데이터베이스 프로그래밍

JOIN

학습 목표

- JOIN을 이용하여 여러 테이블로부터 데이터 검색 가능
- EQUI JOIN 및 NON-EQUI JOIN을 이용하여, 하나 이상의 테이블로 접근 가능
- OUTER JOIN이나 SELF JOIN을 이용하여 JOIN 조건에 맞지 않는 데이터나, 자신의 테이블 접근 가능
- 그 밖에 여러 JOIN을 이용하여 다양한 SQL 문 작성 가능
- JOIN ~ USING, JOIN ~ ON 등 ANSI SQL을 활용한 조인 사용 가능

학습할 내용

- JOIN의 개념
- ORACLE JOIN 구문 및 활용 방법
  - ☞ EQUI JOIN
  - ☞ NON_EQUI JOIN
  - ☞ SELF JOIN
  - ☞ OUTER JOIN
- ANSI JOIN 구문 및 활용
  - ☞ CROSS JOIN
  - ☞ NATURAL JOIN
  - ☞ USING 절을 사용한 JOIN
  - ☞ ON 절을 사용한 JOIN
  - ☞ LEFT OUTER JOIN
  - ☞ RIGHT OUTER JOIN
  - ☞ FULL OUTER JOIN

JOIN이란?

- 여러 테이블의 데이터를 질의할 경우 사용
- 즉, 데이터베이스에서 여러 테이블의 데이터가 필요한 경우 사용
- 관계형 데이터베이스에서 가장 기본적이고 중요한 기능
- 관계형 데이터베이스에서는 서로 독립적인 데이터들간의 조인을 이용하여 필요시 원하는 다양한 정보 참조
- 하나 이상의 테이블이나 뷰의 데이터를 ROW로 결합하여, 어떤 테이블을 기준으로 다른 테이블에 있는 ROW를 검색하는 방법
- 일반적인 경우 Primary key(PK)나 Foreign key(FK) 값의 연관에 의해 조인 성립
- PK, FK의 관계가 없어도 논리적인 값들의 연관만으로 JOIN 작업 가능
- 해당 열에 존재하는 공통 값, 일반적으로 PK 및 FK열을 조인 조건으로 사용하여 한 테이블의 행을 다른 테이블의 행에 조인

JOIN이란?

- ORACLE JOIN 구문

```
SELECT table1.column, table2.column, ...
FROM table1, table2
WHERE table1.column1 = table2.column2;
```

- 설명
  - FROM 절에 필요로 하는 테이블을 모두 적는다.
  - 컬럼 이름의 모호성을 피하기 위해(어느 테이블에 속하는지 알 수 없음)이 있을 수 있으므로 table명에 alias 사용(table명으로 직접 지칭 가능)➔ table명 alias로 이용(as 사용하지 않음)
  - 적절한 JOIN 조건을 WHERE 절에 부여(일반적으로 테이블 개수 – 1개의 조인 조건이 필요)
  - 일반적으로 PK와 FK 간의 = 조건이 붙는 경우가 많음

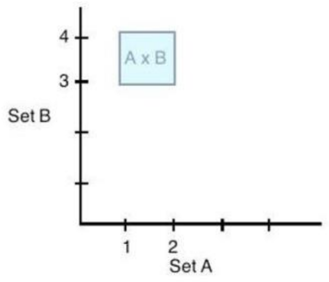
JOIN의 종류

종류		설　명
Inner Join	Equijoin	· 두 개의 테이블들간에 column 값들이 정확하게 일치하는 경우 사용 · 대부분 PK, FK의 관계를 기반으로 함 · 조건에 맞는 데이터만 조회
	Non-Equijoin	· 두 개의 테이블들간에 column 값들이 정확하게 일치하지 않는 경우 사용 · 조건에 맞는 데이터만 조회
Outer Join		· 두 개의 테이블들간에 JOIN을 걸었을 경우 JOIN 조건을 만족하지 않는 데이터들도 같이 조회하는 경우 사용 · (+)라는 연산자 사용 · 조건에 맞지 않는 데이터도 조회 예) 부서원이 없는 40, 50 부서 조회 부서 배정이 안 된 인턴사원 조회 · ERD에서 ○ 기호일 때 Outer Join일 가능성 있음
Self Join		· 두 개의 테이블 간에 JOIN을 거는 것이 아니라, 같은 테이블에 있는 행들을 JOIN하는 데 사용 · 테이블 자체가 계층구조일 때 사용 · 권장하지 않음

카티시안 곱(Cartesian Product)

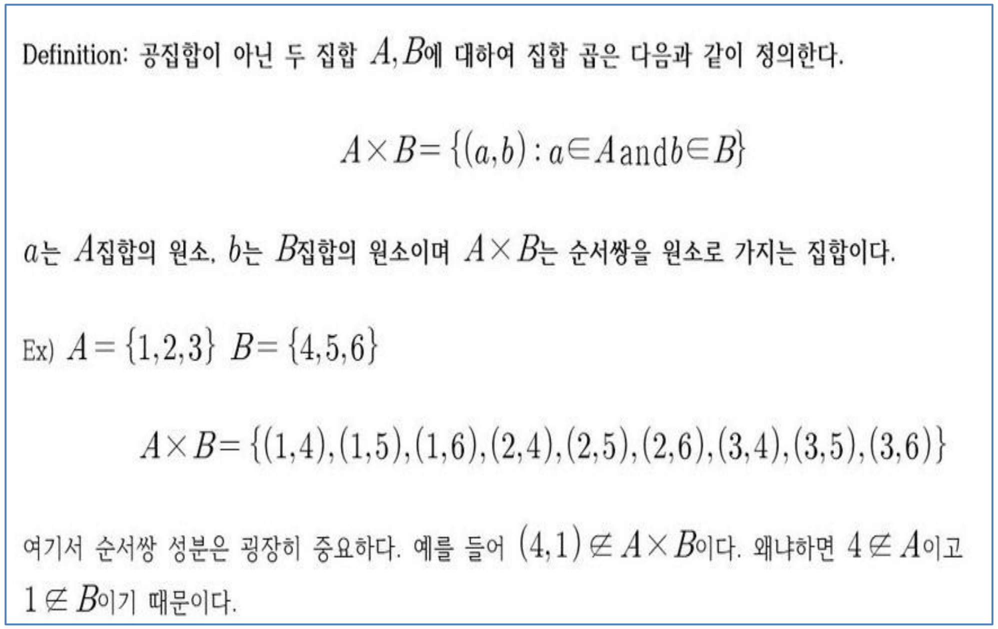
데카르트 곱
(Descartes=Des+Cartes)

Ex2) $A=\{x : x \in \mathbb{R} \text{ and } 1 \le x \le 2\}$ $B=\{y : y \in \mathbb{R} \text{ and } 3 \le y \le 4\}$



<그림 1>

범위로 주어질 경우 <그림 1>과 같이 영역을 나타낸다.



Definition: 공집합이 아닌 두 집합 A, B에 대하여 집합 곱은 다음과 같이 정의한다.

$$A \times B = \{(a,b) : a \in A \text{ and } b \in B\}$$

a는 A집합의 원소, b는 B집합의 원소이며 $A \times B$는 순서쌍을 원소로 가지는 집합이다.

Ex) $A=\{1,2,3\}$ $B=\{4,5,6\}$

$$A \times B = \{(1,4),(1,5),(1,6),(2,4),(2,5),(2,6),(3,4),(3,5),(3,6)\}$$

여기서 순서쌍 성분은 굉장히 중요하다. 예를 들어 $(4,1) \not\in A \times B$이다. 왜냐하면 $4 \not\in A$이고 $1 \not\in B$이기 때문이다.

- 카티시안 곱은 다음과 같은 경우 생성됨
  - 조인 조건을 생략한 경우
  - 조인 조건이 부적합한 경우
- 첫 번째 테이블의 모든 행이 두 번째 테이블의 모든 행이 조인되어 처리
- 카타시안 곱이 생성되지 않도록 하려면 WHERE 절에 항상 유효한 조인 조건을 지정해야 함
- A 테이블에서 얻을 수 있는 ROW 수가 n개, B 테이블에서 얻을 수 있는 ROW 수가 m개 일 때, JOIN의 조건 없이 이 두 테이블을 FROM 절에 기술할 경우, 데이터는 m X n개의 데이터 반환

사원명, 부서번호(Table:employees), 부서번호 (Table:departments), 사원이 속한 부서명 조회

```
SELECT employees.first_name, employees.department_id,
  departments.department_id, departments.department_name
FROM employees, departments
ORDER BY employees.first_name;
```

결과 – 2997개의 데이터 출력

- Cartesian Product 발생 상황
- SELECT * FROM departments;   -- 27개의 데이터
- SELECT * FROM employees;   -- 111개의 데이터
- 카티시안 발생 이유? ➔ WHERE 절이 없으므로

EQUI JOIN

- **EQUI JOIN**

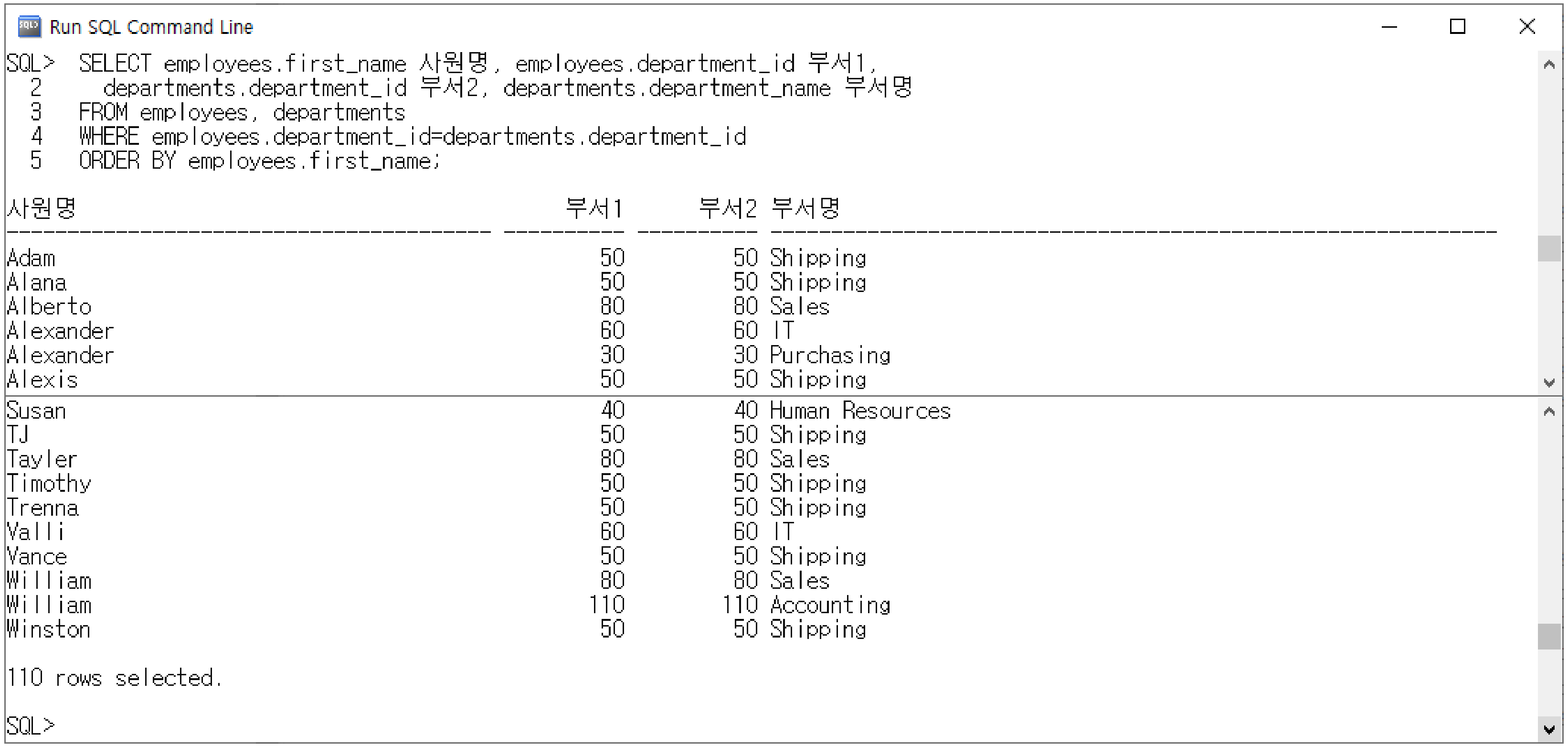
```
SELECT table1.column, table2.column, ...
FROM table1, table2
WHERE table1.column1 = table2.column2;
```

- **JOIN의 조건은 WHERE 절에 기술**

  ➔ Cartesian Product 발생 상황 해결

Cartesian Product 발생 상황 해결

```
SELECT employees.first_name 사원명, employees.department_id 부서1,
  departments.department_id 부서2, departments.department_name 부서명
FROM employees, departments
WHERE employees.department_id=departments.department_id
ORDER BY employees.first_name;
```



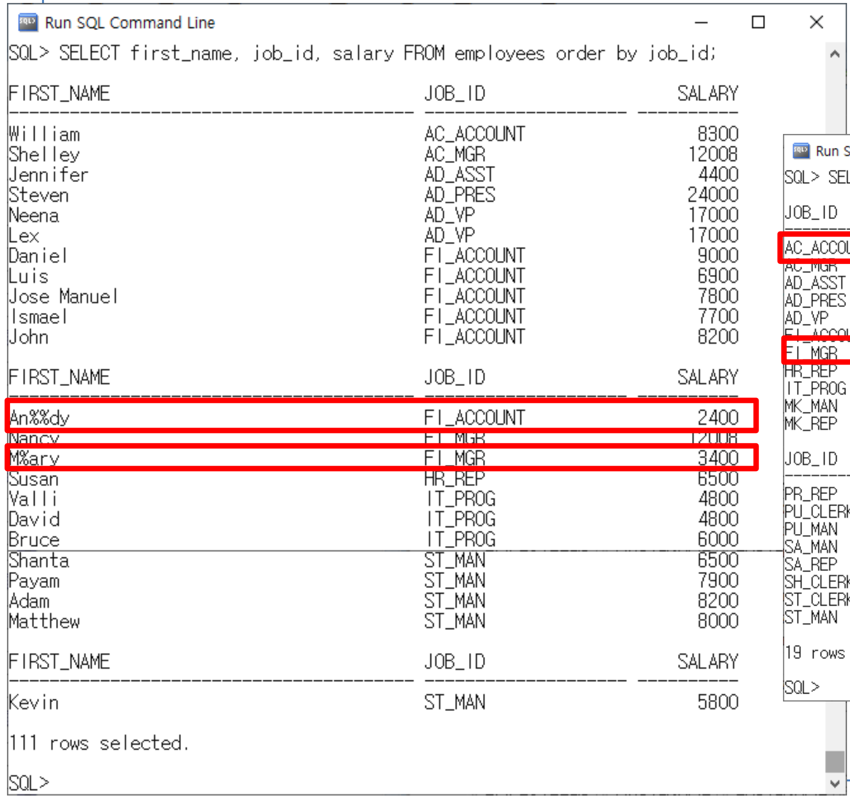
Run SQL Command Line

```
SQL> SELECT employees.first_name 사원명, employees.department_id 부서1,
  2    departments.department_id 부서2, departments.department_name 부서명
  3  FROM employees, departments
  4  WHERE employees.department_id=departments.department_id
  5  ORDER BY employees.first_name;

사원명                                        부서1       부서2 부서명
---------------------------------------- ---------- ---------- ------------------------------------------------------------
Adam                                             50         50 Shipping
Alana                                            50         50 Shipping
Alberto                                          80         80 Sales
Alexander                                        60         60 IT
Alexander                                        30         30 Purchasing
Alexis                                           50         50 Shipping
```

```
Susan                                            40         40 Human Resources
TJ                                               50         50 Shipping
Tayler                                           80         80 Sales
Timothy                                          50         50 Shipping
Trenna                                           50         50 Shipping
Valli                                            60         60 IT
Vance                                            50         50 Shipping
William                                          80         80 Sales
William                                         110        110 Accounting
Winston                                          50         50 Shipping

110 rows selected.

SQL>
```

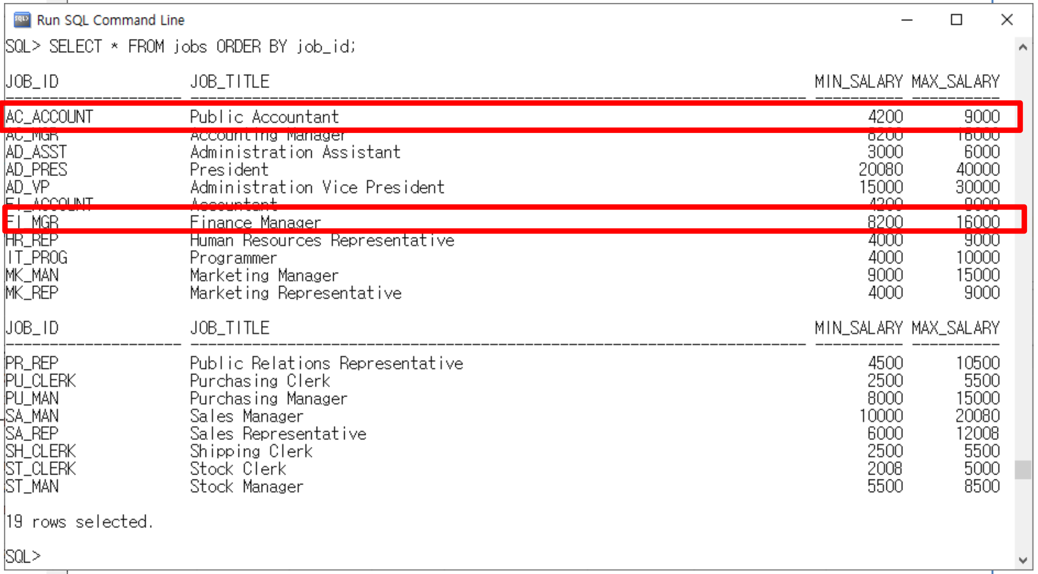
NON-EQUI JOIN

- 등호연산자(=) 외의 다른 비교연산자를 이용하여 두 개 이상의 테이블을 JOIN하는 경우



Run SQL Command Line

```
SQL> SELECT first_name, job_id, salary FROM employees order by job_id;

FIRST_NAME                                 JOB_ID                   SALARY
------------------------------------------ -------------------- ----------
William                                    AC_ACCOUNT                 8300
Shelley                                    AC_MGR                    12008
Jennifer                                   AD_ASST                    4400
Steven                                     AD_PRES                   24000
Neena                                      AD_VP                     17000
Lex                                        AD_VP                     17000
Daniel                                     FI_ACCOUNT                 9000
Luis                                       FI_ACCOUNT                 6900
Jose Manuel                                FI_ACCOUNT                 7800
Ismael                                     FI_ACCOUNT                 7700
John                                       FI_ACCOUNT                 8200

FIRST_NAME                                 JOB_ID                   SALARY
------------------------------------------ -------------------- ----------
An%%dy                                     FI_ACCOUNT                 2400
Nancy                                      FI_MGR                    12008
M%ary                                      FI_MGR                     3400
Susan                                      HR_REP                     6500
Valli                                      IT_PROG                    4800
David                                      IT_PROG                    4800
Bruce                                      IT_PROG                    6000
Shanta                                     ST_MAN                     6500
Payam                                      ST_MAN                     7900
Adam                                       ST_MAN                     8200
Matthew                                    ST_MAN                     8000

FIRST_NAME                                 JOB_ID                   SALARY
------------------------------------------ -------------------- ----------
Kevin                                      ST_MAN                     5800

111 rows selected.

SQL>
```



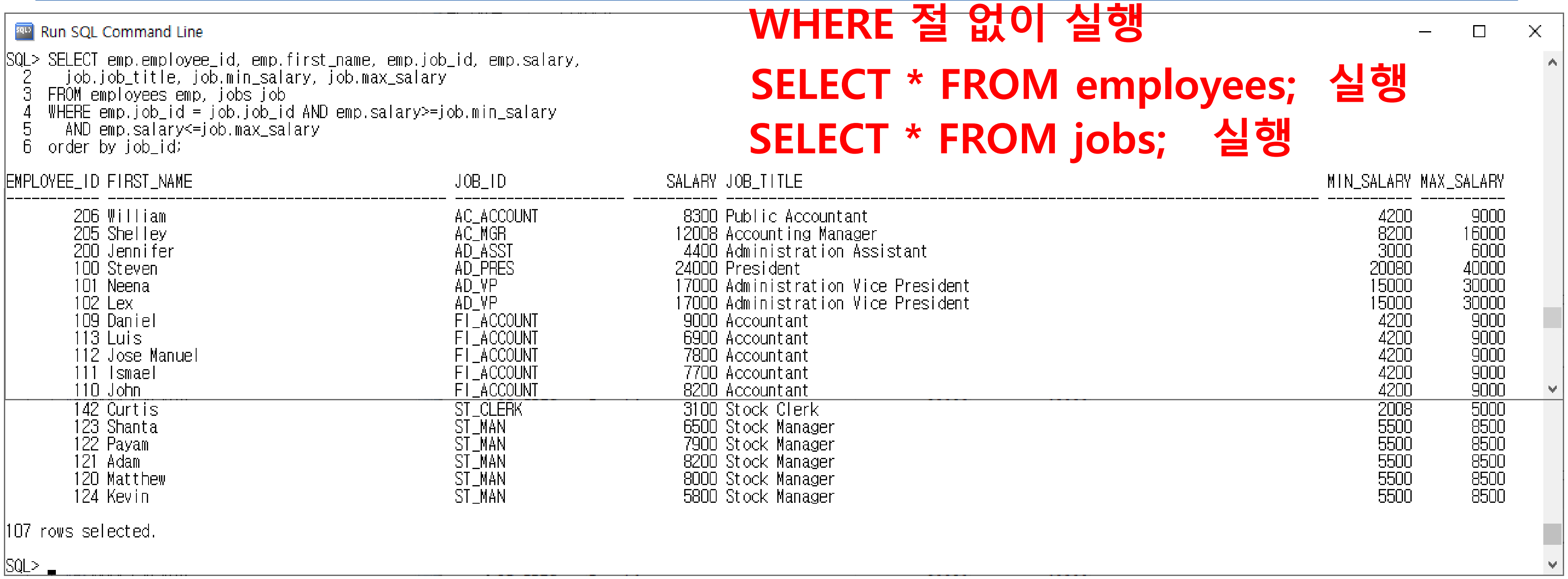
Run SQL Command Line

```
SQL> SELECT * FROM jobs ORDER BY job_id;

JOB_ID               JOB_TITLE                                                      MIN_SALARY MAX_SALARY
-------------------- -------------------------------------------------------------- ---------- ----------
AC_ACCOUNT           Public Accountant                                                    4200       9000
AC_MGR               Accounting Manager                                                   8200      16000
AD_ASST              Administration Assistant                                             3000       6000
AD_PRES              President                                                           20080      40000
AD_VP                Administration Vice President                                       15000      30000
FI_ACCOUNT           Accountant                                                           4200       9000
FI_MGR               Finance Manager                                                      8200      16000
HR_REP               Human Resources Representative                                       4000       9000
IT_PROG              Programmer                                                           4000      10000
MK_MAN               Marketing Manager                                                    9000      15000
MK_REP               Marketing Representative                                             4000       9000

JOB_ID               JOB_TITLE                                                      MIN_SALARY MAX_SALARY
-------------------- -------------------------------------------------------------- ---------- ----------
PR_REP               Public Relations Representative                                      4500      10500
PU_CLERK             Purchasing Clerk                                                     2500       5500
PU_MAN               Purchasing Manager                                                   8000      15000
SA_MAN               Sales Manager                                                       10000      20080
SA_REP               Sales Representative                                                 6000      12008
SH_CLERK             Shipping Clerk                                                       2500       5500
ST_CLERK             Stock Clerk                                                          2008       5000
ST_MAN               Stock Manager                                                        5500       8500

19 rows selected.

SQL>
```

급여가 최소급여와 최대급여 사이인 사원의 사원번호, 사원명, 업무코드, 급여, 업무명, 업무의 최소급여, 업무의 최대급여를 업무코드 순으로 조회

```
SELECT emp.employee_id, emp.first_name, emp.job_id, emp.salary,
  job.job_title, job.min_salary, job.max_salary
FROM employees emp, jobs job
WHERE emp.job_id = job.job_id AND
 emp.salary>=job.min_salary AND emp.salary<=job.max_salary
order by job_id;
```

emp.salary between job.min_salary AND job.max_salary



WHERE 절 없이 실행

SELECT * FROM employees; 실행

SELECT * FROM jobs; 실행

```
SQL> SELECT emp.employee_id, emp.first_name, emp.job_id, emp.salary,
  2    job.job_title, job.min_salary, job.max_salary
  3  FROM employees emp, jobs job
  4  WHERE emp.job_id = job.job_id AND emp.salary>=job.min_salary
  5    AND emp.salary<=job.max_salary
  6  order by job_id;

EMPLOYEE_ID FIRST_NAME                                 JOB_ID                   SALARY JOB_TITLE                                                         MIN_SALARY MAX_SALARY
----------- ------------------------------------------ -------------------- ---------- ----------------------------------------------------------------- ---------- ----------
        206 William                                    AC_ACCOUNT                 8300 Public Accountant                                                       4200       9000
        205 Shelley                                    AC_MGR                    12008 Accounting Manager                                                      8200      16000
        200 Jennifer                                   AD_ASST                    4400 Administration Assistant                                                3000       6000
        100 Steven                                     AD_PRES                   24000 President                                                              20080      40000
        101 Neena                                      AD_VP                     17000 Administration Vice President                                          15000      30000
        102 Lex                                        AD_VP                     17000 Administration Vice President                                          15000      30000
        109 Daniel                                     FI_ACCOUNT                 9000 Accountant                                                              4200       9000
        113 Luis                                       FI_ACCOUNT                 6900 Accountant                                                              4200       9000
        112 Jose Manuel                                FI_ACCOUNT                 7800 Accountant                                                              4200       9000
        111 Ismael                                     FI_ACCOUNT                 7700 Accountant                                                              4200       9000
        110 John                                       FI_ACCOUNT                 8200 Accountant                                                              4200       9000
        142 Curtis                                     ST_CLERK                   3100 Stock Clerk                                                             2008       5000
        123 Shanta                                     ST_MAN                     6500 Stock Manager                                                           5500       8500
        122 Payam                                      ST_MAN                     7900 Stock Manager                                                           5500       8500
        121 Adam                                       ST_MAN                     8200 Stock Manager                                                           5500       8500
        120 Matthew                                    ST_MAN                     8000 Stock Manager                                                           5500       8500
        124 Kevin                                      ST_MAN                     5800 Stock Manager                                                           5500       8500

107 rows selected.

SQL>
```

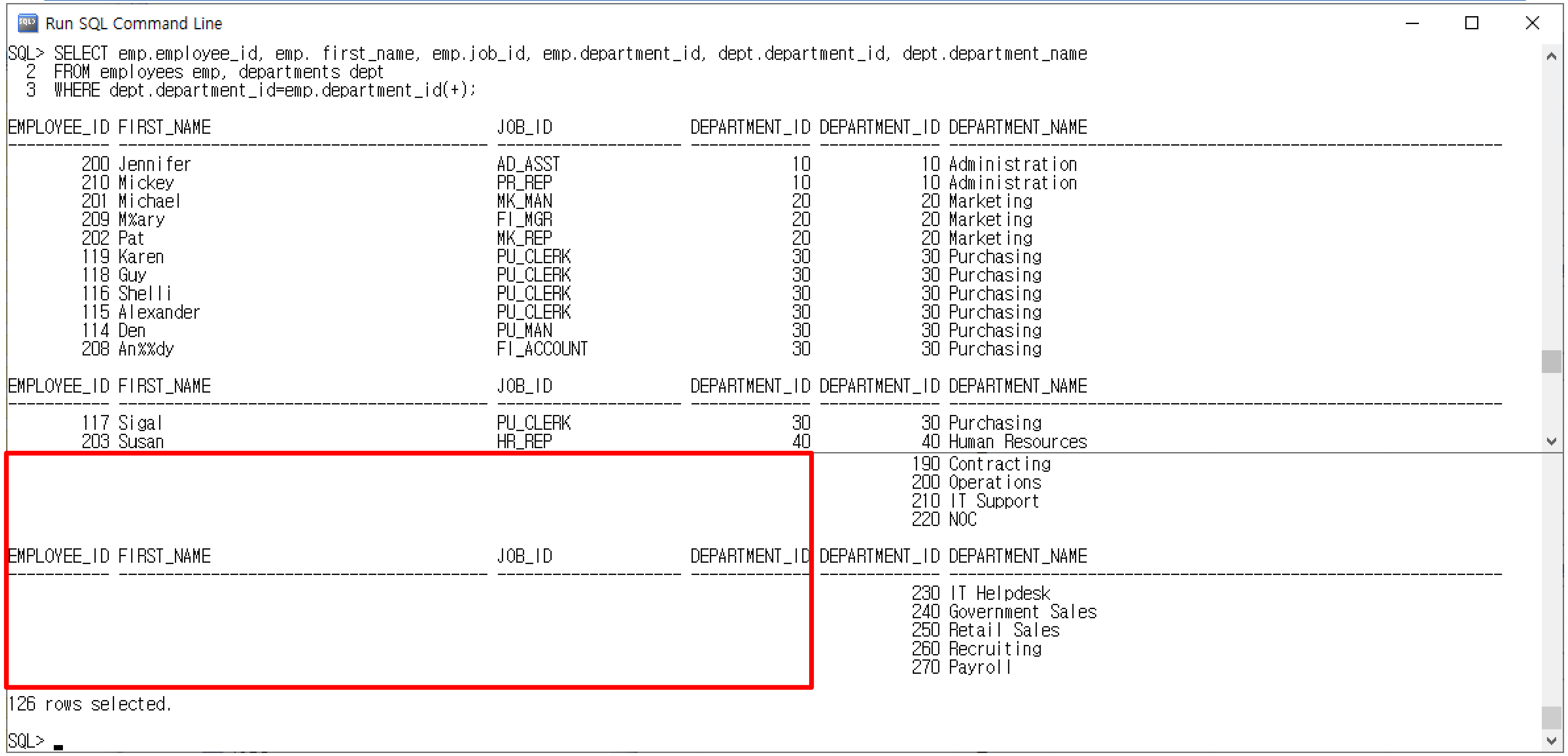
OUTER JOIN

- JOIN 조건을 만족하지 못하는 경우에도 모든 행들을 다 보고자 하는 경우에 사용
- (+) 연산자 사용 → 기준이 아닌 테이블
- 어느 한쪽 테이블이 기준이 되어 다른 쪽 테이블에 연결되는 조건의 만족여부에 상관없이 기준이 되는 테이블은 무조건 추출되는 JOIN
- 기준이 되는 테이블은 항상 JOIN에 성공 → 기준 테이블은 다 보여줌
- JOIN 조건을 만족하지 않는 행이라도, WHERE 절의 어느 한쪽을 기준으로 모두 보고자 하는 경우, 기준이 되는 반대쪽에 (+)를 이용하여 JOIN → 데이터가 부족한 편에 사용
- (+) 기호는 어느 한 쪽에만 위치
- 양쪽의 데이터를 다 보고자 하는 경우에는 FULL [OUTER] JOIN 이용

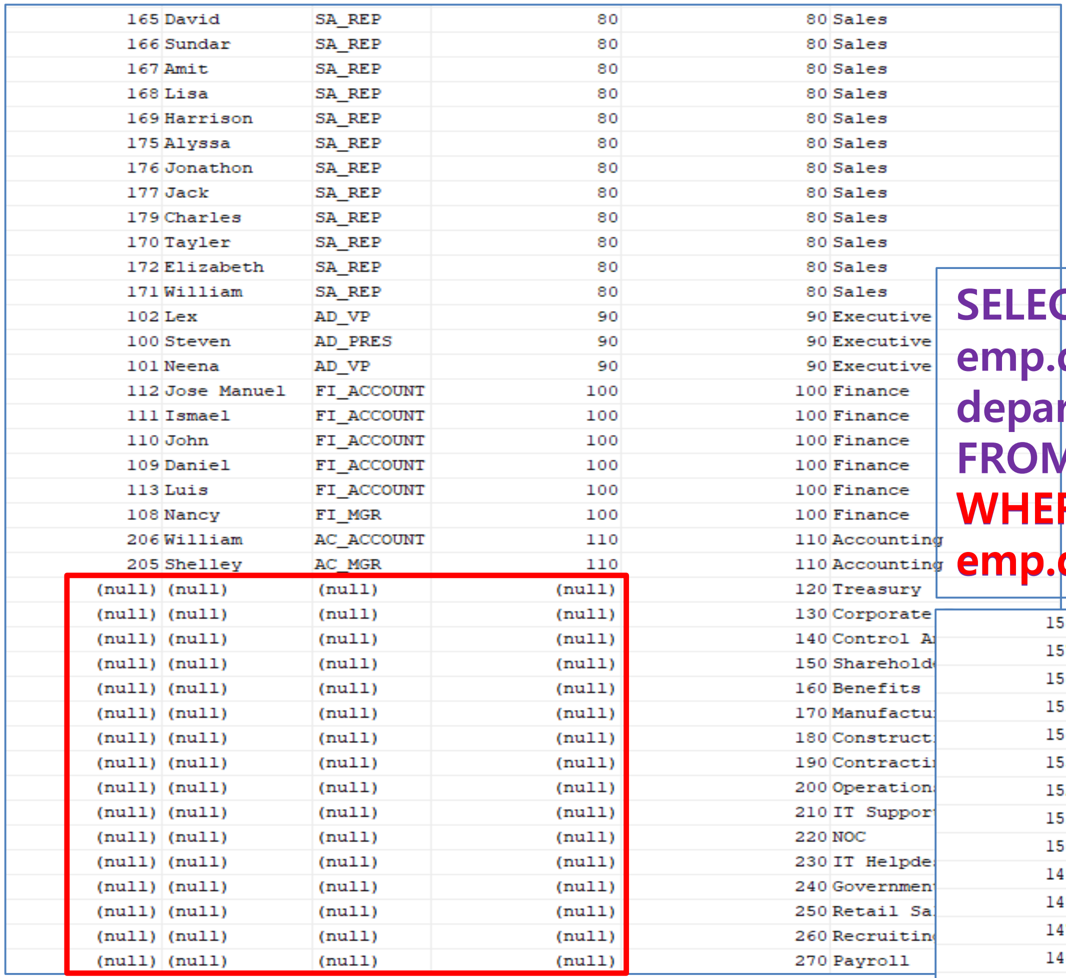
employees 테이블과 departments 테이블에서 departments 테이블에 있는 모든 자료를 기준으로 사원번호, 이름, 업무코드, 부서번호(employees 테이블), 부서번호(departments 테이블), 부서명 조회

```
SELECT emp.employee_id, emp. first_name, emp.job_id, emp.department_id,
dept.department_id, dept.department_name
FROM employees emp, departments dept
WHERE emp.department_id(+)=dept.department_id;
```

기준테이블:departments 테이블



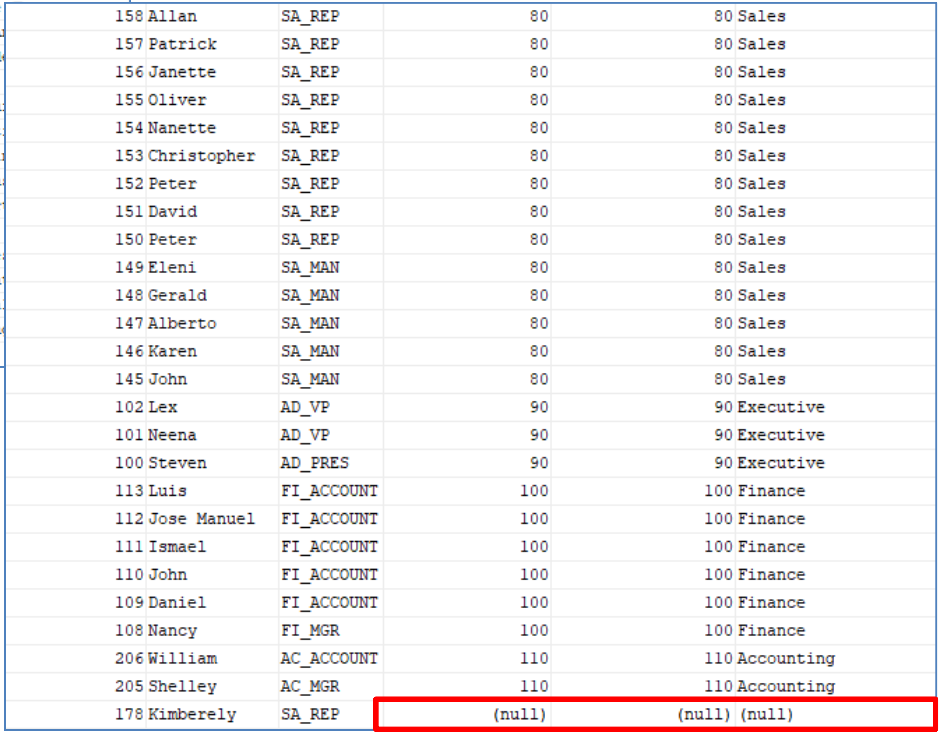
```
SQL> SELECT emp.employee_id, emp. first_name, emp.job_id, emp.department_id, dept.department_id, dept.department_name
  2  FROM employees emp, departments dept
  3  WHERE dept.department_id=emp.department_id(+);

EMPLOYEE_ID FIRST_NAME                               JOB_ID               DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME
----------- ---------------------------------------- -------------------- ------------- ------------- ------------------------------------------------------------
        200 Jennifer                                 AD_ASST                         10            10 Administration
        210 Mickey                                   PR_REP                          10            10 Administration
        201 Michael                                  MK_MAN                          20            20 Marketing
        209 M%ary                                    FI_MGR                          20            20 Marketing
        202 Pat                                      MK_REP                          20            20 Marketing
        119 Karen                                    PU_CLERK                        30            30 Purchasing
        118 Guy                                      PU_CLERK                        30            30 Purchasing
        116 Shelli                                   PU_CLERK                        30            30 Purchasing
        115 Alexander                                PU_CLERK                        30            30 Purchasing
        114 Den                                      PU_MAN                          30            30 Purchasing
        208 An%%dy                                   FI_ACCOUNT                      30            30 Purchasing

EMPLOYEE_ID FIRST_NAME                               JOB_ID               DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME
----------- ---------------------------------------- -------------------- ------------- ------------- ------------------------------------------------------------
        117 Sigal                                    PU_CLERK                        30            30 Purchasing
        203 Susan                                    HR_REP                          40            40 Human Resources
                                                                                                  190 Contracting
                                                                                                  200 Operations
                                                                                                  210 IT Support
                                                                                                  220 NOC

EMPLOYEE_ID FIRST_NAME                               JOB_ID               DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME
----------- ---------------------------------------- -------------------- ------------- ------------- ------------------------------------------------------------
                                                                                                  230 IT Helpdesk
                                                                                                  240 Government Sales
                                                                                                  250 Retail Sales
                                                                                                  260 Recruiting
                                                                                                  270 Payroll

126 rows selected.

SQL> _
```



```
165 David        SA_REP          80     80 Sales
166 Sundar       SA_REP          80     80 Sales
167 Amit         SA_REP          80     80 Sales
168 Lisa         SA_REP          80     80 Sales
169 Harrison     SA_REP          80     80 Sales
175 Alyssa       SA_REP          80     80 Sales
176 Jonathon     SA_REP          80     80 Sales
177 Jack         SA_REP          80     80 Sales
179 Charles      SA_REP          80     80 Sales
170 Tayler       SA_REP          80     80 Sales
172 Elizabeth    SA_REP          80     80 Sales
171 William      SA_REP          80     80 Sales
102 Lex          AD_VP           90     90 Executive
100 Steven       AD_PRES         90     90 Executive
101 Neena        AD_VP           90     90 Executive
112 Jose Manuel  FI_ACCOUNT     100    100 Finance
111 Ismael       FI_ACCOUNT     100    100 Finance
110 John         FI_ACCOUNT     100    100 Finance
109 Daniel       FI_ACCOUNT     100    100 Finance
113 Luis         FI_ACCOUNT     100    100 Finance
108 Nancy        FI_MGR         100    100 Finance
206 William      AC_ACCOUNT     110    110 Accounting
205 Shelley      AC_MGR         110    110 Accounting
(null) (null)    (null)      (null)    120 Treasury
(null) (null)    (null)      (null)    130 Corporate
(null) (null)    (null)      (null)    140 Control A
(null) (null)    (null)      (null)    150 Sharehold
(null) (null)    (null)      (null)    160 Benefits
(null) (null)    (null)      (null)    170 Manufactu
(null) (null)    (null)      (null)    180 Construct
(null) (null)    (null)      (null)    190 Contracti
(null) (null)    (null)      (null)    200 Operation
(null) (null)    (null)      (null)    210 IT Suppor
(null) (null)    (null)      (null)    220 NOC
(null) (null)    (null)      (null)    230 IT Helpde
(null) (null)    (null)      (null)    240 Governmen
(null) (null)    (null)      (null)    250 Retail Sa
(null) (null)    (null)      (null)    260 Recruitin
(null) (null)    (null)      (null)    270 Payroll
```

126개 데이터 출력

SELECT employee_id, first_name, job_id, emp.department_id, dept.department_id, department_name
FROM employees emp, departments dept
WHERE
emp.department_id=dept.department_id(+);

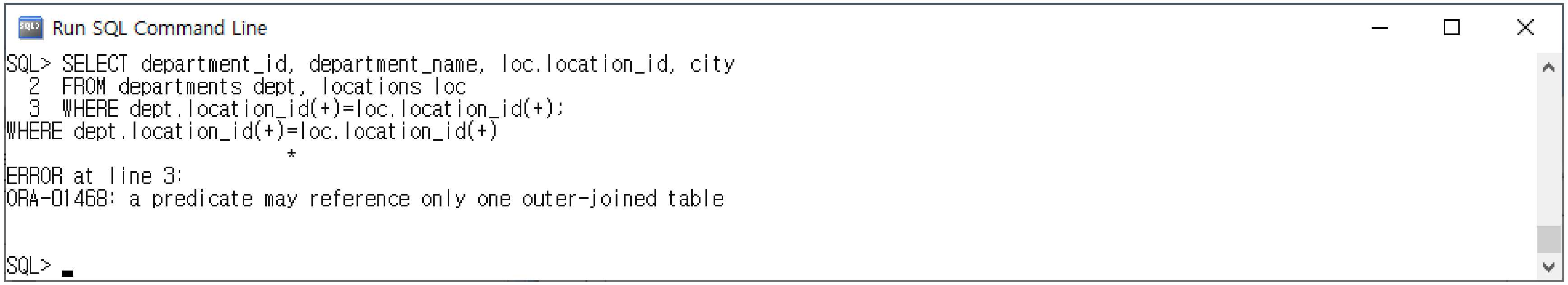


```
158 Allan        SA_REP          80     80 Sales
157 Patrick      SA_REP          80     80 Sales
156 Janette      SA_REP          80     80 Sales
155 Oliver       SA_REP          80     80 Sales
154 Nanette      SA_REP          80     80 Sales
153 Christopher  SA_REP          80     80 Sales
152 Peter        SA_REP          80     80 Sales
151 David        SA_REP          80     80 Sales
150 Peter        SA_REP          80     80 Sales
149 Eleni        SA_MAN          80     80 Sales
148 Gerald       SA_MAN          80     80 Sales
147 Alberto      SA_MAN          80     80 Sales
146 Karen        SA_MAN          80     80 Sales
145 John         SA_MAN          80     80 Sales
102 Lex          AD_VP           90     90 Executive
101 Neena        AD_VP           90     90 Executive
100 Steven       AD_PRES         90     90 Executive
113 Luis         FI_ACCOUNT     100    100 Finance
112 Jose Manuel  FI_ACCOUNT     100    100 Finance
111 Ismael       FI_ACCOUNT     100    100 Finance
110 John         FI_ACCOUNT     100    100 Finance
109 Daniel       FI_ACCOUNT     100    100 Finance
108 Nancy        FI_MGR         100    100 Finance
206 William      AC_ACCOUNT     110    110 Accounting
205 Shelley      AC_MGR         110    110 Accounting
178 Kimberely    SA_REP      (null) (null) (null)
```

111개 데이터 출력

다음 결과 확인

```
SELECT department_id, department_name, loc.location_id, city
FROM departments dept, locations loc
WHERE dept.location_id(+)=loc.location_id(+);
```

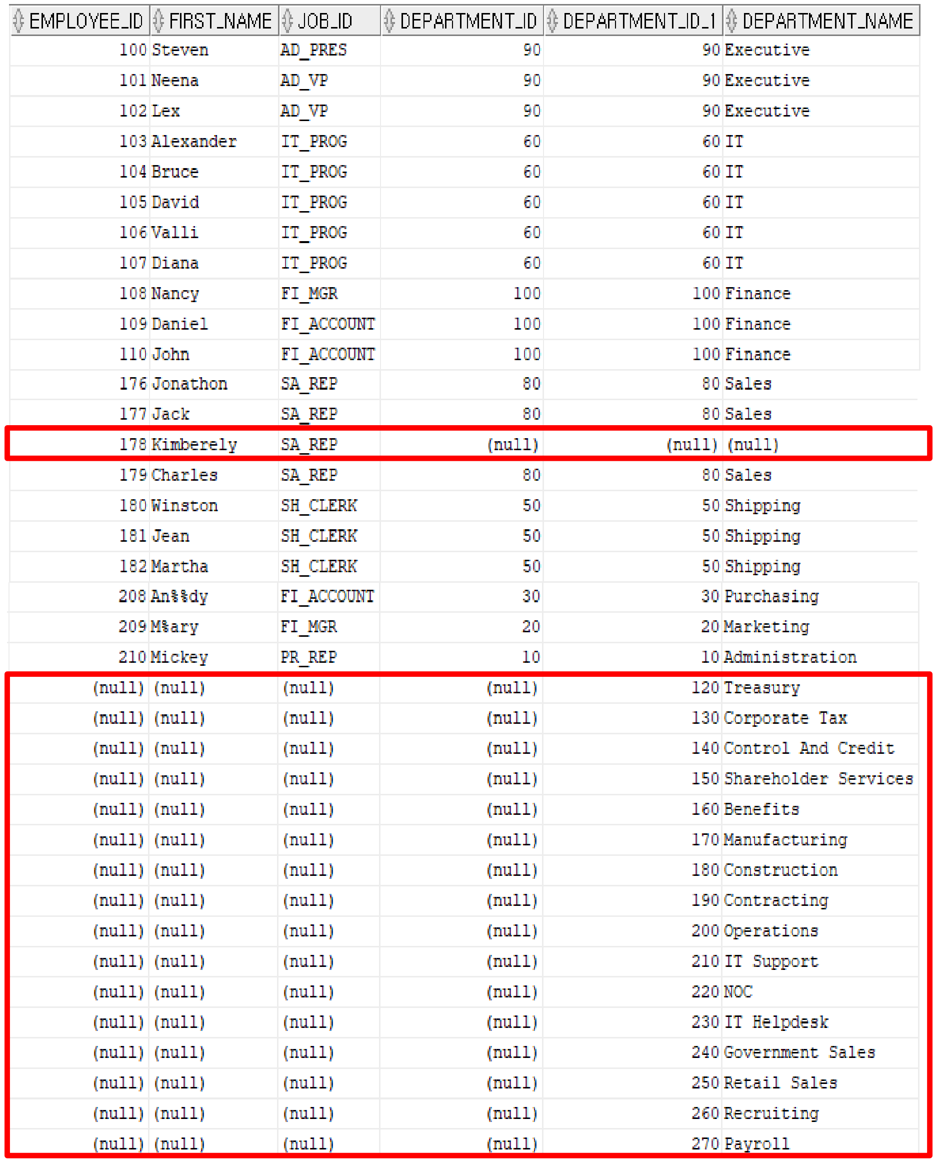


```
SQL> SELECT department_id, department_name, loc.location_id, city
  2  FROM departments dept, locations loc
  3  WHERE dept.location_id(+)=loc.location_id(+);
WHERE dept.location_id(+)=loc.location_id(+)
                         *
ERROR at line 3:
ORA-01468: a predicate may reference only one outer-joined table


SQL> _
```

Syntax Error 발생
발생이유 : outer join table은 하나만 가능
해결방법 : select 문 2개로 UNION 사용

다음 결과 확인(ppt 23장 비교)

```
SELECT employee_id, first_name, job_id,
emp.department_id, dept.department_id,
department_name
FROM employees emp, departments dept
WHERE
emp.department_id=dept.department_id(+)
UNION
SELECT employee_id, first_name, job_id,
emp.department_id, dept.department_id,
department_name
FROM employees emp, departments dept
WHERE
emp.department_id(+)=dept.department_id;
```



EMPLOYEE_ID	FIRST_NAME	JOB_ID	DEPARTMENT_ID	DEPARTMENT_ID_1	DEPARTMENT_NAME
100	Steven	AD_PRES	90	90	Executive
101	Neena	AD_VP	90	90	Executive
102	Lex	AD_VP	90	90	Executive
103	Alexander	IT_PROG	60	60	IT
104	Bruce	IT_PROG	60	60	IT
105	David	IT_PROG	60	60	IT
106	Valli	IT_PROG	60	60	IT
107	Diana	IT_PROG	60	60	IT
108	Nancy	FI_MGR	100	100	Finance
109	Daniel	FI_ACCOUNT	100	100	Finance
110	John	FI_ACCOUNT	100	100	Finance
176	Jonathon	SA_REP	80	80	Sales
177	Jack	SA_REP	80	80	Sales
178	Kimberely	SA_REP	(null)	(null)	(null)
179	Charles	SA_REP	80	80	Sales
180	Winston	SH_CLERK	50	50	Shipping
181	Jean	SH_CLERK	50	50	Shipping
182	Martha	SH_CLERK	50	50	Shipping
208	An%%dy	FI_ACCOUNT	30	30	Purchasing
209	M%ary	FI_MGR	20	20	Marketing
210	Mickey	PR_REP	10	10	Administration
(null)	(null)	(null)	(null)	120	Treasury
(null)	(null)	(null)	(null)	130	Corporate Tax
(null)	(null)	(null)	(null)	140	Control And Credit
(null)	(null)	(null)	(null)	150	Shareholder Services
(null)	(null)	(null)	(null)	160	Benefits
(null)	(null)	(null)	(null)	170	Manufacturing
(null)	(null)	(null)	(null)	180	Construction
(null)	(null)	(null)	(null)	190	Contracting
(null)	(null)	(null)	(null)	200	Operations
(null)	(null)	(null)	(null)	210	IT Support
(null)	(null)	(null)	(null)	220	NOC
(null)	(null)	(null)	(null)	230	IT Helpdesk
(null)	(null)	(null)	(null)	240	Government Sales
(null)	(null)	(null)	(null)	250	Retail Sales
(null)	(null)	(null)	(null)	260	Recruiting
(null)	(null)	(null)	(null)	270	Payroll

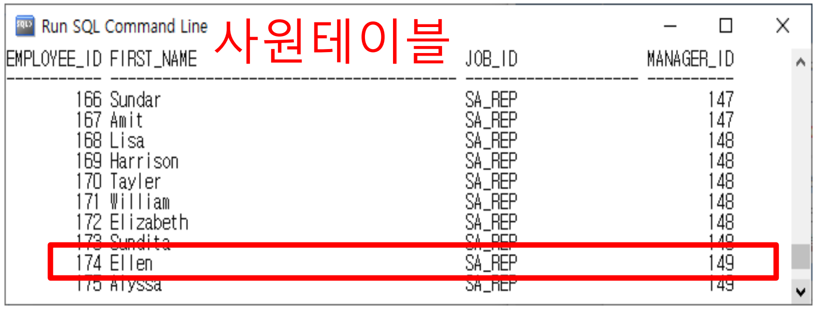
127개 데이터 출력

SELF JOIN

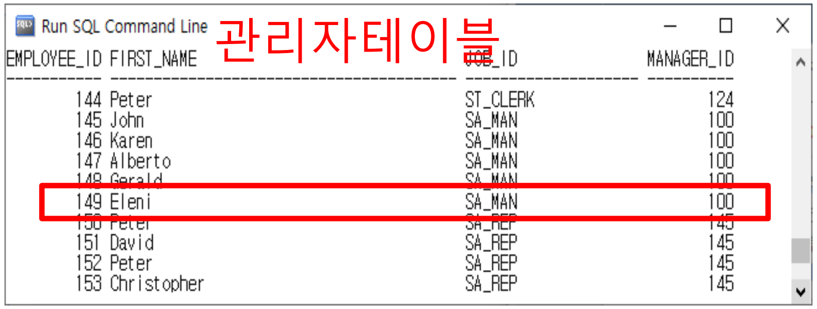
- FROM 절에 동일한 테이블을 두 번 이상 사용하여 한 테이블의 행들을 같은 테이블의 행들과 조인
- 한 테이블을 FROM절에 두 번 이상 명시하되, 각각의 테이블을 두 개 이상으로 구분하여 사용하려면 테이블 별칭을 사용하여야 함
- 테이블 하나를 두 개 또는 그 이상으로 SELF JOIN 가능

SELF JOIN 예

- Ellen의 Manager의 이름을 찾는 방법
  - 사원 테이블에서 first_name이 Ellen인 데이터 검색
  - 사원 테이블에서 Ellen의 manager_id 검색
  - 관리자 테이블에서 사원테이블의 manager_id에 해당되는 employee_id 검색
  - 관리자 테이블에서 employee_id에 해당하는 first_name 조회

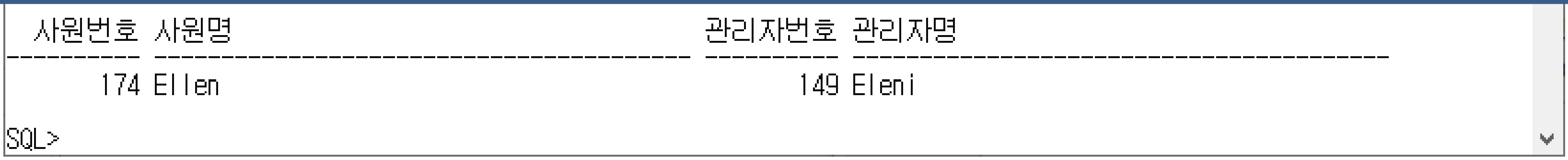


```
EMPLOYEE_ID FIRST_NAME                                JOB_ID               MANAGER_ID
----------- ---------------------------------------- -------------------- ----------
        166 Sundar                                    SA_REP                      147
        167 Amit                                      SA_REP                      147
        168 Lisa                                      SA_REP                      148
        169 Harrison                                  SA_REP                      148
        170 Tayler                                    SA_REP                      148
        171 William                                   SA_REP                      148
        172 Elizabeth                                 SA_REP                      148
        173 Sundita                                   SA_REP                      148
        174 Ellen                                     SA_REP                      149
        175 Alyssa                                    SA_REP                      149
```



```
EMPLOYEE_ID FIRST_NAME                                JOB_ID               MANAGER_ID
----------- ---------------------------------------- -------------------- ----------
        144 Peter                                     ST_CLERK                    124
        145 John                                      SA_MAN                      100
        146 Karen                                     SA_MAN                      100
        147 Alberto                                   SA_MAN                      100
        148 Gerald                                    SA_MAN                      100
        149 Eleni                                     SA_MAN                      100
        150 Peter                                     SA_REP                      145
        151 David                                     SA_REP                      145
        152 Peter                                     SA_REP                      145
        153 Christopher                               SA_REP                      145
```

```
SELECT emp.employee_id 사원번호, emp.first_name 사원명, emp.manager_id 관리자번호,
man.first_name 관리자명
FROM employees emp, employees man
WHERE emp.first_name='Ellen' AND emp.manager_id=man.employee_id;
```



```
  사원번호 사원명                                   관리자번호 관리자명
---------- ---------------------------------------- ---------- ----------------------------------------
       174 Ellen                                           149 Eleni

SQL>
```

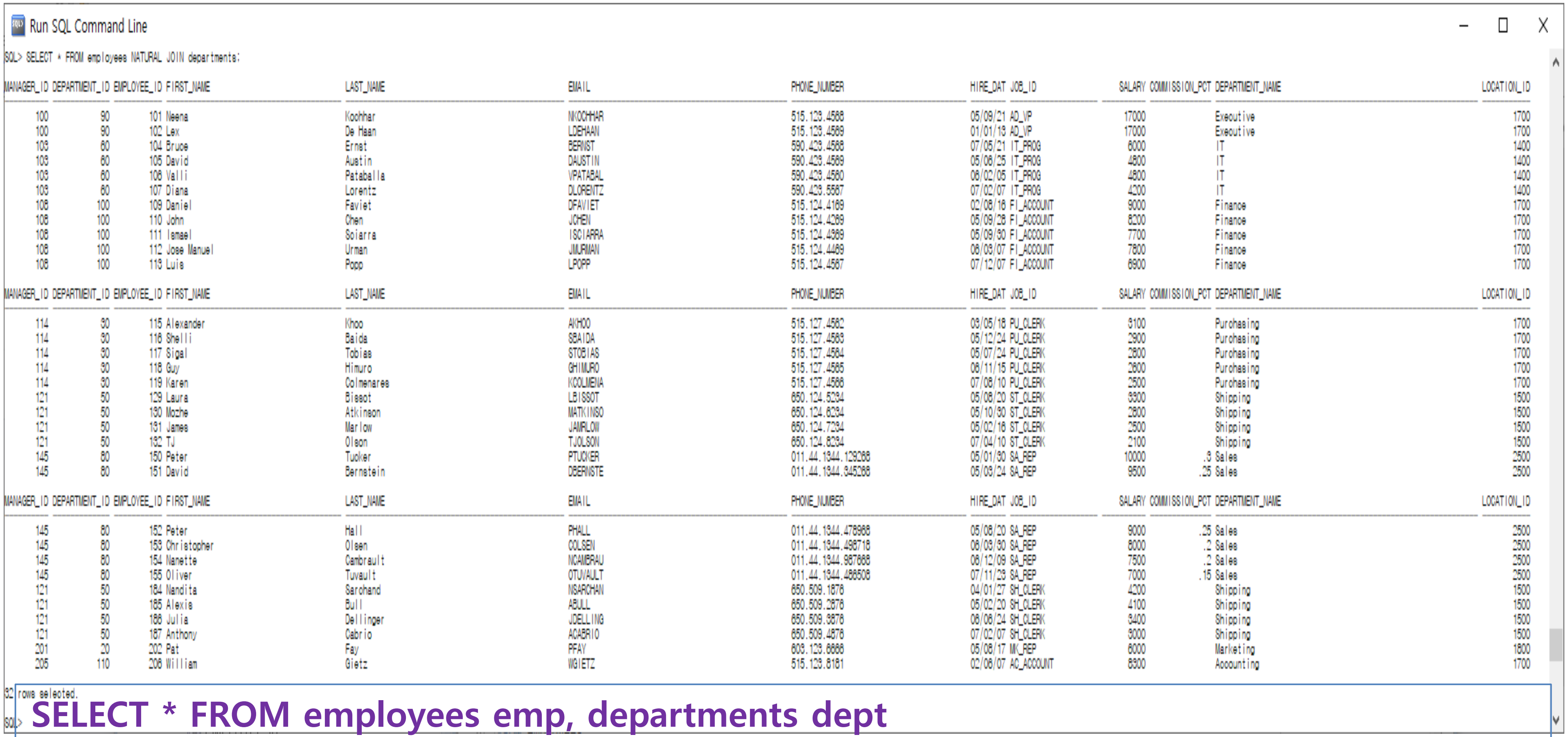
ANSI JOIN

- FROM 절에서 바로 JOIN을 명시적으로 정의

```
SELECT table1.column, table2.column, ...
FROM table1
  [CROSS JOIN table2] |
  [NATURAL JOIN table2] |
  [JOIN table2 USING (column_name)] |
  [JOIN table2 ON (table1.column_name = table2.column_name)] |
  [LEFT|RIGHT|FULL OUTER JOIN table2 ON (table1.column_name
= table2.column_name)];
```

ANSI JOIN 예시1

```
SELECT * FROM employees NATURAL JOIN departments;
```

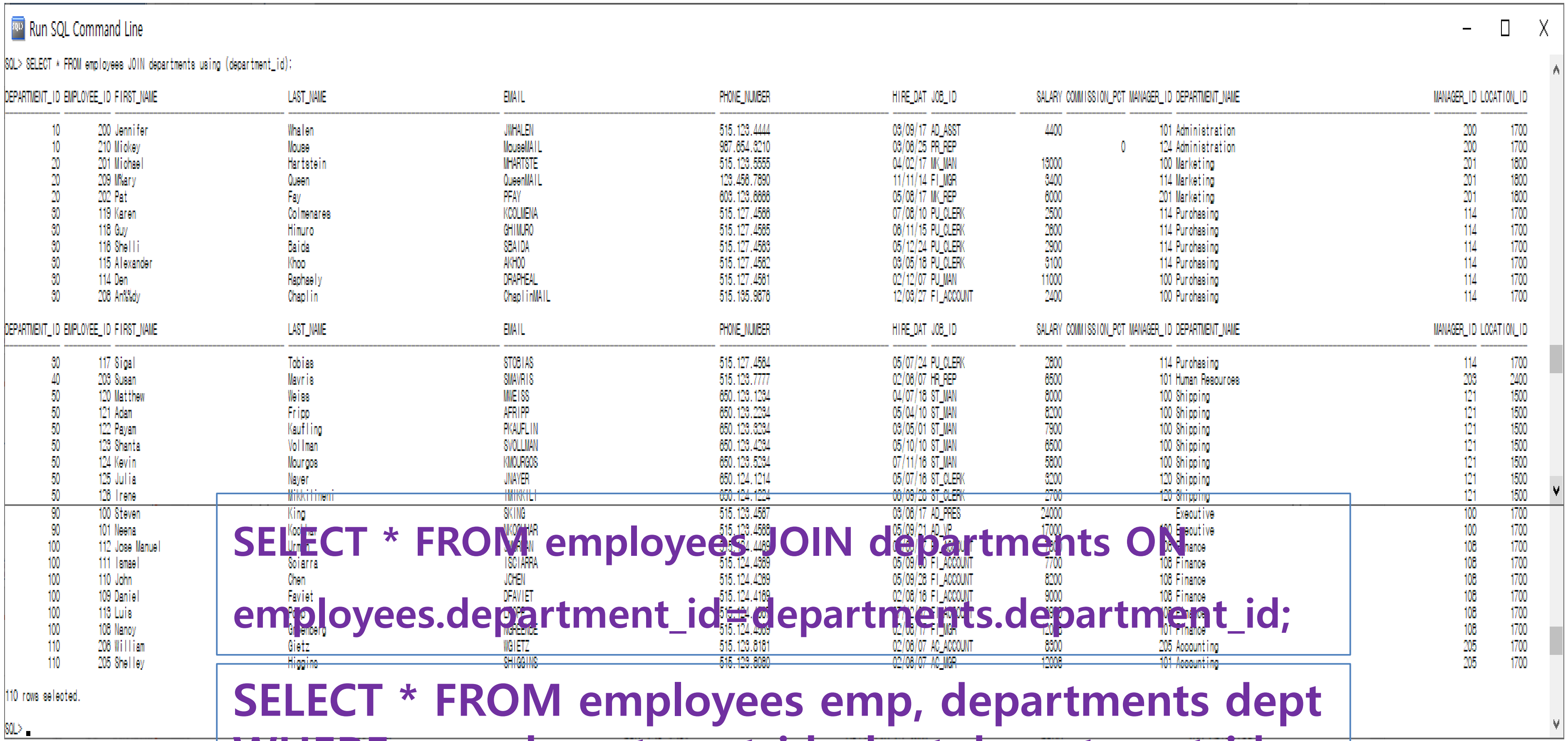


```
Run SQL Command Line

SQL> SELECT * FROM employees NATURAL JOIN departments;

MANAGER_ID DEPARTMENT_ID EMPLOYEE_ID FIRST_NAME        LAST_NAME     EMAIL      PHONE_NUMBER         HIRE_DAT JOB_ID        SALARY COMMISSION_PCT DEPARTMENT_NAME    LOCATION_ID
---------- ------------- ----------- ----------------- ------------- ---------- -------------------- -------- ---------- ------- -------------- ------------------ -----------
       100            90         101 Neena             Kochhar       NKOCHHAR   515.123.4568         05/09/21 AD_VP        17000                Executive                 1700
       100            90         102 Lex               De Haan       LDEHAAN    515.123.4569         01/01/13 AD_VP        17000                Executive                 1700
       103            60         104 Bruce             Ernst         BERNST     590.423.4568         07/05/21 IT_PROG       6000                IT                        1400
       103            60         105 David             Austin        DAUSTIN    590.423.4569         05/06/25 IT_PROG       4800                IT                        1400
       103            60         106 Valli             Pataballa     VPATABAL   590.423.4560         06/02/05 IT_PROG       4800                IT                        1400
       103            60         107 Diana             Lorentz       DLORENTZ   590.423.5567         07/02/07 IT_PROG       4200                IT                        1400
       108           100         109 Daniel            Faviet        DFAVIET    515.124.4169         02/08/16 FI_ACCOUNT    9000                Finance                   1700
       108           100         110 John              Chen          JCHEN      515.124.4269         05/09/28 FI_ACCOUNT    8200                Finance                   1700
       108           100         111 Ismael            Sciarra       ISCIARRA   515.124.4369         05/09/30 FI_ACCOUNT    7700                Finance                   1700
       108           100         112 Jose Manuel       Urman         JMURMAN    515.124.4469         06/03/07 FI_ACCOUNT    7800                Finance                   1700
       108           100         113 Luis              Popp          LPOPP      515.124.4567         07/12/07 FI_ACCOUNT    6900                Finance                   1700

MANAGER_ID DEPARTMENT_ID EMPLOYEE_ID FIRST_NAME        LAST_NAME     EMAIL      PHONE_NUMBER         HIRE_DAT JOB_ID        SALARY COMMISSION_PCT DEPARTMENT_NAME    LOCATION_ID
---------- ------------- ----------- ----------------- ------------- ---------- -------------------- -------- ---------- ------- -------------- ------------------ -----------
       114            30         115 Alexander         Khoo          AKHOO      515.127.4562         03/05/18 PU_CLERK      3100                Purchasing                1700
       114            30         116 Shelli            Baida         SBAIDA     515.127.4563         05/12/24 PU_CLERK      2900                Purchasing                1700
       114            30         117 Sigal             Tobias        STOBIAS    515.127.4564         05/07/24 PU_CLERK      2800                Purchasing                1700
       114            30         118 Guy               Himuro        GHIMURO    515.127.4565         06/11/15 PU_CLERK      2600                Purchasing                1700
       114            30         119 Karen             Colmenares    KCOLMENA   515.127.4566         07/08/10 PU_CLERK      2500                Purchasing                1700
       121            50         129 Laura             Bissot        LBISSOT    650.124.5234         05/08/20 ST_CLERK      3300                Shipping                  1500
       121            50         130 Mozhe             Atkinson      MATKINSO   650.124.6234         05/10/30 ST_CLERK      2800                Shipping                  1500
       121            50         131 James             Marlow        JAMRLOW    650.124.7234         05/02/16 ST_CLERK      2500                Shipping                  1500
       121            50         132 TJ                Olson         TJOLSON    650.124.8234         07/04/10 ST_CLERK      2100                Shipping                  1500
       145            80         150 Peter             Tucker        PTUCKER    011.44.1344.129268   05/01/30 SA_REP       10000             .3 Sales                     2500
       145            80         151 David             Bernstein     DBERNSTE   011.44.1344.345268   05/03/24 SA_REP        9500            .25 Sales                     2500

MANAGER_ID DEPARTMENT_ID EMPLOYEE_ID FIRST_NAME        LAST_NAME     EMAIL      PHONE_NUMBER         HIRE_DAT JOB_ID        SALARY COMMISSION_PCT DEPARTMENT_NAME    LOCATION_ID
---------- ------------- ----------- ----------------- ------------- ---------- -------------------- -------- ---------- ------- -------------- ------------------ -----------
       145            80         152 Peter             Hall          PHALL      011.44.1344.478968   05/08/20 SA_REP        9000            .25 Sales                     2500
       145            80         153 Christopher       Olsen         COLSEN     011.44.1344.498718   06/03/30 SA_REP        8000             .2 Sales                     2500
       145            80         154 Nanette           Cambrault     NCAMBRAU   011.44.1344.987668   06/12/09 SA_REP        7500             .2 Sales                     2500
       145            80         155 Oliver            Tuvault       OTUVAULT   011.44.1344.486508   07/11/23 SA_REP        7000            .15 Sales                     2500
       121            50         184 Nandita           Sarchand      NSARCHAN   650.509.1876         04/01/27 SH_CLERK      4200                Shipping                  1500
       121            50         185 Alexis            Bull          ABULL      650.509.2876         05/02/20 SH_CLERK      4100                Shipping                  1500
       121            50         186 Julia             Dellinger     JDELLING   650.509.3876         06/06/24 SH_CLERK      3400                Shipping                  1500
       121            50         187 Anthony           Cabrio        ACABRIO    650.509.4876         07/02/07 SH_CLERK      3000                Shipping                  1500
       201            20         202 Pat               Fay           PFAY       603.123.6666         05/08/17 MK_REP        6000                Marketing                 1800
       205           110         206 William           Gietz         WGIETZ     515.123.8181         02/06/07 AC_ACCOUNT    8300                Accounting                1700

32 rows selected.

SQL>
```

```
SELECT * FROM employees emp, departments dept
WHERE emp.department_id=dept.department_id AND emp.manager_id=dept.manager_id;
```

ANSI JOIN 예시2

SELECT * FROM employees JOIN departments USING (department_id);



Run SQL Command Line

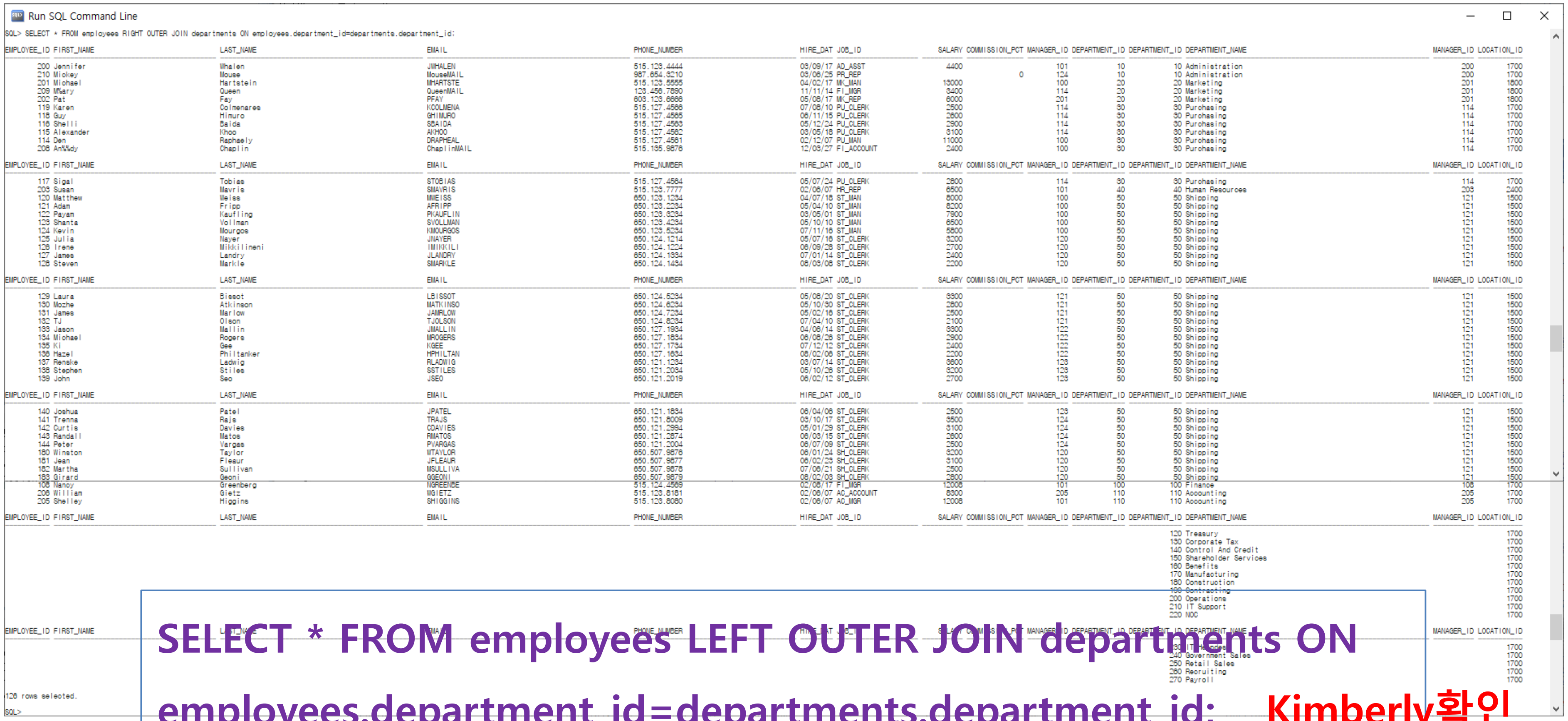
```
SQL> SELECT * FROM employees JOIN departments using (department_id);

DEPARTMENT_ID EMPLOYEE_ID FIRST_NAME           LAST_NAME                 EMAIL                     PHONE_NUMBER         HIRE_DAT JOB_ID       SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_NAME                MANAGER_ID LOCATION_ID
------------- ----------- -------------------- ------------------------- ------------------------- -------------------- -------- ---------- -------- -------------- ---------- ------------------------------ ---------- -----------
           10         200 Jennifer             Whalen                    JWHALEN                   515.123.4444         03/09/17 AD_ASST        4400                       101 Administration                        200        1700
           10         210 Mickey               Mouse                     MouseMAIL                 987.654.3210         03/06/25 PR_REP                              0        124 Administration                        200        1700
           20         201 Michael              Hartstein                 MHARTSTE                  515.123.5555         04/02/17 MK_MAN        13000                       100 Marketing                             201        1800
           20         209 MMary                Queen                     QueenMAIL                 123.456.7890         11/11/14 FI_MGR         3400                       114 Marketing                             201        1800
           20         202 Pat                  Fay                       PFAY                      603.123.6666         05/08/17 MK_REP         6000                       201 Marketing                             201        1800
           30         119 Karen                Colmenares                KCOLMENA                  515.127.4566         07/08/10 PU_CLERK       2500                       114 Purchasing                            114        1700
           30         118 Guy                  Himuro                    GHIMURO                   515.127.4565         06/11/15 PU_CLERK       2600                       114 Purchasing                            114        1700
           30         116 Shelli               Baida                     SBAIDA                    515.127.4563         05/12/24 PU_CLERK       2900                       114 Purchasing                            114        1700
           30         115 Alexander            Khoo                      AKHOO                     515.127.4562         03/05/18 PU_CLERK       3100                       114 Purchasing                            114        1700
           30         114 Den                  Raphaely                  DRAPHEAL                  515.127.4561         02/12/07 PU_MAN        11000                       100 Purchasing                            114        1700
           30         208 An%%dy               Chaplin                   ChaplinMAIL               515.135.9876         12/03/27 FI_ACCOUNT     2400                       100 Purchasing                            114        1700

DEPARTMENT_ID EMPLOYEE_ID FIRST_NAME           LAST_NAME                 EMAIL                     PHONE_NUMBER         HIRE_DAT JOB_ID       SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_NAME                MANAGER_ID LOCATION_ID
------------- ----------- -------------------- ------------------------- ------------------------- -------------------- -------- ---------- -------- -------------- ---------- ------------------------------ ---------- -----------
           30         117 Sigal                Tobias                    STOBIAS                   515.127.4564         05/07/24 PU_CLERK       2800                       114 Purchasing                            114        1700
           40         203 Susan                Mavris                    SMAVRIS                   515.123.7777         02/06/07 HR_REP         6500                       101 Human Resources                       203        2400
           50         120 Matthew              Weiss                     MWEISS                    650.123.1234         04/07/18 ST_MAN         8000                       100 Shipping                              121        1500
           50         121 Adam                 Fripp                     AFRIPP                    650.123.2234         05/04/10 ST_MAN         8200                       100 Shipping                              121        1500
           50         122 Payam                Kaufling                  PKAUFLIN                  650.123.3234         03/05/01 ST_MAN         7900                       100 Shipping                              121        1500
           50         123 Shanta               Vollman                   SVOLLMAN                  650.123.4234         05/10/10 ST_MAN         6500                       100 Shipping                              121        1500
           50         124 Kevin                Mourgos                   KMOURGOS                  650.123.5234         07/11/16 ST_MAN         5800                       100 Shipping                              121        1500
           50         125 Julia                Nayer                     JNAYER                    650.124.1214         05/07/16 ST_CLERK       3200                       120 Shipping                              121        1500
           50         126 Irene                Mikkilineni               IMIKKILI                  650.124.1224         08/09/28 ST_CLERK       2700                       120 Shipping                              121        1500
           90         100 Steven               King                      SKING                     515.123.4567         03/06/17 AD_PRES       24000                           Executive                             100        1700
           90         101 Neena                [illegible]               [illegible]               515.123.4568         05/09/21 AD_VP         17000                       [illegible] Executive                 100        1700
          100         112 Jose Manuel          [illegible]               [illegible]               [illegible]          [illegible]           [illegible]              [illegible] Finance                   108        1700
          100         111 Ismael               Sciarra                   ISCIARRA                  515.124.4369         05/09/30 FI_ACCOUNT     7700                       108 Finance                               108        1700
          100         110 John                 Chen                      JCHEN                     515.124.4269         05/09/28 FI_ACCOUNT     8200                       108 Finance                               108        1700
          100         109 Daniel               Faviet                    DFAVIET                   515.124.4169         02/08/16 FI_ACCOUNT     9000                       108 Finance                               108        1700
          100         113 Luis                 [illegible]               [illegible]               [illegible]          [illegible]           [illegible]              [illegible]                           108        1700
          100         108 Nancy                Greenberg                 NGREENBE                  515.124.4569         02/08/17 FI_MGR        12008                       101 Finance                               108        1700
          110         206 William              Gietz                     WGIETZ                    515.123.8181         02/06/07 AC_ACCOUNT     8300                       205 Accounting                            205        1700
          110         205 Shelley              Higgins                   SHIGGINS                  515.123.8080         02/06/07 AC_MGR        12008                       101 Accounting                            205        1700

110 rows selected.

SQL>
```

SELECT * FROM employees JOIN departments ON employees.department_id=departments.department_id;

SELECT * FROM employees emp, departments dept WHERE emp.department_id=dept.department_id;

ANSI JOIN 예시3

SELECT * FROM employees RIGHT OUTER JOIN departments ON employees.department_id=departments.department_id;



Run SQL Command Line

```
SQL> SELECT * FROM employees RIGHT OUTER JOIN departments ON employees.department_id=departments.department_id;

EMPLOYEE_ID FIRST_NAME  LAST_NAME    EMAIL        PHONE_NUMBER  HIRE_DAT JOB_ID      SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME        MANAGER_ID LOCATION_ID
----------- ----------- ------------ ------------ ------------- -------- ---------- ------- -------------- ---------- ------------- ------------- ---------------------- ---------- -----------
        200 Jennifer    Whalen       JWHALEN      515.123.4444  03/09/17 AD_ASST       4400                       101            10            10 Administration                200        1700
        210 Mickey      Mouse        MouseMAIL    987.654.3210  03/06/25 PR_REP                            0         124            10            10 Administration                200        1700
        201 Michael     Hartstein    MHARTSTE     515.123.5555  04/02/17 MK_MAN       13000                       100            20            20 Marketing                     201        1800
        209 M%ary       Queen        QueenMAIL    123.456.7890  11/11/14 FI_MGR        8400                       114            20            20 Marketing                     201        1800
        202 Pat         Fay          PFAY         603.123.6666  05/08/17 MK_REP        6000                       201            20            20 Marketing                     201        1800
        119 Karen       Colmenares   KCOLMENA     515.127.4566  07/08/10 PU_CLERK      2500                       114            30            30 Purchasing                    114        1700
        118 Guy         Himuro       GHIMURO      515.127.4565  06/11/15 PU_CLERK      2600                       114            30            30 Purchasing                    114        1700
        116 Shelli      Baida        SBAIDA       515.127.4563  05/12/24 PU_CLERK      2900                       114            30            30 Purchasing                    114        1700
        115 Alexander   Khoo         AKHOO        515.127.4562  03/05/18 PU_CLERK      3100                       114            30            30 Purchasing                    114        1700
        114 Den         Raphaely     DRAPHEAL     515.127.4561  02/12/07 PU_MAN       11000                       100            30            30 Purchasing                    114        1700
        208 An%%dy      Chaplin      ChaplinMAIL  515.135.9876  12/03/27 FI_ACCOUNT    2400                       100            30            30 Purchasing                    114        1700

EMPLOYEE_ID FIRST_NAME  LAST_NAME    EMAIL        PHONE_NUMBER  HIRE_DAT JOB_ID      SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME        MANAGER_ID LOCATION_ID
----------- ----------- ------------ ------------ ------------- -------- ---------- ------- -------------- ---------- ------------- ------------- ---------------------- ---------- -----------
        117 Sigal       Tobias       STOBIAS      515.127.4564  05/07/24 PU_CLERK      2800                       114            30            30 Purchasing                    114        1700
        203 Susan       Mavris       SMAVRIS      515.123.7777  02/06/07 HR_REP        6500                       101            40            40 Human Resources               203        2400
        120 Matthew     Weiss        MWEISS       650.123.1234  04/07/18 ST_MAN        8000                       100            50            50 Shipping                      121        1500
        121 Adam        Fripp        AFRIPP       650.123.2234  05/04/10 ST_MAN        8200                       100            50            50 Shipping                      121        1500
        122 Payam       Kaufling     PKAUFLIN     650.123.3234  03/05/01 ST_MAN        7900                       100            50            50 Shipping                      121        1500
        123 Shanta      Vollman      SVOLLMAN     650.123.4234  05/10/10 ST_MAN        6500                       100            50            50 Shipping                      121        1500
        124 Kevin       Mourgos      KMOURGOS     650.123.5234  07/11/16 ST_MAN        5800                       100            50            50 Shipping                      121        1500
        125 Julia       Nayer        JNAYER       650.124.1214  05/07/16 ST_CLERK      3200                       120            50            50 Shipping                      121        1500
        126 Irene       Mikkilineni  IMIKKILI     650.124.1224  06/09/28 ST_CLERK      2700                       120            50            50 Shipping                      121        1500
        127 James       Landry       JLANDRY      650.124.1334  07/01/14 ST_CLERK      2400                       120            50            50 Shipping                      121        1500
        128 Steven      Markle       SMARKLE      650.124.1434  08/03/08 ST_CLERK      2200                       120            50            50 Shipping                      121        1500

EMPLOYEE_ID FIRST_NAME  LAST_NAME    EMAIL        PHONE_NUMBER  HIRE_DAT JOB_ID      SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME        MANAGER_ID LOCATION_ID
----------- ----------- ------------ ------------ ------------- -------- ---------- ------- -------------- ---------- ------------- ------------- ---------------------- ---------- -----------
        129 Laura       Bissot       LBISSOT      650.124.5234  05/08/20 ST_CLERK      3300                       121            50            50 Shipping                      121        1500
        130 Mozhe       Atkinson     MATKINSO     650.124.6234  05/10/30 ST_CLERK      2800                       121            50            50 Shipping                      121        1500
        131 James       Marlow       JAMRLOW      650.124.7234  05/02/16 ST_CLERK      2500                       121            50            50 Shipping                      121        1500
        132 TJ          Olson        TJOLSON      650.124.8234  07/04/10 ST_CLERK      2100                       121            50            50 Shipping                      121        1500
        133 Jason       Mallin       JMALLIN      650.127.1934  04/06/14 ST_CLERK      3300                       122            50            50 Shipping                      121        1500
        134 Michael     Rogers       MROGERS      650.127.1834  06/08/26 ST_CLERK      2900                       122            50            50 Shipping                      121        1500
        135 Ki          Gee          KGEE         650.127.1734  07/12/12 ST_CLERK      2400                       122            50            50 Shipping                      121        1500
        136 Hazel       Philtanker   HPHILTAN     650.127.1634  08/02/06 ST_CLERK      2200                       122            50            50 Shipping                      121        1500
        137 Renske      Ladwig       RLADWIG      650.121.1234  03/07/14 ST_CLERK      3600                       123            50            50 Shipping                      121        1500
        138 Stephen     Stiles       SSTILES      650.121.2034  05/10/26 ST_CLERK      3200                       123            50            50 Shipping                      121        1500
        139 John        Seo          JSEO         650.121.2019  06/02/12 ST_CLERK      2700                       123            50            50 Shipping                      121        1500

EMPLOYEE_ID FIRST_NAME  LAST_NAME    EMAIL        PHONE_NUMBER  HIRE_DAT JOB_ID      SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME        MANAGER_ID LOCATION_ID
----------- ----------- ------------ ------------ ------------- -------- ---------- ------- -------------- ---------- ------------- ------------- ---------------------- ---------- -----------
        140 Joshua      Patel        JPATEL       650.121.1834  06/04/06 ST_CLERK      2500                       123            50            50 Shipping                      121        1500
        141 Trenna      Rajs         TRAJS        650.121.8009  03/10/17 ST_CLERK      3500                       124            50            50 Shipping                      121        1500
        142 Curtis      Davies       CDAVIES      650.121.2994  05/01/29 ST_CLERK      3100                       124            50            50 Shipping                      121        1500
        143 Randall     Matos        RMATOS       650.121.2874  06/03/15 ST_CLERK      2600                       124            50            50 Shipping                      121        1500
        144 Peter       Vargas       PVARGAS      650.121.2004  06/07/09 ST_CLERK      2500                       124            50            50 Shipping                      121        1500
        180 Winston     Taylor       WTAYLOR      650.507.9876  06/01/24 SH_CLERK      3200                       120            50            50 Shipping                      121        1500
        181 Jean        Fleaur       JFLEAUR      650.507.9877  06/02/23 SH_CLERK      3100                       120            50            50 Shipping                      121        1500
        182 Martha      Sullivan     MSULLIVA     650.507.9878  07/06/21 SH_CLERK      2500                       120            50            50 Shipping                      121        1500
        183 Girard      Geoni        GGEONI       650.507.9879  08/02/03 SH_CLERK      2800                       120            50            50 Shipping                      121        1500
        108 Nancy       Greenberg    NGREENBE     515.124.4569  02/08/17 FI_MGR       12008                       101           100           100 Finance                       108        1700
        206 William     Gietz        WGIETZ       515.123.8181  02/06/07 AC_ACCOUNT    8300                       205           110           110 Accounting                    205        1700
        205 Shelley     Higgins      SHIGGINS     515.123.8080  02/06/07 AC_MGR       12008                       101           110           110 Accounting                    205        1700

EMPLOYEE_ID FIRST_NAME  LAST_NAME    EMAIL        PHONE_NUMBER  HIRE_DAT JOB_ID      SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME        MANAGER_ID LOCATION_ID
----------- ----------- ------------ ------------ ------------- -------- ---------- ------- -------------- ---------- ------------- ------------- ---------------------- ---------- -----------
                                                                                                                                              120 Treasury                                 1700
                                                                                                                                              130 Corporate Tax                            1700
                                                                                                                                              140 Control And Credit                       1700
                                                                                                                                              150 Shareholder Services                     1700
                                                                                                                                              160 Benefits                                 1700
                                                                                                                                              170 Manufacturing                            1700
                                                                                                                                              180 Construction                             1700
                                                                                                                                              190 Contracting                              1700
                                                                                                                                              200 Operations                               1700
                                                                                                                                              210 IT Support                               1700
                                                                                                                                              220 NOC                                      1700

EMPLOYEE_ID FIRST_NAME  LAST_NAME    EMAIL        PHONE_NUMBER  HIRE_DAT JOB_ID      SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID DEPARTMENT_ID DEPARTMENT_NAME        MANAGER_ID LOCATION_ID
----------- ----------- ------------ ------------ ------------- -------- ---------- ------- -------------- ---------- ------------- ------------- ---------------------- ---------- -----------
                                                                                                                                              230 IT Helpdesk                              1700
                                                                                                                                              240 Government Sales                         1700
                                                                                                                                              250 Retail Sales                             1700
                                                                                                                                              260 Recruiting                               1700
                                                                                                                                              270 Payroll                                  1700

126 rows selected.

SQL>
```

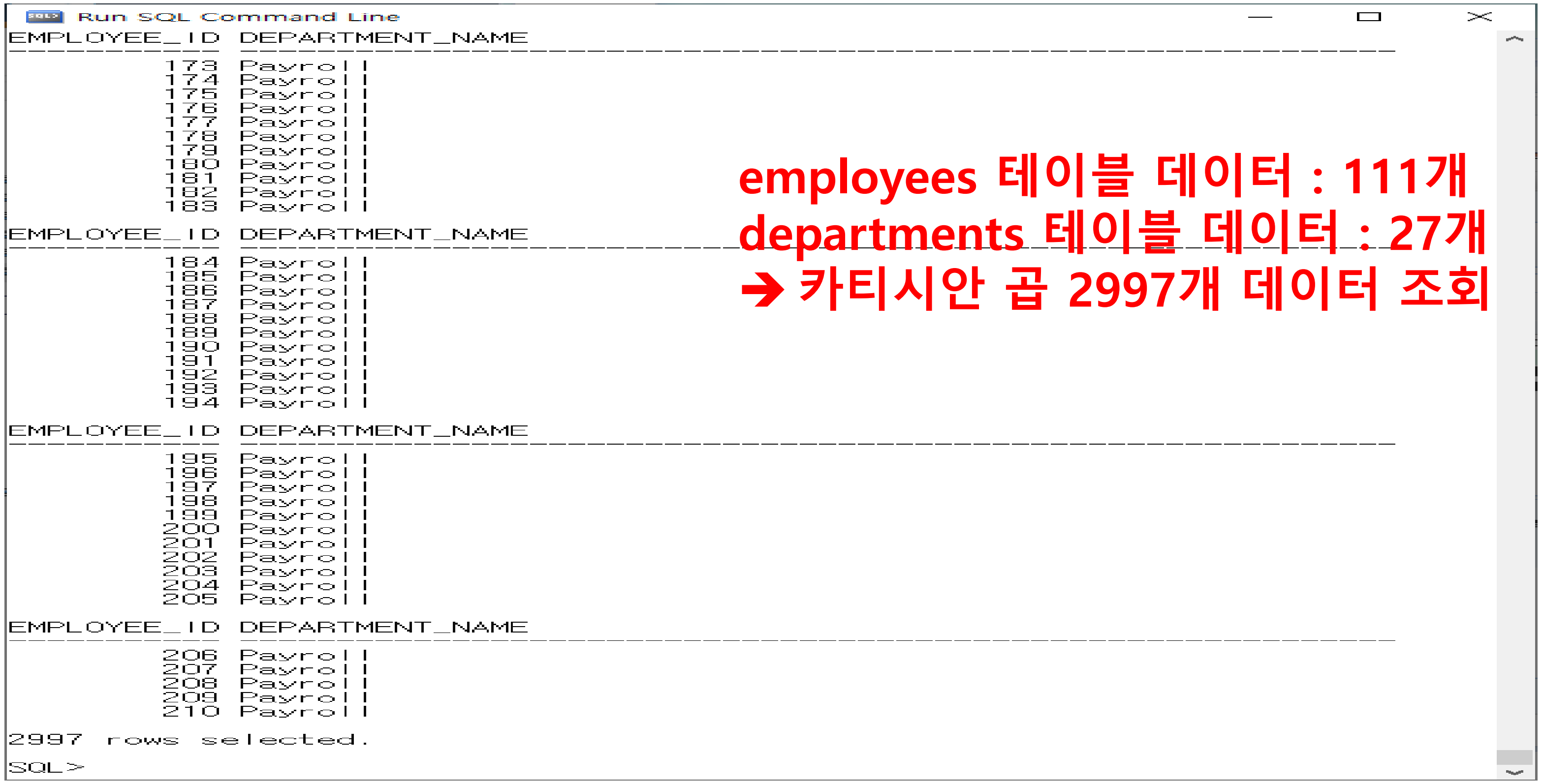
SELECT * FROM employees LEFT OUTER JOIN departments ON employees.department_id=departments.department_id; Kimberly확인

CROSS JOIN

- 두 테이블 상호간의 조합 생성
- 두 테이블 사이의 카티시안곱(Cartesian Product)과 동일

CROSS JOIN 예시

```
SELECT emp.employee_id, dept.department_name

FROM employees emp CROSS JOIN departments dept;
```

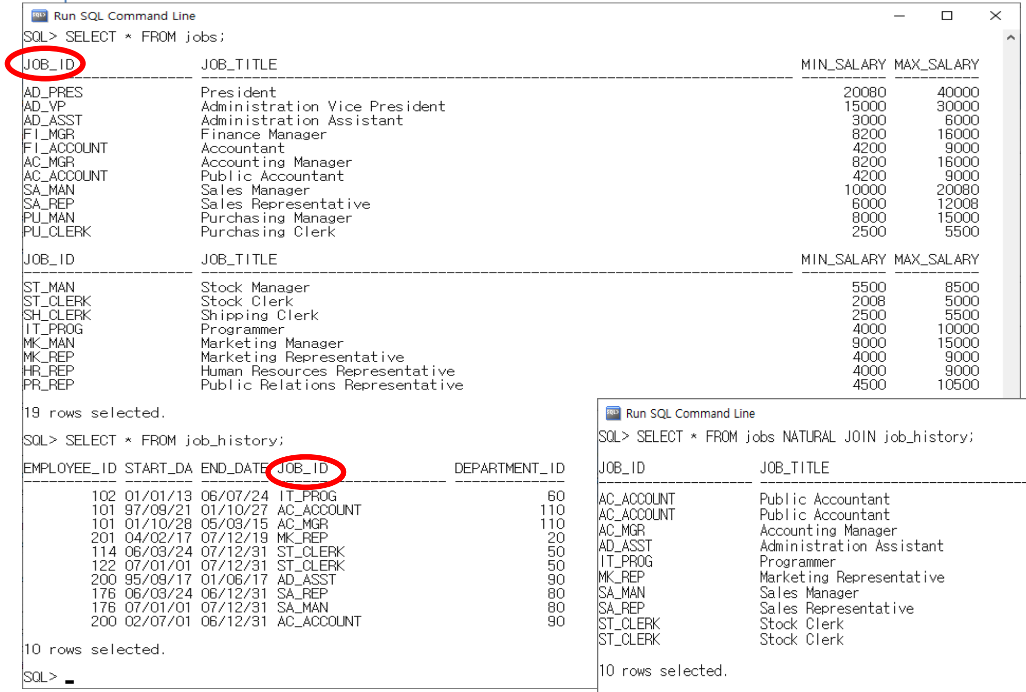


```
EMPLOYEE_ID DEPARTMENT_NAME
----------- ----------------------------------------------------------------------------------
        173 Payroll
        174 Payroll
        175 Payroll
        176 Payroll
        177 Payroll
        178 Payroll
        179 Payroll
        180 Payroll
        181 Payroll
        182 Payroll
        183 Payroll

EMPLOYEE_ID DEPARTMENT_NAME
----------- ----------------------------------------------------------------------------------
        184 Payroll
        185 Payroll
        186 Payroll
        187 Payroll
        188 Payroll
        189 Payroll
        190 Payroll
        191 Payroll
        192 Payroll
        193 Payroll
        194 Payroll

EMPLOYEE_ID DEPARTMENT_NAME
----------- ----------------------------------------------------------------------------------
        195 Payroll
        196 Payroll
        197 Payroll
        198 Payroll
        199 Payroll
        200 Payroll
        201 Payroll
        202 Payroll
        203 Payroll
        204 Payroll
        205 Payroll

EMPLOYEE_ID DEPARTMENT_NAME
----------- ----------------------------------------------------------------------------------
        206 Payroll
        207 Payroll
        208 Payroll
        209 Payroll
        210 Payroll

2997 rows selected.

SQL>
```

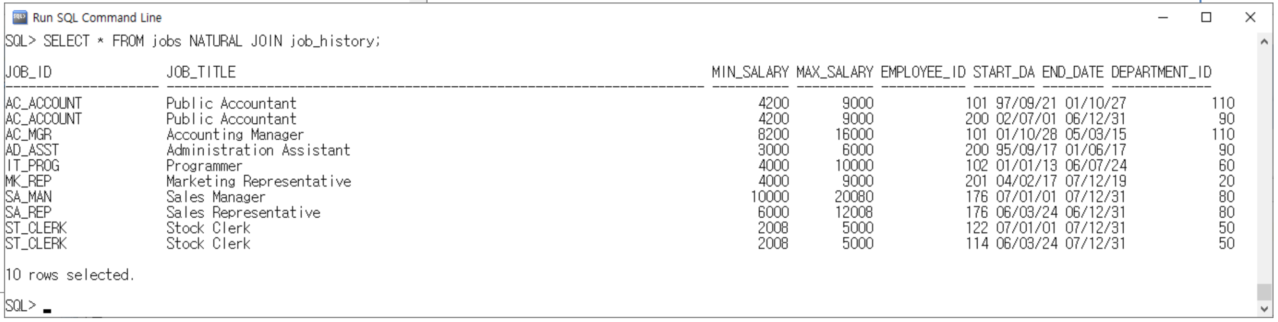
employees 테이블 데이터 : 111개
departments 테이블 데이터 : 27개
➔ 카티시안 곱 2997개 데이터 조회

NATURAL JOIN

- 두 테이블에서 동일한 이름을 가진 모든 열을 기준으로 조인
- 두 테이블의 일치하는 모든 열에서 같은 값을 가진 행을 선택
- 조인조건으로 사용한 컬럼 앞에는 테이블명이나 테이블 별칭을 명시할 수 없다.
- WHERE 절을 사용하여 조건 추가 가능

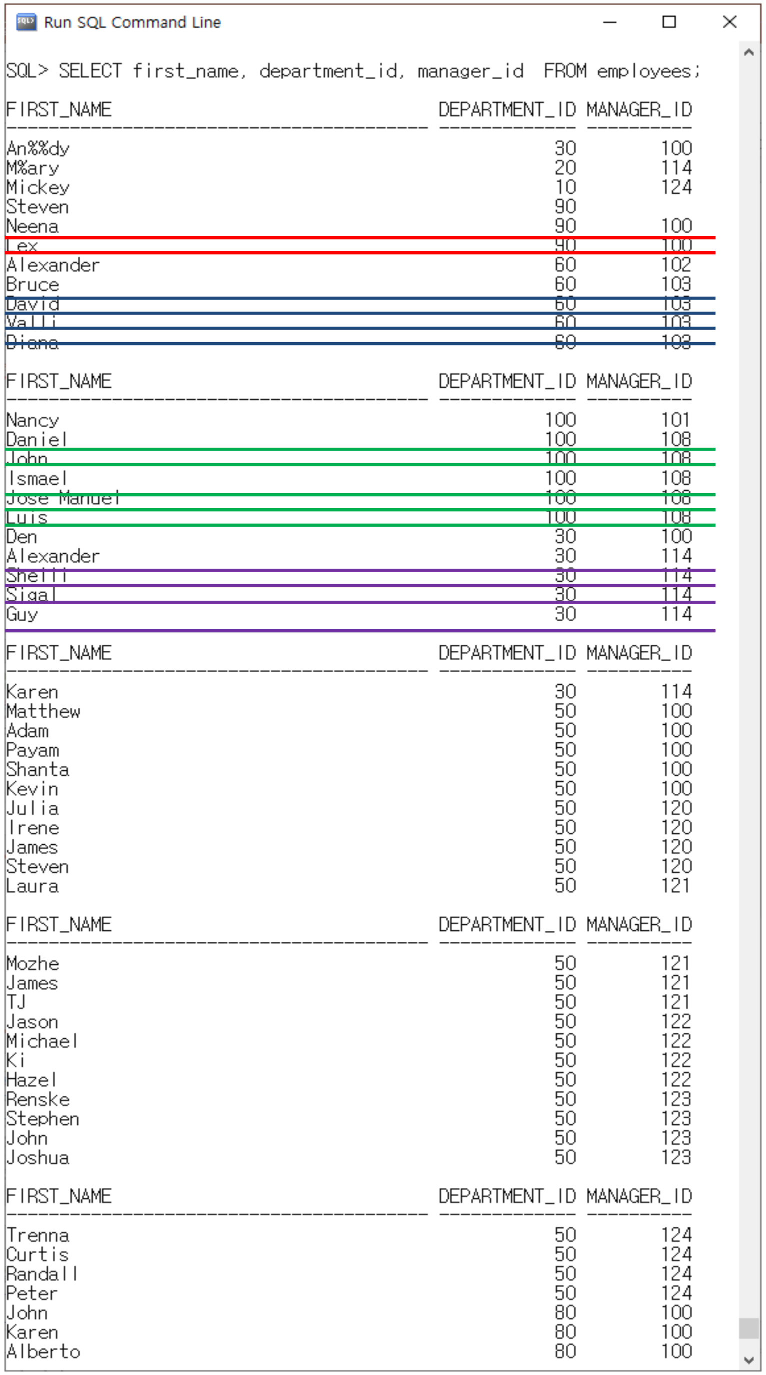

Run SQL Command Line

```
SQL> SELECT * FROM jobs;

JOB_ID               JOB_TITLE                                                          MIN_SALARY MAX_SALARY
-------------------- ------------------------------------------------------------------ ---------- ----------
AD_PRES              President                                                               20080      40000
AD_VP                Administration Vice President                                           15000      30000
AD_ASST              Administration Assistant                                                 3000       6000
FI_MGR               Finance Manager                                                          8200      16000
FI_ACCOUNT           Accountant                                                               4200       9000
AC_MGR               Accounting Manager                                                       8200      16000
AC_ACCOUNT           Public Accountant                                                        4200       9000
SA_MAN               Sales Manager                                                           10000      20080
SA_REP               Sales Representative                                                     6000      12008
PU_MAN               Purchasing Manager                                                       8000      15000
PU_CLERK             Purchasing Clerk                                                         2500       5500

JOB_ID               JOB_TITLE                                                          MIN_SALARY MAX_SALARY
-------------------- ------------------------------------------------------------------ ---------- ----------
ST_MAN               Stock Manager                                                            5500       8500
ST_CLERK             Stock Clerk                                                              2008       5000
SH_CLERK             Shipping Clerk                                                           2500       5500
IT_PROG              Programmer                                                               4000      10000
MK_MAN               Marketing Manager                                                        9000      15000
MK_REP               Marketing Representative                                                 4000       9000
HR_REP               Human Resources Representative                                           4000       9000
PR_REP               Public Relations Representative                                          4500      10500

19 rows selected.

SQL> SELECT * FROM job_history;

EMPLOYEE_ID START_DA END_DATE JOB_ID               DEPARTMENT_ID
----------- -------- -------- -------------------- -------------
        102 01/01/13 06/07/24 IT_PROG                         60
        101 97/09/21 01/10/27 AC_ACCOUNT                     110
        101 01/10/28 05/03/15 AC_MGR                         110
        201 04/02/17 07/12/19 MK_REP                          20
        114 06/03/24 07/12/31 ST_CLERK                        50
        122 07/01/01 07/12/31 ST_CLERK                        50
        200 95/09/17 01/06/17 AD_ASST                         90
        176 06/03/24 06/12/31 SA_REP                          80
        176 07/01/01 07/12/31 SA_MAN                          80
        200 02/07/01 06/12/31 AC_ACCOUNT                      90

10 rows selected.

SQL> _
```

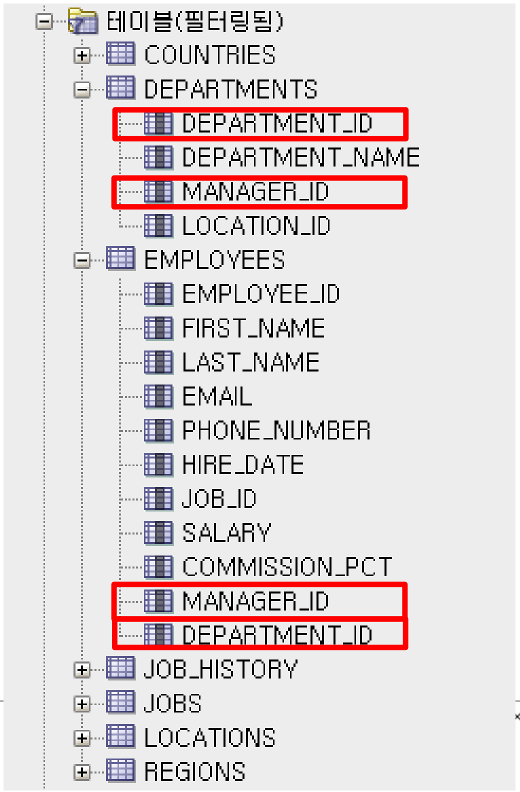

Run SQL Command Line

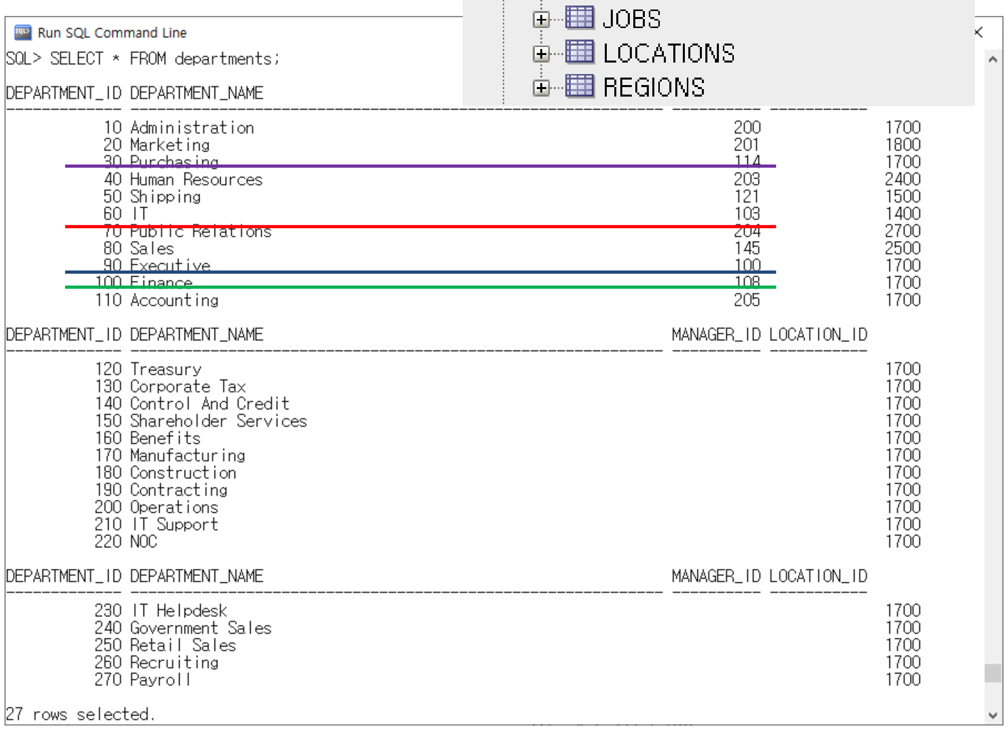
```
SQL> SELECT * FROM jobs NATURAL JOIN job_history;

JOB_ID               JOB_TITLE                                                          MIN_SALARY MAX_SALARY EMPLOYEE_ID START_DA END_DATE DEPARTMENT_ID
-------------------- ------------------------------------------------------------------ ---------- ---------- ----------- -------- -------- -------------
AC_ACCOUNT           Public Accountant                                                        4200       9000         101 97/09/21 01/10/27           110
AC_ACCOUNT           Public Accountant                                                        4200       9000         200 02/07/01 06/12/31            90
AC_MGR               Accounting Manager                                                       8200      16000         101 01/10/28 05/03/15           110
AD_ASST              Administration Assistant                                                 3000       6000         200 95/09/17 01/06/17            90
IT_PROG              Programmer                                                               4000      10000         102 01/01/13 06/07/24            60
MK_REP               Marketing Representative                                                 4000       9000         201 04/02/17 07/12/19            20
SA_MAN               Sales Manager                                                           10000      20080         176 07/01/01 07/12/31            80
SA_REP               Sales Representative                                                     6000      12008         176 06/03/24 06/12/31            80
ST_CLERK             Stock Clerk                                                              2008       5000         122 07/01/01 07/12/31            50
ST_CLERK             Stock Clerk                                                              2008       5000         114 06/03/24 07/12/31            50

10 rows selected.

SQL> _
```

설명



```
SQL> SELECT first_name, department_id, manager_id  FROM employees;

FIRST_NAME                               DEPARTMENT_ID MANAGER_ID
---------------------------------------- ------------- ----------
An%%dy                                              30        100
M%ary                                               20        114
Mickey                                              10        124
Steven                                              90
Neena                                               90        100
Lex                                                 90        100
Alexander                                           60        102
Bruce                                               60        103
David                                               60        103
Valli                                               60        103
Diana                                               60        103

FIRST_NAME                               DEPARTMENT_ID MANAGER_ID
---------------------------------------- ------------- ----------
Nancy                                              100        101
Daniel                                             100        108
John                                               100        108
Ismael                                             100        108
Jose Manuel                                        100        108
Luis                                               100        108
Den                                                 30        100
Alexander                                           30        114
Shelli                                              30        114
Sigal                                               30        114
Guy                                                 30        114

FIRST_NAME                               DEPARTMENT_ID MANAGER_ID
---------------------------------------- ------------- ----------
Karen                                               30        114
Matthew                                             50        100
Adam                                                50        100
Payam                                               50        100
Shanta                                              50        100
Kevin                                               50        100
Julia                                               50        120
Irene                                               50        120
James                                               50        120
Steven                                              50        120
Laura                                               50        121

FIRST_NAME                               DEPARTMENT_ID MANAGER_ID
---------------------------------------- ------------- ----------
Mozhe                                               50        121
James                                               50        121
TJ                                                  50        121
Jason                                               50        122
Michael                                             50        122
Ki                                                  50        122
Hazel                                               50        122
Renske                                              50        123
Stephen                                             50        123
John                                                50        123
Joshua                                              50        123

FIRST_NAME                               DEPARTMENT_ID MANAGER_ID
---------------------------------------- ------------- ----------
Trenna                                              50        124
Curtis                                              50        124
Randall                                             50        124
Peter                                               50        124
John                                                80        100
Karen                                               80        100
Alberto                                             80        100
```



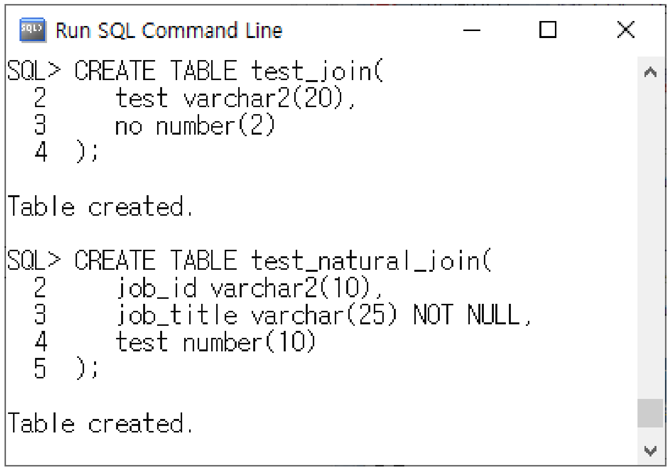


```
SQL> SELECT * FROM departments;

DEPARTMENT_ID DEPARTMENT_NAME
------------- ------------------------------ ---------- -----------
           10 Administration                        200        1700
           20 Marketing                             201        1800
           30 Purchasing                            114        1700
           40 Human Resources                       203        2400
           50 Shipping                              121        1500
           60 IT                                    103        1400
           70 Public Relations                      204        2700
           80 Sales                                 145        2500
           90 Executive                             100        1700
          100 Finance                               108        1700
          110 Accounting                            205        1700

DEPARTMENT_ID DEPARTMENT_NAME                MANAGER_ID LOCATION_ID
------------- ------------------------------ ---------- -----------
          120 Treasury                                         1700
          130 Corporate Tax                                    1700
          140 Control And Credit                               1700
          150 Shareholder Services                             1700
          160 Benefits                                         1700
          170 Manufacturing                                    1700
          180 Construction                                     1700
          190 Contracting                                      1700
          200 Operations                                       1700
          210 IT Support                                       1700
          220 NOC                                              1700

DEPARTMENT_ID DEPARTMENT_NAME                MANAGER_ID LOCATION_ID
------------- ------------------------------ ---------- -----------
          230 IT Helpdesk                                      1700
          240 Government Sales                                 1700
          250 Retail Sales                                     1700
          260 Recruiting                                       1700
          270 Payroll                                          1700

27 rows selected.
```

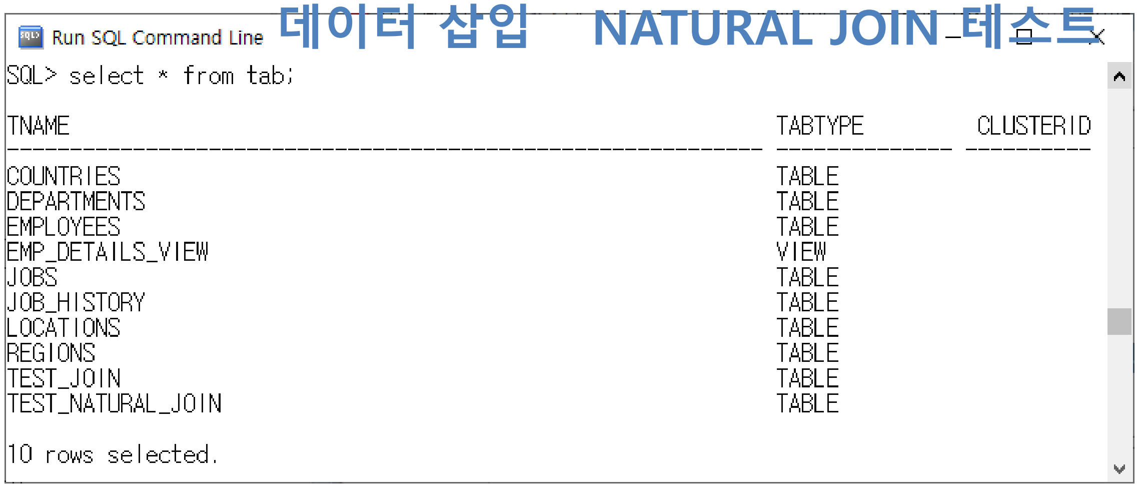
NATURAL JOIN 테스트

TABLE 생성(test_join, test_natural_join)　데이터 삽입　NATURAL JOIN 테스트

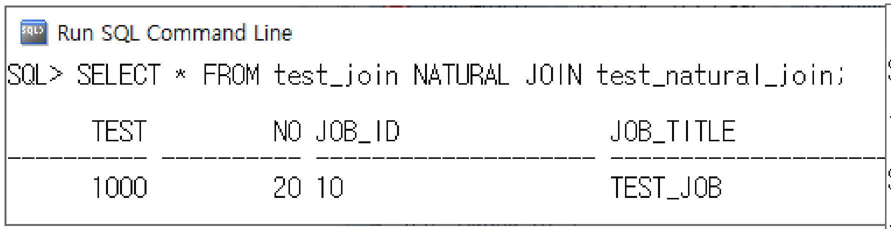
데이터 삽입　NATURAL JOIN 테스트



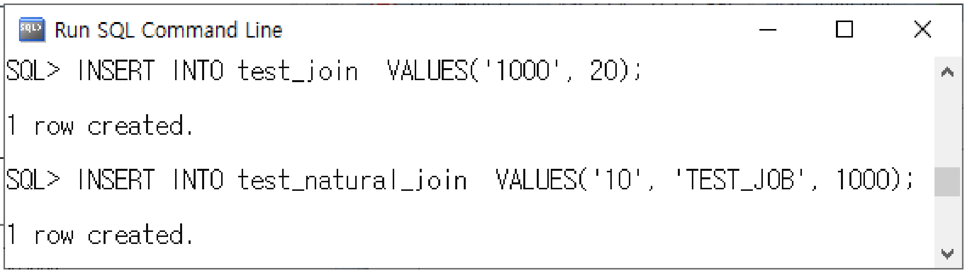
```
SQL> CREATE TABLE test_join(
  2      test varchar2(20),
  3      no number(2)
  4  );

Table created.

SQL> CREATE TABLE test_natural_join(
  2      job_id varchar2(10),
  3      job_title varchar(25) NOT NULL,
  4      test number(10)
  5  );

Table created.
```



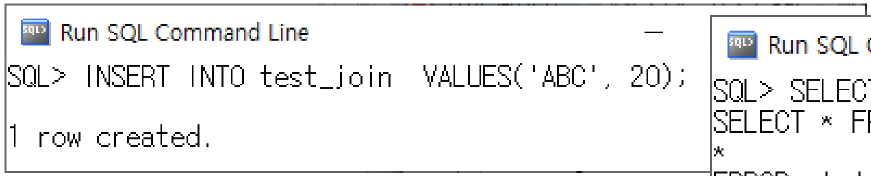
```
SQL> select * from tab;

TNAME                                                        TABTYPE         CLUSTERID
------------------------------------------------------------ --------------- ----------
COUNTRIES                                                    TABLE
DEPARTMENTS                                                  TABLE
EMPLOYEES                                                    TABLE
EMP_DETAILS_VIEW                                             VIEW
JOBS                                                         TABLE
JOB_HISTORY                                                  TABLE
LOCATIONS                                                    TABLE
REGIONS                                                      TABLE
TEST_JOIN                                                    TABLE
TEST_NATURAL_JOIN                                            TABLE

10 rows selected.
```



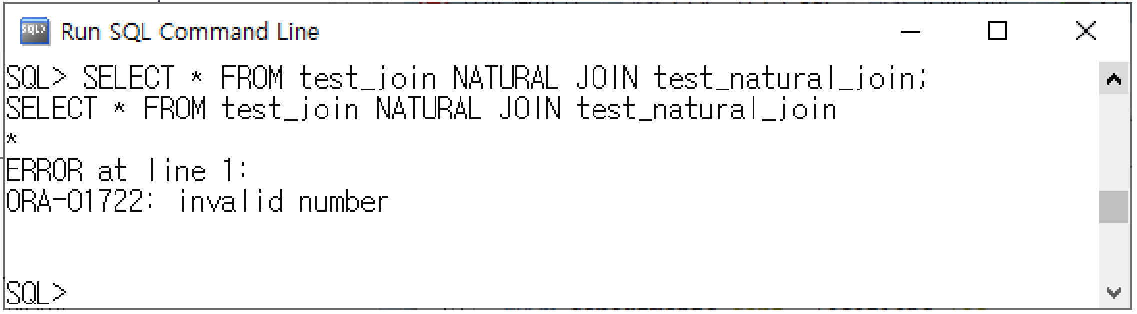
```
SQL> SELECT * FROM test_join NATURAL JOIN test_natural_join;

      TEST         NO JOB_ID                JOB_TITLE
---------- ---------- -------------------- ---------------------
      1000         20 10                    TEST_JOB
```



```
SQL> INSERT INTO test_join  VALUES('1000', 20);

1 row created.

SQL> INSERT INTO test_natural_join  VALUES('10', 'TEST_JOB', 1000);

1 row created.
```



```
SQL> INSERT INTO test_join  VALUES('ABC', 20);

1 row created.
```



```
SQL> SELECT * FROM test_join NATURAL JOIN test_natural_join;
SELECT * FROM test_join NATURAL JOIN test_natural_join
*
ERROR at line 1:
ORA-01722: invalid number


SQL>
```

USING JOIN

- NATURAL JOIN은 이름과 데이터 유형이 일치하는 모든 열을 사용하여 테이블을 조인하지만 USING 절을