



SQL: Schema Definition, Basic Constraints, and Queries

SQL INTRODUCTION

- SQL stands for **Structured Query Language**
- Standard language for querying and manipulating data

Data Definition Language (DDL)

- Create, alter, delete tables and their attributes

Data Manipulation Language (DML)

- Query one or more tables
- Insert, delete, modify tuples in tables

Many standards out there:

ANSI SQL, SQL92 (a.k.a. SQL2), SQL99 (a.k.a. SQL3), ...

SQL QUERIES

Basic form

```
SELECT <attributes>  
FROM   <one or more relations>  
WHERE  <conditions>
```

Not same as the Select σ operation of the relational algebra

Try SQLFiddle for online SQL practice

<http://sqlfiddle.com/>

<https://www.db-fiddle.com/>

SIMPLE SQL QUERIES

Retrieve the details of employees who work under the supervision of employee with id=333445555

```
SELECT *  
FROM EMPLOYEE  
WHERE Super_ssn = 333445555
```

“selection”

$\sigma_{\text{Super_SSN} = 333445555}(\text{EMPLOYEE})$

EMPLOYEE									
Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4

SIMPLE SQL QUERIES

Retrieve the birthdate and address of the employee whose name is 'John Smith'.

```
SELECT      BDATE, ADDRESS
FROM        EMPLOYEE
WHERE       FNAME='John' AND LNAME='Smith'
```

“selection” and
“projection”

$$\pi_{\text{BDATE, ADDRESS}} (\sigma_{\text{FNAME='John' AND LNAME='Smith'}}(\text{EMPLOYEE}))$$

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4

SQL QUERIES

- In SQL, the result can have duplicate tuples
 - SQL relation is a *multi-set* (bag) of tuples; *not* a set of tuples

```
SELECT Salary
FROM Employee
```

Salary
30000
40000
25000
43000
38000
25000
25000
55000

ELIMINATING DUPLICATES

```
SELECT Salary
FROM Employee
```

Salary
30000
40000
25000
43000
38000
25000
25000
55000

```
SELECT DISTINCT Salary
FROM Employee
```

Salary
30000
40000
25000
43000
38000
55000

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

JOIN OPERATION

Retrieve the name of all projects

```
SELECT      PNAME
FROM        PROJECT JOIN DEPARTMENT ON DNUM=DNUMBER
```

$DEPT_MGR \leftarrow \pi_{PNAME} (PROJECT \bowtie_{DNUM=DNUMBER} DEPARTMENT)$

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_da
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

JOIN OPERATION

Retrieve the name of all projects **that are offered by 'Research' department.**

```
SELECT      PNAME
FROM        PROJECT JOIN DEPARTMENT ON DNUM=DNUMBER
WHERE       DNAME='Research'
```

$$D_MGR \leftarrow \pi_{PNAME} (PROJECT \bowtie_{DNUM=DNUMBER} (\sigma_{DNAME='Research'}(DEPARTMENT)))$$

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_da
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

JOIN OPERATION

Retrieve the name of all projects that are offered by 'Research' department.

```
SELECT      PNAME
FROM        PROJECT, DEPARTMENT
WHERE       DNAME='Research' and DNUM=DNUMBER
```

join condition

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-0
Administration	4	987654321	1995-0
Headquarters	1	888665555	1981-0

PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

DIFFERENT JOINS IN SQL

```
SELECT E.FNAME, E.LNAME, S.FNAME, S.LNAME  
FROM EMPLOYEE AS E , EMPLOYEE AS S  
WHERE E.SUPERSSN=S.SSN
```

```
SELECT E.FNAME, E.LNAME, S.FNAME, S.LNAME  
FROM (EMPLOYEE E JOIN EMPLOYEE S)  
    ON E.SUPERSSN=S.SSN
```

No Natural Join in T-SQL

UNSPECIFIED WHERE-clause

Retrieve the SSN values for all employees.

- **SELECT** **SSN**
- **FROM** **EMPLOYEE**

Missing WHERE-clause

- indicates there is no condition and is same as WHERE TRUE

If there is no join condition, then we get
CARTESIAN PRODUCT

- **SELECT** **SSN, DNAME**
- **FROM** **EMPLOYEE, DEPARTMENT**

Ssn	Dname
123456789	Research
333445555	Research
999887777	Research
987654321	Research
666884444	Research
453453453	Research
987987987	Research
888665555	Research
123456789	Administration
333445555	Administration
999887777	Administration
987654321	Administration
666884444	Administration
453453453	Administration
987987987	Administration
888665555	Administration
123456789	Headquarters
333445555	Headquarters
999887777	Headquarters
987654321	Headquarters
666884444	Headquarters
453453453	Headquarters
987987987	Headquarters
888665555	Headquarters

Example Queries

List the employees name and the department name that they manage.

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

DEPT_LOCATIONS

<u>Dnumber</u>	<u>Dlocation</u>
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia								987654321	4
Jennifer								55555	4
Ramesh								55555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

Temp \leftarrow (Employee \bowtie Ssn=Mgr_Ssn Department)

Result $\leftarrow \pi_{\text{Fname, Minit, Lname, Dname}}(\text{Temp})$

Example Queries

List the employees name and the department name that they manage.

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

DEPT_LOCATIONS

<u>Dnumber</u>	<u>Dlocation</u>
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia								4321	4
Jennifer								5555	4
Ramesh								5555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

**SELECT Fname, Lname, Dname
FROM Employee Join Department ON Ssn=Mgr_ssn**

JOIN OPERATION

For projects located in 'Stafford', list the project no, the controlling department no, and the department manager's last name, address and birthdate.

$SP \leftarrow \sigma_{PLOCATION='Stanford'}(PROJECT)$

$R1 \leftarrow EMPLOYEE \bowtie_{SSN=Mgr_ssn} (SP \bowtie_{Dnum=Dnumber} Department)$

$Result \leftarrow \pi_{FPnumber, Dnumber, Lname, Address, Bdate}(R1)$

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	25000	999887777	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Houston, TX	F	15000	987654321	5
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Houston, TX	F	10000		5

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

JOIN OPERATION

For projects located in 'Stafford', list the project no, the controlling department no, and the department manager's last name, address and birthdate.

```
SELECT      PNUMBER, DNUM, LNAME, ADDRESS, BDATE
FROM        ((PROJECT JOIN DEPARTMENT ON DNUM=DNUMBER)
              JOIN EMPLOYEE ON MGRSSN=SSN)
WHERE       PLOCATION = 'Stafford'
```

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	25000	333445555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Houston, TX	F	20000	999887777	5
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Houston, TX	F	15000	987654321	5

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

PROJECT

Pname	<u>Pnumber</u>	Plocation	Dnum
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4

JOIN OPERATION

For projects located in 'Stafford', list the project no, the controlling department no, and the department manager's last name, address and birthdate.

```

SELECT      PNUMBER, DNUM, LNAME, ADDRESS, BDATE
FROM        ((PROJECT JOIN DEPARTMENT ON DNUM=DNUMBER)
              JOIN EMPLOYEE ON MGRSSN=SSN )
WHERE       PLOCATION='Stafford'
    
```

EMPLOY				DEPART			
Fname				Dn			
John				Research	5	333445555	1988-05-22
Franklin				Administration	4	987654321	1995-01-01
Alicia				Headquarters	1	888665555	1981-06-19
Jennifer				Computerization	10	Stafford	4
				Reorganization	20	Houston	1
				Newbenefits	30	Stafford	4

SET OPERATIONS

SQL set operations are

- Union operation (**UNION**),
- Set difference (**EXCEPT**)
- Intersection operation (**INTERSECT**)

Duplicate tuples are eliminated from the result

Requires union compatible relations

SET OPERATIONS

Make a list of Pname's for projects that involve an employee whose last name is 'Smith'

as a worker **OR**

as a manager of the department that controls the project.

EMPLOYEE

FNAME	MINIT	LNAME	<u>SSN</u>	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
-------	-------	-------	------------	-------	---------	-----	--------	----------	-----

DEPARTMENT

DNAME	<u>DNUMBER</u>	MGRSSN	MGRSTARTDATE
-------	----------------	--------	--------------

PROJECT

PNAME	<u>PNUMBER</u>	PLOCATION	DNUM
-------	----------------	-----------	------

DEPT_LOCATIONS

<u>DNUMBER</u>	<u>DLOCATION</u>
----------------	------------------

WORKS_ON

<u>ESSN</u>	<u>PNO</u>	HOURS
-------------	------------	-------

SET OPERATIONS

Make a list of Pname's for projects that involve an employee whose last name is 'Smith'

as a worker **OR**

as a manager of the department that controls the project.

```
(SELECT PNAME
FROM   (PROJECT JOIN WORKS_ON ON PNUMBER=PNO ) JOIN
        EMPLOYEE ON ESSN=SSN
WHERE  LNAME='Smith')
```

UNION

```
(SELECT PNAME
FROM   (PROJECT JOIN DEPARTMENT ON DNUM=DNUMBER ) JOIN
        EMPLOYEE ON MGRSSN=SSN
WHERE  LNAME='Smith')
```

EXAMPLE: Retrieve the SSN of employees who have no dependents.

$ALL_EMPS \leftarrow \pi_{SSN}(EMPLOYEE)$

$EMPS_WITH_DEPS(SSN) \leftarrow \pi_{ESSN}(DEPENDENT)$

$EMPS_WITHOUT_DEPS \leftarrow (ALL_EMPS - EMPS_WITH_DEPS)$

DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

EXAMPLE: Retrieve the SSN of employees who have no dependents.

SELECT SSN FROM EMPLOYEE

EXCEPT

SELECT ESSN FROM DEPENDENT

DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

EXAMPLE: Retrieve the names of employees who have no dependents.

$ALL_EMPS \leftarrow \pi_{SSN}(EMPLOYEE)$

$EMPS_WITH_DEPS(SSN) \leftarrow \pi_{ESSN}(DEPENDENT)$

$EMPS_WITHOUT_DEPS \leftarrow (ALL_EMPS - EMPS_WITH_DEPS)$

$RESULT \leftarrow \pi_{LNAME, FNAME} (EMPS_WITHOUT_DEPS * EMPLOYEE)$

DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	NULL	1

EXAMPLE: Retrieve the SSN of employees who has a daughter as well as a son

SELECT ESSN

FROM DEPENDENT

WHERE Relationship = 'Daughter' and Relationship = 'SON'

**WHATS
WRONG ??**

DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

EXAMPLE: Retrieve the SSN of employees who has a daughter as well as a son

```
SELECT ESSN  
FROM DEPENDENT  
WHERE Relationship = 'Daughter'
```

INTERSECT

```
SELECT ESSN  
FROM DEPENDENT  
WHERE Relationship = 'SON'
```

DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
333445555	Alice	F	1986-04-05	Daughter
333445555	Theodore	M	1983-10-25	Son
333445555	Joy	F	1958-05-03	Spouse
987654321	Abner	M	1942-02-28	Spouse
123456789	Michael	M	1988-01-04	Son
123456789	Alice	F	1988-12-30	Daughter
123456789	Elizabeth	F	1967-05-05	Spouse

SET OPERATIONS

Find SSN of employees who work on project named ProductX **and** as well as on project named ProductY

EMPLOYEE

FNAME	MINIT	LNAME	<u>SSN</u>	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
-------	-------	-------	------------	-------	---------	-----	--------	----------	-----

DEPARTMENT

DNAME	<u>DNUMBER</u>	MGRSSN	MGRSTARTDATE
-------	----------------	--------	--------------

PROJECT

PNAME	<u>PNUMBER</u>	PLOCATION	DNUM
-------	----------------	-----------	------

DEPT_LOCATIONS

<u>DNUMBER</u>	<u>DLOCATION</u>
----------------	------------------

WORKS_ON

<u>ESSN</u>	<u>PNO</u>	HOURS
-------------	------------	-------