```
SQL> SET FEEDBACK ON
SQL> --i)
SQL> EXPLAIN PLAN FOR SELECT O_ORDERSTATUS, O_ORDERDATE, O_TOTALPRICE FROM ORDERS
ORDER BY O_ORDERDATE;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 36248429

--------------------------------------------------------------------------------
-----

| Id  | Operation          | Name   | Rows  | Bytes |TempSpc| Cost (%CPU)| Time
    |

--------------------------------------------------------------------------------
-----


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |        |   450K|  7031K|       |  4342   (1)| 00:00
:01 |

|   1 |  SORT ORDER BY     |        |   450K|  7031K|    12M|  4342   (1)| 00:00
:01 |

|   2 |   TABLE ACCESS FULL| ORDERS |   450K|  7031K|       |  1949   (1)| 00:00
:01 |

--------------------------------------------------------------------------------
-----

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------


9 rows selected.

SQL>
SQL> --Create index
SQL> CREATE INDEX IDX1 ON ORDERS(O_ORDERDATE, O_TOTALPRICE, O_ORDERSTATUS);

Index created.
```

```
SQL>
SQL> EXPLAIN PLAN FOR
  2  SELECT O_ORDERSTATUS, O_ORDERDATE, O_TOTALPRICE
  3  FROM ORDERS
  4  ORDER BY O_ORDERDATE;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 1990381845

-------------------------------------------------------------------------------
| Id  | Operation        | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT |      |   450K|  7031K|  1697   (1)| 00:00:01 |
|   1 |  INDEX FULL SCAN | IDX1 |   450K|  7031K|  1697   (1)| 00:00:01 |
-------------------------------------------------------------------------------

8 rows selected.

SQL>
SQL> DROP INDEX IDX1;

Index dropped.

SQL>
SQL> --ii)
SQL> EXPLAIN PLAN FOR SELECT (SELECT COUNT(P_BRAND) FROM PART) TOTALBRAND, (SELECT
COUNT(DISTINCT P_BRAND)FROM PART) DISTTOTALBRAND FROM DUAL;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 4151837227

--------------------------------------------------------------------------------
----

| Id  | Operation             | Name       | Rows  | Bytes | Cost (%CPU)| Time
   |

--------------------------------------------------------------------------------
```

```
----


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT      |            |     1 |       |   344   (1)| 00:00:
01 |

|   1 |  SORT AGGREGATE       |            |     1 |       |            |
   |

|   2 |   INDEX FAST FULL SCAN| PART_PEKEY | 60000 |       |    32   (0)| 00:00:
01 |

|   3 |  SORT AGGREGATE       |            |     1 |    12 |            |
   |

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

|   4 |   VIEW                | VW_DAG_0   |    25 |   300 |   310   (1)| 00:00:
01 |

|   5 |    SORT GROUP BY      |            |    25 |   275 |   310   (1)| 00:00:
01 |

|   6 |     TABLE ACCESS FULL | PART       | 60000 |   644K|   308   (1)| 00:00:
01 |

|   7 |  FAST DUAL            |            |     1 |       |     2   (0)| 00:00:

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
01 |

--------------------------------------------------------------------------------
----


14 rows selected.

SQL>
SQL> CREATE INDEX IDX2 ON PART(P_BRAND);

Index created.

SQL>
SQL> EXPLAIN PLAN FOR SELECT (SELECT COUNT(P_BRAND) FROM PART) TOTALBRAND, (SELECT
COUNT(DISTINCT P_BRAND)FROM PART) DISTTOTALBRAND FROM DUAL;
```

```
Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 1950043705

--------------------------------------------------------------------------------
------

| Id  | Operation               | Name       | Rows  | Bytes | Cost (%CPU)| Time
     |

--------------------------------------------------------------------------------
------


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT        |            |     1 |       |    89   (4)| 00:0
0:01 |

|   1 |  SORT AGGREGATE         |            |     1 |       |            |
     |

|   2 |   INDEX FAST FULL SCAN  | PART_PEKEY | 60000 |       |    32   (0)| 00:0
0:01 |

|   3 |  SORT AGGREGATE         |            |     1 |    12 |            |
     |

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

|   4 |   VIEW                  | VW_DAG_0   |    25 |   300 |    54   (4)| 00:0
0:01 |

|   5 |    SORT GROUP BY        |            |    25 |   275 |    54   (4)| 00:0
0:01 |

|   6 |     INDEX FAST FULL SCAN| IDX2       | 60000 |   644K|    52   (0)| 00:0
0:01 |

|   7 |  FAST DUAL              |            |     1 |       |     2   (0)| 00:0

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
0:01 |
```

```
--------------------------------------------------------------------------------
------


14 rows selected.

SQL>
SQL> DROP INDEX IDX2;

Index dropped.

SQL>
SQL> --iii)
SQL> EXPLAIN PLAN FOR SELECT O_CLERK, COUNT(*) FROM ORDERS GROUP BY O_CLERK;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 2183589723

-------------------------------------------------------------------------------
| Id  | Operation          | Name   | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |        |  1000 | 16000 |  1961   (1)| 00:00:01 |
|   1 |  HASH GROUP BY     |        |  1000 | 16000 |  1961   (1)| 00:00:01 |
|   2 |   TABLE ACCESS FULL| ORDERS |   450K|  7031K|  1950   (1)| 00:00:01 |
-------------------------------------------------------------------------------

9 rows selected.

SQL>
SQL> CREATE INDEX IDX3 ON ORDERS(O_CLERK);

Index created.

SQL>
SQL> EXPLAIN PLAN FOR SELECT O_CLERK, COUNT(*) FROM ORDERS GROUP BY O_CLERK;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
```

```
Plan hash value: 2377188265

-------------------------------------------------------------------------------
| Id  | Operation             | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT      |      |  1000 | 16000 |   475   (3)| 00:00:01 |
|   1 |  HASH GROUP BY        |      |  1000 | 16000 |   475   (3)| 00:00:01 |
|   2 |   INDEX FAST FULL SCAN| IDX3 |   450K|  7031K|   464   (1)| 00:00:01 |
-------------------------------------------------------------------------------

9 rows selected.

SQL>
SQL> DROP INDEX IDX3;

Index dropped.

SQL>
SQL> --iv)
SQL> EXPLAIN PLAN FOR
  2  SELECT O_CLERK, O_ORDERDATE
  3  FROM ORDERS
  4  ORDER BY O_CLERK, O_ORDERDATE;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 36248429

--------------------------------------------------------------------------------
-----

| Id  | Operation          | Name   | Rows  | Bytes |TempSpc| Cost (%CPU)| Time
    |

--------------------------------------------------------------------------------
-----


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |        |   450K|    10M|       |  5107   (1)| 00:00
:01 |

|   1 |  SORT ORDER BY     |        |   450K|    10M|    13M|  5107   (1)| 00:00
:01 |
```

```
|   2 |   TABLE ACCESS FULL| ORDERS |   450K|    10M|       |  1950   (1)| 00:00
:01 |

-------------------------------------------------------------------------------
-----

PLAN_TABLE_OUTPUT
-------------------------------------------------------------------------------


9 rows selected.

SQL>
SQL> CREATE INDEX IDX4 ON ORDERS(O_CLERK, O_ORDERDATE);

Index created.

SQL>
SQL> EXPLAIN PLAN FOR
  2  SELECT O_CLERK, O_ORDERDATE
  3  FROM ORDERS
  4  ORDER BY O_CLERK, O_ORDERDATE;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
-------------------------------------------------------------------------------
Plan hash value: 2215783780

-------------------------------------------------------------------------
| Id  | Operation        | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------
|   0 | SELECT STATEMENT |      |   450K|    10M|  2201   (1)| 00:00:01 |
|   1 |  INDEX FULL SCAN | IDX4 |   450K|    10M|  2201   (1)| 00:00:01 |
-------------------------------------------------------------------------

8 rows selected.

SQL>
SQL> DROP INDEX IDX4;

Index dropped.

SQL>
SQL> --v)
SQL> EXPLAIN PLAN FOR
```

```
  2  SELECT O_CLERK, O_ORDERDATE
  3  FROM ORDERS
  4  WHERE O_CLERK = 'CLERK#000000446'
  5  AND O_ORDERSTATUS = 'F';

Explained.

SQL> --select query returns no values
SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 1275100350

-------------------------------------------------------------------------------
| Id  | Operation         | Name   | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |        |   219 |  5694 |  1953   (1)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| ORDERS |   219 |  5694 |  1953   (1)| 00:00:01 |
-------------------------------------------------------------------------------

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

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

   1 - filter("O_CLERK"='CLERK#000000446' AND "O_ORDERSTATUS"='F')

13 rows selected.

SQL>
SQL> --create index or o_orderstatus
SQL> CREATE INDEX IDX5 ON ORDERS(O_CLERK, O_ORDERSTATUS);

Index created.

SQL>
SQL> EXPLAIN PLAN FOR
  2  SELECT O_CLERK, O_ORDERDATE FROM ORDERS WHERE O_CLERK = 'CLERK#000000446'AND
O_ORDERSTATUS = 'F';

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
```

```
Plan hash value: 4057061640

-------------------------------------------------------------------------------
--------------

| Id  | Operation                           | Name   | Rows  | Bytes | Cost (%CP
U)| Time     |

-------------------------------------------------------------------------------
--------------


PLAN_TABLE_OUTPUT
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                    |        |   219 |  5694 |   219   (
0)| 00:00:01 |

|   1 |  TABLE ACCESS BY INDEX ROWID BATCHED| ORDERS |   219 |  5694 |   219   (
0)| 00:00:01 |

|*  2 |   INDEX RANGE SCAN                  | IDX5   |   219 |       |     3   (
0)| 00:00:01 |

-------------------------------------------------------------------------------
--------------

PLAN_TABLE_OUTPUT
-------------------------------------------------------------------------------


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

   2 - access("O_CLERK"='CLERK#000000446' AND "O_ORDERSTATUS"='F')

14 rows selected.

SQL>
SQL> DROP INDEX IDX5;

Index dropped.

SQL>
SQL> --vi)
SQL> EXPLAIN PLAN FOR
  2  SELECT COUNT(*)
  3  FROM ORDERS;

Explained.
```

```
SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 3211320914

-----------------------------------------------------------------------------
| Id  | Operation             | Name        | Rows  | Cost (%CPU)| Time     |
-----------------------------------------------------------------------------
|   0 | SELECT STATEMENT      |             |     1 |   239   (1)| 00:00:01 |
|   1 |  SORT AGGREGATE       |             |     1 |            |          |
|   2 |   INDEX FAST FULL SCAN| ORDERS_PKEY |   450K|   239   (1)| 00:00:01 |
-----------------------------------------------------------------------------

9 rows selected.

SQL>
SQL> --NO INDEX
SQL> --CREATE INDEX IDX6A ON ORDERS(O_ORDERDATE);
SQL> --CREATE INDEX IDX6B ON ORDERS(O_CLERK);
SQL>
SQL> EXPLAIN PLAN FOR
  2  SELECT COUNT(*)
  3  FROM ORDERS;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 3211320914

-----------------------------------------------------------------------------
| Id  | Operation             | Name        | Rows  | Cost (%CPU)| Time     |
-----------------------------------------------------------------------------
|   0 | SELECT STATEMENT      |             |     1 |   239   (1)| 00:00:01 |
|   1 |  SORT AGGREGATE       |             |     1 |            |          |
|   2 |   INDEX FAST FULL SCAN| ORDERS_PKEY |   450K|   239   (1)| 00:00:01 |
-----------------------------------------------------------------------------

9 rows selected.

SQL>
SQL> --DROP INDEX IDX6A;
SQL> --DROP INDEX IDX6B;
SQL>
SQL> --vii)
```

```
SQL> EXPLAIN PLAN FOR
  2  SELECT O_CLERK, O_ORDERDATE, L_RECEIPTDATE
  3  FROM ORDERS JOIN LINEITEM ON O_ORDERKEY = L_ORDERKEY
  4  WHERE O_CLERK = 'Clerk#00000046'AND O_ORDERSTATUS = 'F';

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 523862552

--------------------------------------------------------------------------------
--------------

| Id  | Operation                    | Name          | Rows  | Bytes | Cost (%CP
U)| Time     |

--------------------------------------------------------------------------------
--------------


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT             |               |   863 | 39698 |  2610   (
1)| 00:00:01 |

|   1 |  NESTED LOOPS                |               |   863 | 39698 |  2610   (
1)| 00:00:01 |

|   2 |   NESTED LOOPS               |               |   876 | 39698 |  2610   (
1)| 00:00:01 |

|*  3 |    TABLE ACCESS FULL         | ORDERS        |   219 |  7008 |  1953   (
1)| 00:00:01 |

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

|*  4 |    INDEX RANGE SCAN          | LINEITEM_PKEY |     4 |       |     2   (
0)| 00:00:01 |

|   5 |   TABLE ACCESS BY INDEX ROWID| LINEITEM      |     4 |    56 |     3   (
0)| 00:00:01 |

--------------------------------------------------------------------------------
--------------
```

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

   3 - filter("ORDERS"."O_CLERK"='Clerk#00000046' AND "ORDERS"."O_ORDERSTATUS"='
F')

   4 - access("O_ORDERKEY"="L_ORDERKEY")

Note
-----
   - this is an adaptive plan

22 rows selected.

SQL>
```

Bitmap join index, bitmap index (low cardinality), function index kkkk

```
SQL> --CREATE BITMAP INDEX
SQL> --CREATE INDEX IDX7A ON ORDERS(O_CLERK, O_ORDERSTATUS);
SQL> CREATE BITMAP INDEX IDX7B ON LINEITEM (ORDERS.O_CLERK) FROM ORDERS, LINEITEM
WHERE ORDERS.O_ORDERKEY = LINEITEM.L_ORDERKEY;

Index created.

SQL>
SQL> EXPLAIN PLAN FOR
  2  SELECT O_CLERK, O_ORDERDATE, L_RECEIPTDATE
  3  FROM ORDERS JOIN LINEITEM ON O_ORDERKEY = L_ORDERKEY
  4  WHERE O_CLERK = 'Clerk#00000046'AND O_ORDERSTATUS = 'F';

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 3529090336

--------------------------------------------------------------------------------
-----------------

| Id  | Operation                           | Name     | Rows  | Bytes | Cost (
%CPU)| Time     |

--------------------------------------------------------------------------------
-----------------
```

```
PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                    |          |     1 |    46 |  2349
  (1)| 00:00:01 |

|*  1 |  HASH JOIN                          |          |     1 |    46 |  2349
  (1)| 00:00:01 |

|*  2 |   TABLE ACCESS FULL                 | ORDERS   |   219 |  7008 |  1953
  (1)| 00:00:01 |

|   3 |   TABLE ACCESS BY INDEX ROWID BATCHED| LINEITEM |  1800 | 25200 |   397
  (0)| 00:00:01 |

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

|   4 |    BITMAP CONVERSION TO ROWIDS      |          |       |       |
     |          |

|*  5 |     BITMAP INDEX SINGLE VALUE       | IDX7B    |       |       |
     |          |

--------------------------------------------------------------------------------
----------------



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

   1 - access("O_ORDERKEY"="L_ORDERKEY")
   2 - filter("ORDERS"."O_CLERK"='Clerk#00000046' AND "ORDERS"."O_ORDERSTATUS"='
F')

   5 - access("LINEITEM"."SYS_NC00017$"='Clerk#00000046')

Note
-----

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
   - this is an adaptive plan

23 rows selected.

SQL>
```

```
SQL> --DROP INDEX IDX7A;
SQL> DROP INDEX IDX7B;

Index dropped.

SQL>
SQL> --viii)
SQL> EXPLAIN PLAN FOR
  2  SELECT O_CLERK, O_ORDERDATE, O_TOTALPRICE
  3  FROM ORDERS
  4  WHERE O_CLERK = 'Clerk#00000046'
  5  UNION
  6  SELECT O_CLERK, O_ORDERDATE, O_TOTALPRICE
  7  FROM ORDERS
  8  WHERE O_TOTALPRICE > 400000;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 4042372449

-------------------------------------------------------------------------------
| Id  | Operation           | Name   | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT    |        |  1928 | 57840 |  3904   (1)| 00:00:01 |
|   1 |  SORT UNIQUE        |        |  1928 | 57840 |  3904   (1)| 00:00:01 |
|   2 |   UNION-ALL         |        |       |       |            |          |
|*  3 |    TABLE ACCESS FULL| ORDERS |   450 | 13500 |  1953   (1)| 00:00:01 |
|*  4 |    TABLE ACCESS FULL| ORDERS |  1478 | 44340 |  1949   (1)| 00:00:01 |
-------------------------------------------------------------------------------

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

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

   3 - filter("O_CLERK"='Clerk#00000046')
   4 - filter("O_TOTALPRICE">400000)

17 rows selected.

SQL>
SQL> CREATE INDEX IDX8 ON ORDERS(O_CLERK, O_TOTALPRICE);

Index created.
```

```
SQL>
SQL> EXPLAIN PLAN FOR
  2  SELECT O_CLERK, O_ORDERDATE, O_TOTALPRICE
  3  FROM ORDERS
  4  WHERE O_CLERK = 'Clerk#00000046'
  5  UNION
  6  SELECT O_CLERK, O_ORDERDATE, O_TOTALPRICE
  7  FROM ORDERS
  8  WHERE O_TOTALPRICE > 400000;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 665216000

--------------------------------------------------------------------------------
----------------

| Id  | Operation                             | Name   | Rows  | Bytes | Cost (%
CPU)| Time     |

--------------------------------------------------------------------------------
----------------


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                      |        |  1928 | 57840 |  2407
 (1)| 00:00:01 |

|   1 |  SORT UNIQUE                          |        |  1928 | 57840 |  2407
 (1)| 00:00:01 |

|   2 |   UNION-ALL                           |        |       |       |
    |          |

|   3 |    TABLE ACCESS BY INDEX ROWID BATCHED| ORDERS |   450 | 13500 |   455
 (0)| 00:00:01 |

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

|*  4 |     INDEX RANGE SCAN                  | IDX8   |   450 |       |     5
 (0)| 00:00:01 |
```

```
|*  5 |    TABLE ACCESS FULL                  | ORDERS |  1478 | 44340 |  1949
 (1)| 00:00:01 |

---------------------------------------------------------------------------
---------------



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

   4 - access("O_CLERK"='Clerk#00000046')
   5 - filter("O_TOTALPRICE">400000)

18 rows selected.

SQL>
SQL> DROP INDEX IDX8;

Index dropped.

SQL>
SQL> --ix)
SQL> EXPLAIN PLAN FOR SELECT C_NAME, O_TOTALPRICE
  2  FROM CUSTOMER JOIN ORDERS ON C_CUSTKEY = O_CUSTKEY
  3  WHERE C_MKTSEGMENT = 'AUTOMOBILE' AND C_ACCTBAL < 500;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
---------------------------------------------------------------------------
Plan hash value: 484670660

-----------------------------------------------------------------------------
| Id  | Operation          | Name     | Rows  | Bytes | Cost (%CPU)| Time     |
-----------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |          | 18036 |   915K|  2258   (1)| 00:00:01 |
|*  1 |  HASH JOIN         |          | 18036 |   915K|  2258   (1)| 00:00:01 |
|*  2 |   TABLE ACCESS FULL| CUSTOMER |  1209 | 49569 |   308   (1)| 00:00:01 |
|*  3 |   TABLE ACCESS FULL| ORDERS   |   450K|  4833K|  1949   (1)| 00:00:01 |
-----------------------------------------------------------------------------


PLAN_TABLE_OUTPUT
---------------------------------------------------------------------------
```

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

   1 - access("C_CUSTKEY"="O_CUSTKEY")
   2 - filter("CUSTOMER"."C_ACCTBAL"<500 AND
              "CUSTOMER"."C_MKTSEGMENT"='AUTOMOBILE')
   3 - filter("O_CUSTKEY">=0)

18 rows selected.

SQL>
SQL> CREATE BITMAP INDEX IDX9A ON ORDERS (CUSTOMER.C_MKTSEGMENT,
CUSTOMER.C_ACCTBAL) FROM ORDERS, CUSTOMER WHERE ORDERS.O_CUSTKEY =
CUSTOMER.C_CUSTKEY;

Index created.

SQL> CREATE INDEX IDX9B ON CUSTOMER(CASE C_MKTSEGMENT WHEN 'AUTOMOBILE' THEN
'AUTOMOBILE' END);

Index created.

SQL>
SQL> EXPLAIN PLAN FOR SELECT C_NAME, O_TOTALPRICE
  2  FROM CUSTOMER JOIN ORDERS ON C_CUSTKEY = O_CUSTKEY
  3  WHERE C_MKTSEGMENT = 'AUTOMOBILE' AND C_ACCTBAL < 500;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 3446467944

--------------------------------------------------------------------------------
-----------------

| Id  | Operation                           | Name     | Rows  | Bytes | Cost (
%CPU)| Time     |

--------------------------------------------------------------------------------
-----------------


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                    |          |   484 | 25168 |  1761
  (1)| 00:00:01 |
```

```
|*  1 |  HASH JOIN                          |          |   484 | 25168 |  1761
  (1)| 00:00:01 |

|*  2 |   TABLE ACCESS FULL                 | CUSTOMER |  1209 | 49569 |   308
  (1)| 00:00:01 |

|*  3 |   TABLE ACCESS BY INDEX ROWID BATCHED| ORDERS   | 12089 |   129K|  1454
  (1)| 00:00:01 |

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

|   4 |    BITMAP CONVERSION TO ROWIDS       |          |       |       |
     |          |

|*  5 |     BITMAP INDEX RANGE SCAN          | IDX9A    |       |       |
     |          |

--------------------------------------------------------------------------------
-----------------



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

   1 - access("C_CUSTKEY"="O_CUSTKEY")
   2 - filter("CUSTOMER"."C_ACCTBAL"<500 AND "CUSTOMER"."C_MKTSEGMENT"='AUTOMOBI
LE')

   3 - filter("O_CUSTKEY">=0)
   5 - access("ORDERS"."SYS_NC00010$"='AUTOMOBILE' AND "ORDERS"."SYS_NC00011$"<5
00)


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
       filter("ORDERS"."SYS_NC00010$"='AUTOMOBILE' AND "ORDERS"."SYS_NC00011$"<5
00)


21 rows selected.

SQL>
SQL> DROP INDEX IDX9A;

Index dropped.
```

```
SQL> DROP INDEX IDX9B;

Index dropped.

SQL>
SQL> --x)
SQL> EXPLAIN PLAN FOR
  2  SELECT P_PARTKEY, P_RETAILPRICE
  3  FROM PART
  4  WHERE P_RETAILPRICE < 1000;

Explained.

SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 673417232

-------------------------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |  5614 | 56140 |   308   (1)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| PART |  5614 | 56140 |   308   (1)| 00:00:01 |
-------------------------------------------------------------------------------

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

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

   1 - filter("P_RETAILPRICE"<1000)

13 rows selected.

SQL>
SQL> CREATE INDEX IDX10 ON PART(P_RETAILPRICE);

Index created.

SQL>
SQL> EXPLAIN PLAN FOR
  2  SELECT P_PARTKEY, P_RETAILPRICE
  3  FROM PART
  4  WHERE P_RETAILPRICE < 1000;

Explained.
```

```
SQL>
SQL> SELECT * FROM TABLE(DBMS_XPLAN.DISPLAY);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
Plan hash value: 281158565

--------------------------------------------------------------------------------
-----------

| Id  | Operation              | Name             | Rows  | Bytes | Cost (%CPU)|
 Time     |

--------------------------------------------------------------------------------
-----------


PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT       |                  |  5614 | 56140 |   128   (1)|
 00:00:01 |

|*  1 |  VIEW                  | index$_join$_001 |  5614 | 56140 |   128   (1)|
 00:00:01 |

|*  2 |   HASH JOIN            |                  |       |       |            |
          |

|*  3 |    INDEX RANGE SCAN    | IDX10            |  5614 | 56140 |    14   (0)|
 00:00:01 |

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------

|   4 |    INDEX FAST FULL SCAN| PART_PEKEY       |  5614 | 56140 |   142   (1)|
 00:00:01 |

--------------------------------------------------------------------------------
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Predicate Information (identified by operation id):
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PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------
   1 - filter("P_RETAILPRICE"<1000)
   2 - access(ROWID=ROWID)
```

```
   3 - access("P_RETAILPRICE"<1000)

18 rows selected.

SQL>
SQL> DROP INDEX IDX10;

Index dropped.

SQL>
SQL> SPOOL OFF
```