INDEX 를 사용하는 SQL

```
CREATE INDEX emp_ename_ix ON emp(ename);
Index EMP_ENAME_IX 이(가) 생성되었습니다.

SELECT index_name, table_name
FROM user_indexes
WHERE table_name = 'EMP';


INDEX_NAME                     TABLE_NAME
------------------------------ ------------------------------
EMP_JOB_IDX                    EMP
EMP_ENAME_IX                   EMP


ALTER INDEX emp_ename_ix INVISIBLE;
Index EMP_ENAME_IX 이(가) 변경되었습니다.

SET AUTOTRACE ON EXPLAIN
자동 추적 사용
실행 계획만 표시합니다.


column rowid new_value rid

SELECT empno, ename, rowid
FROM emp
WHERE ename = 'SCOTT' ;

     EMPNO ENAME      ROWID
---------- ---------- ------------------
      7788 SCOTT      AAAE6KAAEAAAAKmAAH

--------------------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |     1 |    22 |     3   (0)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| EMP  |     1 |    22 |     3   (0)| 00:00:01 |
--------------------------------------------------------------------------

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

   1 - filter("ENAME"='SCOTT')
```

```
SELECT empno, ename, rowid
  FROM emp
 WHERE rowid = '&rid';

이전:SELECT empno, ename, rowid
       FROM emp
      WHERE rowid = '&rid'
신규:SELECT empno, ename, rowid
       FROM emp
      WHERE rowid = 'AAAE6KAAEAAAAKmAAH'

     EMPNO ENAME      ROWID
---------- ---------- ------------------
      7788 SCOTT      AAAE6KAAEAAAAKmAAH

-----------------------------------------------------------------------------------
| Id  | Operation                  | Name | Rows  | Bytes | Cost (%CPU)| Time     |
-----------------------------------------------------------------------------------
|   0 | SELECT STATEMENT           |      |     1 |    22 |     1   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY USER ROWID| EMP  |     1 |    22 |     1   (0)| 00:00:01 |
-----------------------------------------------------------------------------------


ALTER INDEX emp_ename_ix VISIBLE ;
Index EMP_ENAME_IX이(가) 변경되었습니다.


SELECT empno, ename, rowid
FROM emp
WHERE ename = 'SCOTT' ;


     EMPNO ENAME      ROWID
---------- ---------- ------------------
      7788 SCOTT      AAAE6KAAEAAAAKmAAH

--------------------------------------------------------------------------------------------
Plan hash value: 80071485

--------------------------------------------------------------------------------------------
| Id  | Operation                   | Name         | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |              |     1 |    22 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP          |     1 |    22 |     2   (0)| 00:00:01 |
|*  2 |   INDEX RANGE SCAN          | EMP_ENAME_IX |     1 |       |     1   (0)| 00:00:01 |
--------------------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------
    2 - access("ENAME"='SCOTT')
```

Case 1. 잘못 사용된 조건식 또는 조건식의 부재

```
CREATE INDEX emp_deptno_ix ON emp(deptno);
Index EMP_DEPTNO_IX 이(가) 생성되었습니다.

SELECT deptno, SUM(sal)
  FROM emp
 GROUP BY deptno
 HAVING deptno IN (10,20);

    DEPTNO   SUM(SAL)
---------- ----------
        20      10875
        10       8750

----------------------------------------------------------------------------
| Id  | Operation           | Name | Rows  | Bytes | Cost (%CPU)| Time     |
----------------------------------------------------------------------------
|   0 | SELECT STATEMENT    |      |     1 |     7 |     4  (25)| 00:00:01 |
|*  1 |  FILTER             |      |       |       |            |          |
|   2 |   HASH GROUP BY     |      |     1 |     7 |     4  (25)| 00:00:01 |
|   3 |    TABLE ACCESS FULL| EMP  |    14 |    98 |     3   (0)| 00:00:01 |
----------------------------------------------------------------------------
Predicate Information (identified by operation id):
---------------------------------------------------
   1 - filter("DEPTNO"=10 OR "DEPTNO"=20)


SELECT deptno, SUM(sal)
  FROM emp
 WHERE deptno IN (10,20)
 GROUP BY deptno;

    DEPTNO   SUM(SAL)
---------- ----------
        10       8750
        20      10875

-----------------------------------------------------------------------------------------------
| Id  | Operation                     | Name          | Rows  | Bytes | Cost (%CPU)| Time     |
-----------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT              |               |     2 |    14 |     2   (0)| 00:00:01 |
|   1 |  SORT GROUP BY NOSORT         |               |     2 |    14 |     2   (0)| 00:00:01 |
|   2 |   INLIST ITERATOR             |               |       |       |            |          |
|   3 |    TABLE ACCESS BY INDEX ROWID| EMP           |     9 |    63 |     2   (0)| 00:00:01 |
|*  4 |     INDEX RANGE SCAN          | EMP_DEPTNO_IX |     9 |       |     1   (0)| 00:00:01 |
-----------------------------------------------------------------------------------------------
Predicate Information (identified by operation id):
---------------------------------------------------
   4 - access("DEPTNO"=10 OR "DEPTNO"=20)
```

Case 2. 컬럼의 변형 (표현식에 포함된 컬럼)

case2 - 1. emp 테이블에서 ename 컬럼의 두 번째 문자가 대문자 C 인 사원을 조회하시오.

```
SELECT *
FROM emp
WHERE SUBSTR(ename,2,1) = 'C';

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7788 SCOTT      ANALYST         7566 1982/12/09       3000                    20

--------------------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |     1 |    38 |     3   (0)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| EMP  |     1 |    38 |     3   (0)| 00:00:01 |
--------------------------------------------------------------------------
 Predicate Information (identified by operation id):
---------------------------------------------------
   1 - filter(SUBSTR("ENAME",2,1)='C')
```

case2 - 2. 1년 급여가 30000 이상인 사원의 모든 정보를 조회하시오.

```
CREATE INDEX emp_sal_ix ON emp(sal);
Index EMP_SAL_IX 이(가) 생성되었습니다.

SELECT *
FROM emp
WHERE sal * 12 > 30000;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7566 JONES      MANAGER         7839 1981/04/02       2975                    20
      7698 BLAKE      MANAGER         7839 1981/05/01       2850                    30
      7788 SCOTT      ANALYST         7566 1982/12/09       3000                    20
      7839 KING       PRESIDENT            1981/11/17       5000                    10
      7902 FORD       ANALYST         7566 1981/12/03       3000                    20

--------------------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |     1 |    38 |     3   (0)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| EMP  |     1 |    38 |     3   (0)| 00:00:01 |
--------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------
1 - filter("SAL"*12>30000)
```

```
case2 - 1 -> sol)
CREATE INDEX emp_ename_fbi ON emp(SUBSTR(ename,2,1));
Index EMP_ENAME_FBI 이(가) 생성되었습니다.

SELECT *
FROM emp
WHERE SUBSTR(ename, 2, 1) = 'C' ;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7788 SCOTT      ANALYST         7566 1982/12/09       3000                    20

---------------------------------------------------------------------------------------------
| Id  | Operation                   | Name          | Rows  | Bytes | Cost (%CPU)| Time     |
---------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |               |     1 |    38 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP           |     1 |    38 |     2   (0)| 00:00:01 |
|*  2 |   INDEX RANGE SCAN          | EMP_ENAME_FBI |     1 |       |     1   (0)| 00:00:01 |
---------------------------------------------------------------------------------------------

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

   2 - access(SUBSTR("ENAME",2,1)='C')

case2 - 2 -> sol)
SELECT *
FROM emp
WHERE sal > 30000 / 12 ;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7698 BLAKE      MANAGER         7839 1981/05/01       2850                    30
      7566 JONES      MANAGER         7839 1981/04/02       2975                    20
      7788 SCOTT      ANALYST         7566 1982/12/09       3000                    20
      7902 FORD       ANALYST         7566 1981/12/03       3000                    20
      7839 KING       PRESIDENT            1981/11/17       5000                    10

------------------------------------------------------------------------------------------
| Id  | Operation                   | Name       | Rows  | Bytes | Cost (%CPU)| Time     |
------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |            |     8 |   304 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP        |     8 |   304 |     2   (0)| 00:00:01 |
|*  2 |   INDEX RANGE SCAN          | EMP_SAL_IX |     8 |       |     1   (0)| 00:00:01 |
------------------------------------------------------------------------------------------

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

   2 - access("SAL">2500)
DROP INDEX emp_ename_fbi ;
Index EMP_ENAME_FBI 이(가) 삭제되었습니다.
```

Case 3. IS NULL, IS NOT NULL 비교

```
CREATE INDEX emp_comm ON emp(comm);
Index EMP_COMM 이(가) 생성되었습니다.
```

case3 - 1. IS NULL 체크!

```
SELECT *
  FROM emp
 WHERE comm IS NULL;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7369 SMITH      CLERK           7902 1980/12/17        800                    20
      7566 JONES      MANAGER         7839 1981/04/02       2975                    20
       …
10 개 행이 선택되었습니다.

--------------------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |    10 |   380 |     3   (0)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| EMP  |    10 |   380 |     3   (0)| 00:00:01 |
--------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------
1 - filter("COMM" IS NULL)
```

case3 - 2. IS NOT NULL 체크!

```
SELECT *
  FROM emp
 WHERE comm IS NOT NULL;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7844 TURNER     SALESMAN        7698 1981/09/08       1500          0         30
      7499 ALLEN      SALESMAN        7698 1981/02/20       1600        300         30
      7521 WARD       SALESMAN        7698 1981/02/22       1250        500         30
      7654 MARTIN     SALESMAN        7698 1981/09/28       1250       1400         30

----------------------------------------------------------------------------------------
| Id  | Operation                   | Name     | Rows  | Bytes | Cost (%CPU)| Time     |
----------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |          |     4 |   152 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP      |     4 |   152 |     2   (0)| 00:00:01 |
|*  2 |   INDEX FULL SCAN           | EMP_COMM |     4 |       |     1   (0)| 00:00:01 |
----------------------------------------------------------------------------------------
Predicate Information (identified by operation id):
---------------------------------------------------
2 - filter("COMM" IS NOT NULL)
```

Case 4. 잘못 사용된 LIKE 조건식

case4 - 1. emp 테이블의 사원 이름이 대문자 S 로 시작되는 사원을 조회하시오.

```
SELECT *
  FROM emp
 WHERE ename LIKE 'S%';

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7788 SCOTT      ANALYST         7566 1982/12/09       3000                    20
      7369 SMITH      CLERK           7902 1980/12/17        800                    20

---------------------------------------------------------------------------------------------
| Id  | Operation                   | Name         | Rows  | Bytes | Cost (%CPU)| Time     |
---------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |              |     2 |    76 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP          |     2 |    76 |     2   (0)| 00:00:01 |
|*  2 |   INDEX RANGE SCAN          | EMP_ENAME_IX |     2 |       |     1   (0)| 00:00:01 |
---------------------------------------------------------------------------------------------

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

   2 - access("ENAME" LIKE 'S%')
       filter("ENAME" LIKE 'S%')
```

case4 - 2. emp 테이블의 사원 이름이 대문자 S 로 끝나는 사원을 조회하시오.

```
SELECT *
  FROM emp
 WHERE ename LIKE '%S';

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7876 ADAMS      CLERK           7788 1983/01/12       1100                    20
      7900 JAMES      CLERK           7698 1981/12/03        950                    30
      7566 JONES      MANAGER         7839 1981/04/02       2975                    20

---------------------------------------------------------------------------------------------
| Id  | Operation                   | Name         | Rows  | Bytes | Cost (%CPU)| Time     |
---------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |              |     1 |    38 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP          |     1 |    38 |     2   (0)| 00:00:01 |
|*  2 |   INDEX FULL SCAN           | EMP_ENAME_IX |     1 |       |     1   (0)| 00:00:01 |
---------------------------------------------------------------------------------------------

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

   2 - filter("ENAME" LIKE '%S' AND "ENAME" IS NOT NULL)
```

INDEX FULL SCAN 이 아닌 INDEX RANGE SCAN 을 할 수 있는 방법은 없을까?

case4 - 2 -> 또 다른 방법!!

```
CREATE INDEX ename_fbi ON emp(REVERSE(ename)) ;
Index ENAME_FBI 이(가) 생성되었습니다.

SELECT *
  FROM emp
 WHERE REVERSE(ename) LIKE 'S%' ;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7900 JAMES      CLERK           7698 1981/12/03        950                    30
      7566 JONES      MANAGER         7839 1981/04/02       2975                    20
      7876 ADAMS      CLERK           7788 1983/01/12       1100                    20

-----------------------------------------------------------------------------------------
| Id  | Operation                   | Name      | Rows  | Bytes | Cost (%CPU)| Time     |
-----------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |           |     1 |    38 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP       |     1 |    38 |     2   (0)| 00:00:01 |
|*  2 |   INDEX RANGE SCAN          | ENAME_FBI |     1 |       |     1   (0)| 00:00:01 |
-----------------------------------------------------------------------------------------

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

   2 - access(REVERSE("ENAME") LIKE 'S%')
       filter(REVERSE("ENAME") LIKE 'S%')

DROP INDEX ename_fbi ;
Index ENAME_FBI 이(가) 삭제되었습니다.
```

단 와일드 카드가 앞뒤로 정의되는 경우 사용 불가!!

Case 5. 부정형 비교

```
SELECT *
  FROM emp
 WHERE deptno != 20;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7499 ALLEN      SALESMAN        7698 1981/02/20       1600        300         30
      7521 WARD       SALESMAN        7698 1981/02/22       1250        500         30
      7654 MARTIN     SALESMAN        7698 1981/09/28       1250       1400         30
      7698 BLAKE      MANAGER         7839 1981/05/01       2850                    30
      7782 CLARK      MANAGER         7839 1981/06/09       2450                    10
      7839 KING       PRESIDENT            1981/11/17       5000                    10
      7844 TURNER     SALESMAN        7698 1981/09/08       1500          0         30
      7900 JAMES      CLERK           7698 1981/12/03        950                    30
      7934 MILLER     CLERK           7782 1982/01/23       1300                    10
9 개 행이 선택되었습니다.

--------------------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |     9 |   342 |     3   (0)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| EMP  |     9 |   342 |     3   (0)| 00:00:01 |
--------------------------------------------------------------------------
 Predicate Information (identified by operation id):
---------------------------------------------------
   1 - filter("DEPTNO"<>20)


SELECT /*+ index(emp(deptno)) */*
  FROM emp
 WHERE deptno != 20;

---------------------------------------------------------------------------------------------
| Id  | Operation                   | Name          | Rows  | Bytes | Cost (%CPU)| Time     |
---------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |               |     9 |   342 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP           |     9 |   342 |     2   (0)| 00:00:01 |
|*  2 |   INDEX FULL SCAN           | EMP_DEPTNO_IX |     9 |       |     1   (0)| 00:00:01 |
---------------------------------------------------------------------------------------------
Predicate Information (identified by operation id):
---------------------------------------------------
   2 - filter("DEPTNO"<>20)
```

case 5 -> sol : INDEX RANGE SCAN 가능하도록 조건식 변경!

```
SELECT *
  FROM emp
 WHERE deptno IN (10,30) ;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7782 CLARK      MANAGER         7839 1981/06/09       2450                    10
      7839 KING       PRESIDENT            1981/11/17       5000                    10
      7934 MILLER     CLERK           7782 1982/01/23       1300                    10
      7499 ALLEN      SALESMAN        7698 1981/02/20       1600        300         30
      7521 WARD       SALESMAN        7698 1981/02/22       1250        500         30
      7654 MARTIN     SALESMAN        7698 1981/09/28       1250       1400         30
      7698 BLAKE      MANAGER         7839 1981/05/01       2850                    30
      7844 TURNER     SALESMAN        7698 1981/09/08       1500          0         30
      7900 JAMES      CLERK           7698 1981/12/03        950                    30

9 개 행이 선택되었습니다.

----------------------------------------------------------------------------------------------
| Id  | Operation                    | Name         | Rows  | Bytes | Cost (%CPU)| Time     |
----------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT             |              |     9 |   342 |     2   (0)| 00:00:01 |
|   1 |  INLIST ITERATOR             |              |       |       |            |          |
|   2 |   TABLE ACCESS BY INDEX ROWID| EMP          |     9 |   342 |     2   (0)| 00:00:01 |
|*  3 |    INDEX RANGE SCAN          | EMP_DEPTNO_IX |     9 |       |     1   (0)| 00:00:01 |
----------------------------------------------------------------------------------------------
Predicate Information (identified by operation id):
---------------------------------------------------
    3 - access("DEPTNO"=10 OR "DEPTNO"=30)
```

Case 6. 암시적 형 변환

```
SELECT *
  FROM emp
 WHERE empno LIKE '77%' ;

     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7782 CLARK      MANAGER         7839 1981/06/09       2450                    10
      7788 SCOTT      ANALYST         7566 1982/12/09       3000                    20

--------------------------------------------------------------------------
| Id  | Operation         | Name | Rows  | Bytes | Cost (%CPU)| Time     |
--------------------------------------------------------------------------
|   0 | SELECT STATEMENT  |      |     1 |    38 |     3   (0)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| EMP  |     1 |    38 |     3   (0)| 00:00:01 |
--------------------------------------------------------------------------

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

   1 - filter(TO_CHAR("EMPNO") LIKE '77%')


SELECT *
FROM emp
WHERE empno BETWEEN 7700 AND 7799 ;


     EMPNO ENAME      JOB              MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ---------- ---------- ---------- ----------
      7782 CLARK      MANAGER         7839 1981/06/09       2450                    10
      7788 SCOTT      ANALYST         7566 1982/12/09       3000                    20

---------------------------------------------------------------------------------------------
| Id  | Operation                   | Name         | Rows  | Bytes | Cost (%CPU)| Time     |
---------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |              |     4 |   152 |     2   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID| EMP          |     4 |   152 |     2   (0)| 00:00:01 |
|*  2 |   INDEX RANGE SCAN          | EMP_EMPNO_IX |     4 |       |     1   (0)| 00:00:01 |
---------------------------------------------------------------------------------------------
Predicate Information (identified by operation id):
---------------------------------------------------

   2 - access("EMPNO">=7700 AND "EMPNO"<=7799)

SET AUTOTRACE OFF
자동 추적 사용 안함
```