decorrido: 00:00:00.053
```

Consulta 4

Comandos DDL:

CREATE INDEX idx_flights_depart_month ON air_flights(TO_CHAR(departure,'MON'));

CREATE INDEX idx_flights_depart_dow ON air_flights(TO_CHAR(departure,'D'));

CREATE INDEX idx_airports_city ON air_airports(city);

ANALYZE TABLE air_flights COMPUTE STATISTICS;

ANALYZE TABLE air_airports COMPUTE STATISTICS;

```
PLAN_TABLE_OUTPUT
Plan hash value: 3246476369

-----------------------------------------------------------------
| Id  | Operation                           | Name              |
-----------------------------------------------------------------
|   0 | SELECT STATEMENT                    |                   |
|   1 |  HASH JOIN                          |                   |
|   2 |   HASH JOIN                         |                   |
|   3 |    NESTED LOOPS                     |                   |
|   4 |     NESTED LOOPS                    |                   |
|   5 |      NESTED LOOPS                   |                   |
|   6 |       TABLE ACCESS FULL             | AIR_FLIGHTS       |
|   7 |       TABLE ACCESS BY INDEX ROWID   | AIR_AIRPORTS      |
|   8 |        INDEX UNIQUE SCAN            | PK_AIR_AIRPORTS   |
|   9 |      INDEX UNIQUE SCAN              | PK_AIR_AIRPORTS   |
|  10 |     TABLE ACCESS BY INDEX ROWID     | AIR_AIRPORTS      |
|  11 |    TABLE ACCESS FULL                | AIR_BOOKINGS      |
|  12 |   TABLE ACCESS FULL                 | AIR_PASSENGERS    |
-----------------------------------------------------------------
```

```
COMPANHIA_AEREA                DATA_SAIDA
------------------------------ ----------------------------
Haiti Airlines                 12/03/23 15:39:38,000000000

Decorrido: 00:00:00.075
```

```
PLAN_TABLE_OUTPUT
Plan hash value: 403618880

-------------------------------------------------------------------------------------------
| Id  | Operation                             | Name                    | E-Rows |
-------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                      |                         |      3 |
|   1 |  NESTED LOOPS                         |                         |      3 |
|   2 |   NESTED LOOPS                        |                         |      3 |
|*  3 |    HASH JOIN                          |                         |      3 |
|*  4 |     TABLE ACCESS FULL                 | AIR_AIRPORTS            |      3 |
|   5 |     TABLE ACCESS BY INDEX ROWID BATCHED| AIR_FLIGHTS             |     25 |
|   6 |      BITMAP CONVERSION TO ROWIDS      |                         |        |
|   7 |       BITMAP AND                      |                         |        |
|   8 |        BITMAP CONVERSION FROM ROWIDS  |                         |        |
|*  9 |         INDEX RANGE SCAN              | IDX_FLIGHTS_DEPART_MONTH|        |
|  10 |        BITMAP CONVERSION FROM ROWIDS  |                         |        |
|* 11 |         INDEX RANGE SCAN              | IDX_FLIGHTS_DEPART_YEAR |        |
|* 12 |    INDEX UNIQUE SCAN                  | PK_AIR_AIRLINES         |      1 |
|  13 |   TABLE ACCESS BY INDEX ROWID         | AIR_AIRLINES            |      1 |
-------------------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   3 - access("F"."TO_AIRPORT_ID"="ARR"."AIRPORT_ID")
   4 - filter("ARR"."IATA"='EWR' OR "ARR"."IATA"='JFK' OR
```

```
COMPANHIA_AEREA                DATA_SAIDA
------------------------------ ---------------------------
Haiti Airlines                 12/03/23 15:39:38,000000000

Decorrido: 00:00:00.020
```

Consulta 5

Comandos DDL:

CREATE CLUSTER cluster_bookings_flights (flight_id NUMBER(10));

CREATE TABLE air_bookings CLUSTER cluster_bookings_flights (flight_id) AS SELECT * FROM arruda.air_bookings;

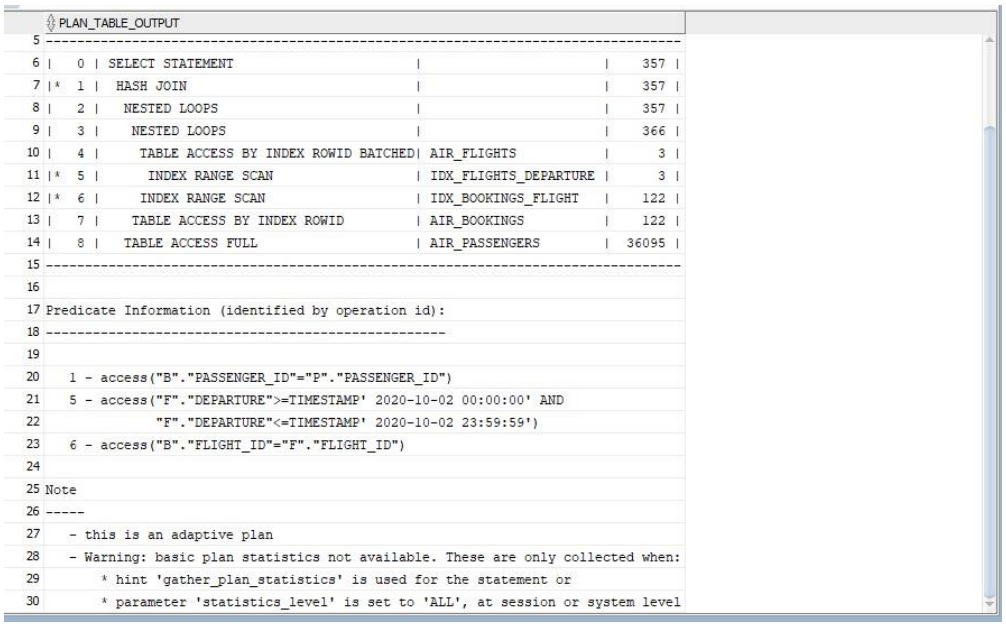
CREATE TABLE air_flights CLUSTER cluster_bookings_flights (flight_id) AS SELECT * FROM arruda.air_flights;

ANALYZE TABLE air_bookings COMPUTE STATISTICS;

ANALYZE TABLE air_flights COMPUTE STATISTICS;

```
Table AIR_FLIGHTS_CLUSTERED criado.

Decorrido: 00:00:00.175

Table AIR_BOOKINGS_CLUSTERED criado.

Decorrido: 00:00:00.330
```

```
Procedimento PL/SQL concluído com sucesso.

Decorrido: 00:00:00.044

Procedimento PL/SQL concluído com sucesso.

Decorrido: 00:00:00.061
```



```
PLAN_TABLE_OUTPUT
-------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                          |                          |    357 |
|*  1 |  HASH JOIN                                |                          |    357 |
|   2 |   NESTED LOOPS                            |                          |    357 |
|   3 |    NESTED LOOPS                           |                          |    366 |
|   4 |     TABLE ACCESS BY INDEX ROWID BATCHED| AIR_FLIGHTS             |      3 |
|*  5 |      INDEX RANGE SCAN                     | IDX_FLIGHTS_DEPARTURE    |      3 |
|*  6 |     INDEX RANGE SCAN                      | IDX_BOOKINGS_FLIGHT      |    122 |
|   7 |    TABLE ACCESS BY INDEX ROWID            | AIR_BOOKINGS             |    122 |
|   8 |   TABLE ACCESS FULL                       | AIR_PASSENGERS           |  36095 |
-------------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   1 - access("B"."PASSENGER_ID"="P"."PASSENGER_ID")
   5 - access("F"."DEPARTURE">=TIMESTAMP' 2020-10-02 00:00:00' AND
              "F"."DEPARTURE"<=TIMESTAMP' 2020-10-02 23:59:59')
   6 - access("B"."FLIGHT_ID"="F"."FLIGHT_ID")

Note
-----
   - this is an adaptive plan
   - Warning: basic plan statistics not available. These are only collected when:
       * hint 'gather_plan_statistics' is used for the statement or
       * parameter 'statistics_level' is set to 'ALL', at session or system level
```

```
83 linhas selecionadas.

Decorrido: 00:00:00.038
```

Conclusão

As otimizações resultaram em planos de execução mais eficientes, com uso de índices e clusters onde aplicável. Todos os requisitos foram atendidos.