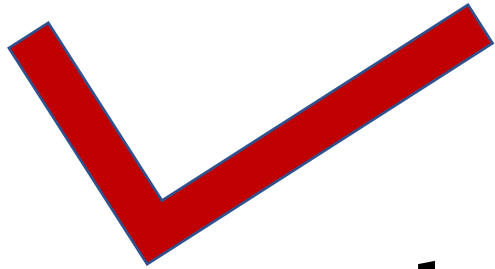이럴때는

nested loop join 으로 유도하라！세번째

▣ 학습 내용

1. 연결고리가 되는 컬럼에 인덱스가 있었을때 두개의 테이블 조인시 성능을 높이는 방법 배우기

2. 연결고리가 되는 컬럼에 인덱스가 있고 검색조건이 별도로 있었을때 조인의 성능을 높이는 방법 배우기

▣ 학습 목표

여러개의 테이블을 조인할 때 인덱스를 사용할 수 있으며 조인되는 순서를 올바르게 제시할 수 있습니다.

1. 조인하려는 테이블 사이의 연결고리에 인덱스가 없었을때

select /*+ leading(d e) use_nl(e) */ e.ename, d.loc
from emp e, dept d
where e.deptno = d.deptno;

full table scan !

emp 테이블

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7839	KING	PRESIDENT		1981-11-17	5000		10
7698	BLAKE	MANAGER	7839	1981-05-01	2850		30
7782	CLARK	MANAGER	7839	1981-05-09	2450		10
7566	JONES	MANAGER	7839	1981-04-01	2975		20
7654	MARTIN	SALESMAN	7698	1981-09-10	1250	1400	30
7499	ALLEN	SALESMAN	7698	1981-02-11	1600	300	30
7844	TURNER	SALESMAN	7698	1981-08-21	1500	0	30
7900	JAMES	CLERK	7698	1981-12-11	950		30
7521	WARD	SALESMAN	7698	1981-02-23	1250	500	30
7902	FORD	ANALYST	7566	1981-12-11	3000		20
7369	SMITH	CLERK	7902	1980-12-09	800		20
7788	SCOTT	ANALYST	7566	1982-12-22	3000		20
7876	ADAMS	CLERK	7788	1983-01-15	1100		20
7934	MILLER	CLERK	7782	1982-01-11	1300		10

dept 테이블

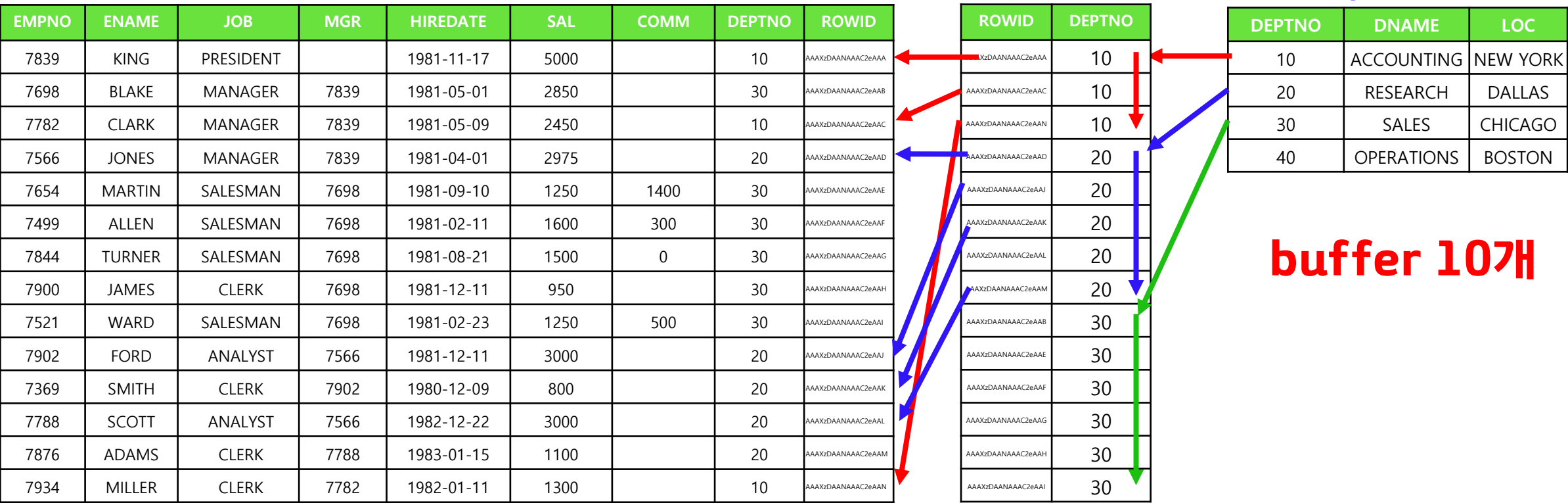| DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

buffer 35개

2.조인하려는 테이블 사이의 연결고리에 인덱스가 있었을때

```
select  /*+ leading(d e)  use_nl(e) index(emp emp_deptno) */ e.ename, d.loc
 from emp e, dept  d
where  e.deptno = d.deptno;
```

index range scan !

index 생성

emp 테이블

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	ROWID
7839	KING	PRESIDENT		1981-11-17	5000		10	AAAXzDAANAAAC2eAAA
7698	BLAKE	MANAGER	7839	1981-05-01	2850		30	AAAXzDAANAAAC2eAAB
7782	CLARK	MANAGER	7839	1981-05-09	2450		10	AAAXzDAANAAAC2eAAC
7566	JONES	MANAGER	7839	1981-04-01	2975		20	AAAXzDAANAAAC2eAAD
7654	MARTIN	SALESMAN	7698	1981-09-10	1250	1400	30	AAAXzDAANAAAC2eAAE
7499	ALLEN	SALESMAN	7698	1981-02-11	1600	300	30	AAAXzDAANAAAC2eAAF
7844	TURNER	SALESMAN	7698	1981-08-21	1500	0	30	AAAXzDAANAAAC2eAAG
7900	JAMES	CLERK	7698	1981-12-11	950		30	AAAXzDAANAAAC2eAAH
7521	WARD	SALESMAN	7698	1981-02-23	1250	500	30	AAAXzDAANAAAC2eAAI
7902	FORD	ANALYST	7566	1981-12-11	3000		20	AAAXzDAANAAAC2eAAJ
7369	SMITH	CLERK	7902	1980-12-09	800		20	AAAXzDAANAAAC2eAAK
7788	SCOTT	ANALYST	7566	1982-12-22	3000		20	AAAXzDAANAAAC2eAAL
7876	ADAMS	CLERK	7788	1983-01-15	1100		20	AAAXzDAANAAAC2eAAM
7934	MILLER	CLERK	7782	1982-01-11	1300		10	AAAXzDAANAAAC2eAAN

emp_deptno인덱스

ROWID	DEPTNO
AAAXzDAANAAAC2eAAA	10
AAAXzDAANAAAC2eAAC	10
AAAXzDAANAAAC2eAAN	10
AAAXzDAANAAAC2eAAD	20
AAAXzDAANAAAC2eAAJ	20
AAAXzDAANAAAC2eAAK	20
AAAXzDAANAAAC2eAAL	20
AAAXzDAANAAAC2eAAM	20
AAAXzDAANAAAC2eAAB	30
AAAXzDAANAAAC2eAAE	30
AAAXzDAANAAAC2eAAF	30
AAAXzDAANAAAC2eAAG	30
AAAXzDAANAAAC2eAAH	30
AAAXzDAANAAAC2eAAI	30

dept 테이블

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

buffer 10개

3. 검색 조건이 있었을때의 조인문장 튜닝

select /*+ leading(e d) use_nl(d) index(dept dept_deptno) */ e.ename, d.loc
 from emp e, dept d
 where e.deptno = d.deptno and e.ename='SCOTT';

index 생성

emp 테이블

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7839	KING	PRESIDENT		1981-11-17	5000		10
7698	BLAKE	MANAGER	7839	1981-05-01	2850		30
7782	CLARK	MANAGER	7839	1981-05-09	2450		10
7566	JONES	MANAGER	7839	1981-04-01	2975		20
7654	MARTIN	SALESMAN	7698	1981-09-10	1250	1400	30
7499	ALLEN	SALESMAN	7698	1981-02-11	1600	300	30
7844	TURNER	SALESMAN	7698	1981-08-21	1500	0	30
7900	JAMES	CLERK	7698	1981-12-11	950		30
7521	WARD	SALESMAN	7698	1981-02-23	1250	500	30
7902	FORD	ANALYST	7566	1981-12-11	3000		20
7369	SMITH	CLERK	7902	1980-12-09	800		20
7788	SCOTT	ANALYST	7566	1982-12-22	3000		20
7876	ADAMS	CLERK	7788	1983-01-15	1100		20
7934	MILLER	CLERK	7782	1982-01-11	1300		10

dept_deptno인덱스

DEPTNO	ROWID
10	AAAXzCAANAAACz+AAA
20	AAAXzCAANAAACz+AAB
30	AAAXzCAANAAACz+AAC
40	AAAXzCAANAAACz+AAD

dept 테이블

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

buffer 9개

3.검색조건에 인덱스까지 걸어준다면 ?

```sql
select  /*+ leading(e d)  use_nl(d) index(emp emp_ename)
              index(dept dept_deptno) */ e.ename, d.loc
 from emp e, dept  d
 where  e.deptno = d.deptno  and e.ename='SCOTT';
```

index 생성   index 생성

emp_ename인덱스   **emp 테이블**   **dept_deptno인덱스**   **dept 테이블**

ENAME	ROWID
ADAMS	AAATifAAHAAA DL1AAM
ALLEN	AAATifAAHAAA DL1AAF
BLAKE	AAATifAAHAAA DL1AAB
CLARK	AAATifAAHAAA DL1AAC
FORD	AAATifAAHAAA DL1AAJ
JAMES	AAATifAAHAAA DL1AAH
JONES	AAATifAAHAAA DL1AAD
KING	AAATifAAHAAA DL1AAA
MARTIN	AAATifAAHAAA DL1AAE
MILLER	AAATifAAHAAA DL1AAN
SCOTT	AAATifAAHAAA DL1AAL
SMITH	AAATifAAHAAA DL1AAK
TURNER	AAATifAAHAAA DL1AAG
WARD	AAATifAAHAAA DL1AAI

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7839	KING	PRESIDENT		1981-11-17	5000		10
7698	BLAKE	MANAGER	7839	1981-05-01	2850		30
7782	CLARK	MANAGER	7839	1981-05-09	2450		10
7566	JONES	MANAGER	7839	1981-04-01	2975		20
7654	MARTIN	SALESMAN	7698	1981-09-10	1250	1400	30
7499	ALLEN	SALESMAN	7698	1981-02-11	1600	300	30
7844	TURNER	SALESMAN	7698	1981-08-21	1500	0	30
7900	JAMES	CLERK	7698	1981-12-11	950		30
7521	WARD	SALESMAN	7698	1981-02-23	1250	500	30
7902	FORD	ANALYST	7566	1981-12-11	3000		20
7369	SMITH	CLERK	7902	1980-12-09	800		20
7788	SCOTT	ANALYST	7566	1982-12-22	3000		20
7876	ADAMS	CLERK	7788	1983-01-15	1100		20
7934	MILLER	CLERK	7782	1982-01-11	1300		10

DEPTNO	ROWID
10	AAAXzCAANAA ACz+AAA
20	AAAXzCAANAA ACz+AAB
30	AAAXzCAANAA ACz+AAC
40	AAAXzCAANAA ACz+AAD

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

buffer 4개

4. 조건이 여러개일 때의 조인문장 튜닝

```sql
select /*+ gather_plan_statistics leading(d e) use_nl(e) */ e.ename, e.sal, d.loc
  from  emp  e,  dept  d
 where  e.deptno = d.deptno  and e.job='SALESMAN' and d.loc='CHICAGO';
```

index 생성

emp 테이블

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	ROWID
7839	KING	PRESIDENT		1981-11-17	5000		10	AAAXzDAANAAAC2eAAA
7698	BLAKE	MANAGER	7839	1981-05-01	2850		30	AAAXzDAANAAAC2eAAB
7782	CLARK	MANAGER	7839	1981-05-09	2450		10	AAAXzDAANAAAC2eAAC
7566	JONES	MANAGER	7839	1981-04-01	2975		20	AAAXzDAANAAAC2eAAD
7654	MARTIN	SALESMAN	7698	1981-09-10	1250	1400	30	AAAXzDAANAAAC2eAAE
7499	ALLEN	SALESMAN	7698	1981-02-11	1600	300	30	AAAXzDAANAAAC2eAAF
7844	TURNER	SALESMAN	7698	1981-08-21	1500	0	30	AAAXzDAANAAAC2eAAG
7900	JAMES	CLERK	7698	1981-12-11	950		30	AAAXzDAANAAAC2eAAH
7521	WARD	SALESMAN	7698	1981-02-23	1250	500	30	AAAXzDAANAAAC2eAAI
7902	FORD	ANALYST	7566	1981-12-11	3000		20	AAAXzDAANAAAC2eAAJ
7369	SMITH	CLERK	7902	1980-12-09	800		20	AAAXzDAANAAAC2eAAK
7788	SCOTT	ANALYST	7566	1982-12-22	3000		20	AAAXzDAANAAAC2eAAL
7876	ADAMS	CLERK	7788	1983-01-15	1100		20	AAAXzDAANAAAC2eAAM
7934	MILLER	CLERK	7782	1982-01-11	1300		10	AAAXzDAANAAAC2eAAN

emp_deptno인덱스

ROWID	DEPTNO
AAAXzDAANAAAC2eAAA	10
AAAXzDAANAAAC2eAAC	10
AAAXzDAANAAAC2eAAN	10
AAAXzDAANAAAC2eAAD	20
AAAXzDAANAAAC2eAAJ	20
AAAXzDAANAAAC2eAAK	20
AAAXzDAANAAAC2eAAL	20
AAAXzDAANAAAC2eAAM	20
AAAXzDAANAAAC2eAAB	30
AAAXzDAANAAAC2eAAE	30
AAAXzDAANAAAC2eAAF	30
AAAXzDAANAAAC2eAAG	30
AAAXzDAANAAAC2eAAH	30
AAAXzDAANAAAC2eAAI	30

dept 테이블

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

buffer 9개

5. 조건이 여러개일 때 검색조건에 인덱스가 있다면?

```
select /*+ gather_plan_statistics leading(d e) use_nl(e)
          index(dept dept_loc)  index(emp emp_deptno) */ e.ename, e.sal, d.loc
 from  emp  e,  dept  d
 where  e.deptno = d.deptno  and e.job='SALESMAN' and d.loc='CHICAGO';
```

index 생성

index 생성

emp 테이블

emp_deptno 인덱스

dept 테이블

dept_loc 인덱스

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	ROWID
7839	KING	PRESIDENT		1981-11-17	5000		10	AAAXzDAANAAAC2eAAA
7698	BLAKE	MANAGER	7839	1981-05-01	2850		30	AAAXzDAANAAAC2eAAB
7782	CLARK	MANAGER	7839	1981-05-09	2450		10	AAAXzDAANAAAC2eAAC
7566	JONES	MANAGER	7839	1981-04-01	2975		20	AAAXzDAANAAAC2eAAD
7654	MARTIN	SALESMAN	7698	1981-09-10	1250	1400	30	AAAXzDAANAAAC2eAAE
7499	ALLEN	SALESMAN	7698	1981-02-11	1600	300	30	AAAXzDAANAAAC2eAAF
7844	TURNER	SALESMAN	7698	1981-08-21	1500	0	30	AAAXzDAANAAAC2eAAG
7900	JAMES	CLERK	7698	1981-12-11	950		30	AAAXzDAANAAAC2eAAH
7521	WARD	SALESMAN	7698	1981-02-23	1250	500	30	AAAXzDAANAAAC2eAAI
7902	FORD	ANALYST	7566	1981-12-11	3000		20	AAAXzDAANAAAC2eAAJ
7369	SMITH	CLERK	7902	1980-12-09	800		20	AAAXzDAANAAAC2eAAK
7788	SCOTT	ANALYST	7566	1982-12-22	3000		20	AAAXzDAANAAAC2eAAL
7876	ADAMS	CLERK	7788	1983-01-15	1100		20	AAAXzDAANAAAC2eAAM
7934	MILLER	CLERK	7782	1982-01-11	1300		10	AAAXzDAANAAAC2eAAN

ROWID	DEPTNO
AAAXzDAANAAAC2eAAA	10
AAAXzDAANAAAC2eAAC	10
AAAXzDAANAAAC2eAAN	10
AAAXzDAANAAAC2eAAD	20
AAAXzDAANAAAC2eAAJ	20
AAAXzDAANAAAC2eAAK	20
AAAXzDAANAAAC2eAAL	20
AAAXzDAANAAAC2eAAM	20
AAAXzDAANAAAC2eAAB	30
AAAXzDAANAAAC2eAAE	30
AAAXzDAANAAAC2eAAF	30
AAAXzDAANAAAC2eAAG	30
AAAXzDAANAAAC2eAAH	30
AAAXzDAANAAAC2eAAI	30

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

ROWID	LOC
AAAXzDAANAAAC2eAAA	BOSTON
AAAXzDAANAAAC2eAAC	CHCAGO
AAAXzDAANAAAC2eAAN	DALLAS
AAAXzDAANAAAC2eAAD	NEW YORK

buffer 4개