How the Programmer build DBMS

- Start with DDL to create tables:

```
CREATE TABLE Students (
        Name CHAR(30)
        SSN CHAR(9) PRIMARY KEY NOT NULL,
        Category CHAR(20)
)  . . .
```

- Continue with DML to populate tables:

```
INSERT INTO Students
VALUES('Charles', '123456789', 'undergraduate')
. . . .
```

Used to specify database retrievals and updates

Operations in RDBMS

Operations in RDBMS are classified as
- Retrieval
- Update

Integrity constraints should not be violated by the update operations.

Update Operations on Relations

INSERT a tuple.

DELETE a tuple.

MODIFY a tuple.

Insert Operation

- **Insert Operation** can violate following constraints
  - Domain constraint
  - Key constraint (if key value already exists)
  - Entity (if PK contains NULL)
  - Referential (FK refers to a tuple that does not exist in referenced relation)

EMPLOYEE

Fname	Minit	Lname	Ssn	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

INSERT a tuple in a Relation

EMPLOYEE

Fname	Minit	Lname	Ssn	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

- **INSERT INTO EMPLOYEE VALUES ('Richard','K','Marini', '653298653', '30DEC-52','98 Oak Forest,Katy,TX', 'M', 37000,'987654321', 4)**

- Attribute values should be listed in the same order as the attributes were specified in the TABLE

INSERT (cont.)

- **Example:** Insert a tuple for a new EMPLOYEE for whom we only know the FNAME, LNAME, and SSN attributes.

  INSERT INTO EMPLOYEE (FNAME, LNAME, SSN) VALUES ('Richard', 'Marini', '653298653')

- Attributes with NULL values can be left out

- **INSERT INTO EMPLOYEE VALUES**('Cecilia', 'F', 'Kolonsky', NULL, '1960-04-05', '6357 Windy Lane, Katy, TX', F, 28000, NULL, 4)

EMPLOYEE

Fname	Minit	Lname	Ssn	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

DEPARTMENT

Dname	Dnumber	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

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

- **INSERT INTO EMPLOYEE VALUES**('Cecilia', 'F', 'Kolonsky', '677678989', '1960-04-05', '6357 Windswept, Katy, TX', F, 28000, '987654321', 7)

EMPLOYEE

Fname	Minit	Lname	Ssn	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

DEPARTMENT

Dname	Dnumber	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

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

INSERT INTO EMPLOYEE VALUES ('Alicia', 'J', 'Zelaya', '999887777', '1960-04-05', '6357 Windy Lane, Katy,TX', F, 28000, '987654321', 4)

EMPLOYEE

Fname	Minit	Lname	Ssn	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

DEPARTMENT

Dname	Dnumber	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

Dnumber	Dlocation
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

Delete Operation and Constraints

- **Delete operation** can violate
  - **Referential Integrity constraint**

- Delete FROM Employee WHERE Ssn = '999887777'.

Delete FROM Employee WHERE Ssn = '999887777'

EMPLOYEE

Fname	Minit	Lname	Ssn	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			

DEPARTMENT

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

DEPENDENT

Essn	Dependent_name	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

WORKS_ON

Essn	Pno	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	NULL

EMPLOYEE

Fname	Minit	Lname	Ssn	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
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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			

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
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DEPENDENT

Essn	Dependent_name	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

WORKS_ON

Essn	Pno	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40.0
453453453	1	20.0
453453453	2	20.0
333445555	2	10.0
333445555	3	10.0
333445555	10	10.0
333445555	20	10.0
999887777	30	30.0
999887777	10	10.0
987987987	10	35.0
987987987	30	5.0
987654321	30	20.0
987654321	20	15.0
888665555	20	NULL

DELETE

- **Tuples are deleted from only *one table* at a time (unless CASCADE is specified on a referential integrity constraint)**

- <u>Examples:</u>

  DELETE FROM   EMPLOYEE

  WHERE   LNAME='Brown'

-     DELETE FROM   EMPLOYEE

A missing WHERE-clause specifies that *all tuples* in the relation are to be deleted

The table then becomes an empty table

Update Operation and Constraints

- **Update operation**
  - that involve no PK or FK cause no problem
    - only domain constraint are to be check
  - Modifying PK is like
    - deleting a tuple and
    - then inserting another

EMPLOYEE

Fname	Minit	Lname	Ssn	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

Update Operation and Constraints

○ **Example: C**hange the location to 'Bellaire' & department number to 5 of project number 10.

```
UPDATE          PROJECT
SET              LOCATION = 'Bellaire', DNUM = 5
WHERE           PNUMBER=10
```

PROJECT

Pname	Pnumber	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

Update Operation and Constraints

Update Employee
Set DNO=7
WHERE SSN= '999887777'

Update Employee
Set SSN= '987654321
WHERE SSN= '999887777'

EMPLOYEE

Fname	Minit	Lname	Ssn	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
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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

Insert Operation can violate	**Delete operation** can violate	**Update operation** can violate
Domain constraint	**FK constraint**	If no change in PK or FK => **Domain constraint**
Key constraint (if key already exists)		If modifies PK => delete a tuple and insert another
Entity (if PK contains Null)		If modifies FK => **FK constraint**
Referential FK constraint		

Operations and Constraints

How to handle violation
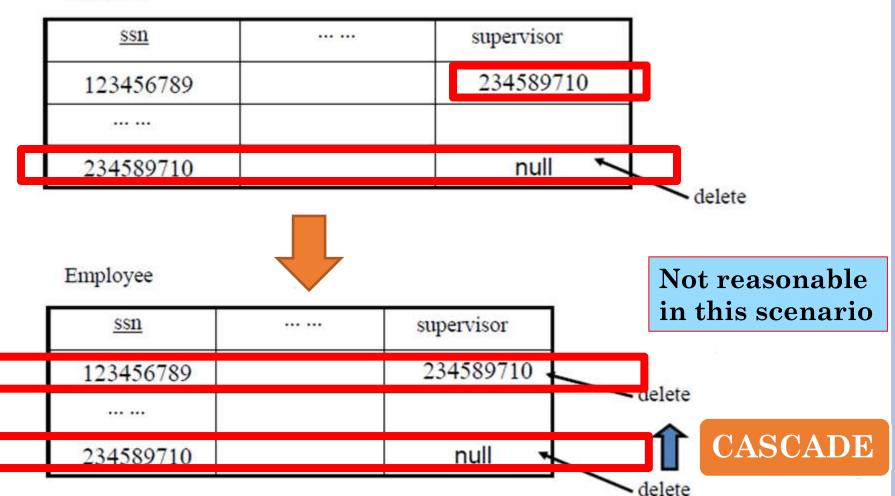
Cancel the operation that causes the violation

Perform the operation but inform the user of the violation

Trigger additional updates so the violation is corrected

- CASCADE option
- SET NULL option

Execute a user-specified error-correction routine

REFERENTIAL INTEGRITY OPTIONS

Employee

ssn	... ...	supervisor
123456789		234589710
... ...		
234589710		null	← delete

Employee

Not reasonable in this scenario

ssn	... ...	supervisor
123456789		234589710	← delete
... ...		
234589710		null	← delete

CASCADE

REFERENTIAL INTEGRITY OPTIONS

Employee

ssn	... ...	supervisor
123456789		234589710
... ...		
234589710		null	← delete

Employee

ssn	... ...	supervisor
123456789		**NULL**
... ...		

SET NULL

In Class Exercise

Consider the following relations for a database that keeps track of automobile sales in a car dealership (OPTION refers to some optional equipment installed on an automobile):

- **CAR(Serial_no, Model, Manufacturer, Price)**
- **OPTION(Serial_no, Option_name, Price)**
- **SALE(Salesperson_id, Serial_no, Date, Sale_price)**
- **SALESPERSON(Salesperson_id, Name, Phone)**

- Draw a relational schema diagram specifying the foreign keys for this schema.

Lecture 4

DB Constraints

```
                    Schema-
                     Based
                   constraints
         ┌──────────────┼──────────────┬──────────────┐
```

| Domain constraints | Key constraints | Entity integrity constraints | Referential integrity constraints |

EMPLOYEE

Fname	Minit	Lname	Ssn	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
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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

Insert Operation can violate

- **Domain constraint**

- **Key constraint** (if key already exists)

- **Entity** (if PK contains Null)

- **Referential FK constraint**

Delete operation can violate

- **FK constraint**

Update operation can violate

- If no change in PK or FK => **Domain constraint**

- If modifies PK => delete a tuple and insert another

- If modifies FK => **FK constraint**

Quick Review

Operations and Constraints

CREATE TABLE

- Creates a new relation in the database
  - Specifies relation's attributes and their data types
  - Specifies constraints such as **NOT NULL** , **UNIQUE** , **CHECK** etc…

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

```
CREATE TABLE  DEPARTMENT(
      DNAME              VARCHAR(10)    NOT NULL ,
      DNUMBER            INTEGER  CHECK(DNUMBER >0 AND
                                        DNUMBER <25),
      MGRSSN             CHAR(9),
      MGRSTARTDATE       DATE
  );
```

ADDITIONAL DATA TYPES

DATE
- Made up of year-month-day in the format yyyy-mm-dd

TIME
- Made up of hour:minute:second in the format hh:mm:ss

TIME(i)
- Made up of hour:minute:second plus i additional digits specifying fractions of a second
- format is hh:mm:ss:ii...i

TIMESTAMP
- Has both DATE and TIME components

Constraints in SQL

- CREATE TABLE command allows us to specify the primary key, secondary keys, and foreign keys.
- **Key attributes** can be specified via the PRIMARY KEY and UNIQUE phrases

```
CREATE TABLE   DEPARTMENT
(
    DNAME               VARCHAR(10) NOT NULL,
    DNUMBER             INTEGER NOT NULL,
    MGRSSN              CHAR(9),
    MGRSTARTDATE        CHAR(9),
    PRIMARY KEY (DNUMBER),
    UNIQUE (DNAME),

);
```

Constraints in SQL

- CREATE TABLE command allows us to specify the primary key, secondary keys, and foreign keys.
- **Key attributes** can be specified via the PRIMARY KEY and UNIQUE phrases

```
CREATE TABLE   DEPARTMENT
(
    DNAME               VARCHAR(10) NOT NULL,
    DNUMBER             INTEGER NOT NULL,
    MGRSSN              CHAR(9),
    MGRSTARTDATE        CHAR(9),
    PRIMARY KEY (DNUMBER),
    UNIQUE (DNAME),
    FOREIGN KEY (MGRSSN) REFERENCES EMPLOYEE
);
```

How to handle violation
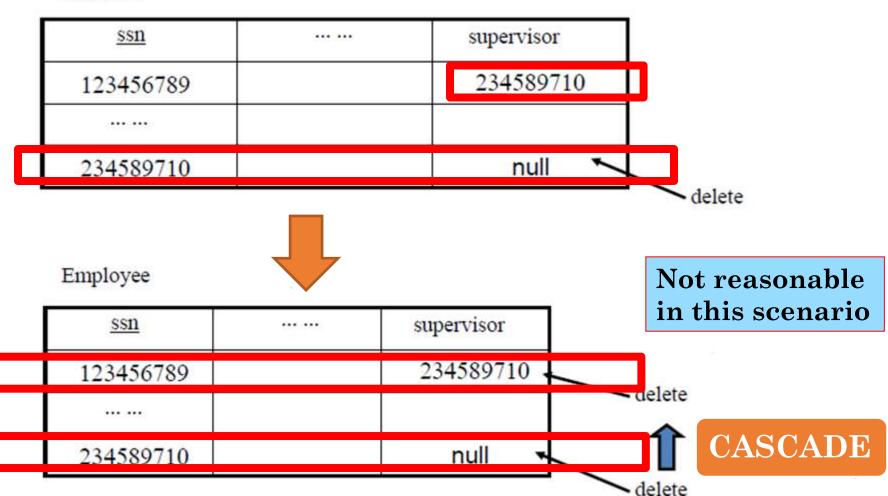
Cancel the operation that causes the violation

Perform the operation but inform the user of the violation

Trigger additional updates so the violation is corrected

- CASCADE option
- SET NULL option

Execute a user-specified error-correction routine

REFERENTIAL INTEGRITY OPTIONS

Employee

ssn	... ...	supervisor
123456789		234589710
... ...		
234589710		null

delete

Not reasonable in this scenario

Employee

ssn	... ...	supervisor
123456789		234589710
... ...		
234589710		null

delete

delete

CASCADE

REFERENTIAL INTEGRITY OPTIONS

Employee

ssn	... ...	supervisor
123456789		234589710
... ...		
234589710		null

delete

Employee

ssn	... ...	supervisor
123456789		NULL
... ...		

SET NULL

REFERENTIAL INTEGRITY OPTIONS

- We can specify RESTRICT, CASCADE, SET NULL or SET DEFAULT on foreign keys.

```
CREATE TABLE   DEPARTMENT
(
    DNAME              VARCHAR(10) NOT NULL,
    DNUMBER            INTEGER NOT NULL,
    MGRSSN             CHAR(9),
    MGRSTARTDATE       CHAR(9),
    PRIMARY KEY (DNUMBER),
    UNIQUE (DNAME),
    FOREIGN KEY (MGRSSN) REFERENCES EMPLOYEE
    ON DELETE SET NULL ON UPDATE  CASCADE
);
```

EMPLOYEE

Fname	Minit	Lname	Ssn	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

DEPARTMENT

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

REFERENTIAL INTEGRITY OPTIONS

CREATE TABLE   EMPLOYEE
```
    (
    NAME            VARCHAR(30) NOT NULL,
    SSN             CHAR(9),
    BDATE           DATE,
    DNO             INTEGER  DEFAULT 1,
    SUPERSSN        CHAR(9),
    PRIMARY KEY (ESSN),
```

);

REFERENTIAL INTEGRITY OPTIONS

CREATE TABLE   EMPLOYEE
 (
 ENAME   VARCHAR(30) NOT NULL,
 ESSN   CHAR(9),
 BDATE   DATE,
 DNO   INTEGER **DEFAULT 1,**
 SUPERSSN CHAR(9),
PRIMARY KEY (ESSN),

  FOREIGN KEY (DNO) REFERENCES DEPARTMENT
  ON DELETE SET DEFAULT **ON UPDATE** CASCADE,

);

REFERENTIAL INTEGRITY OPTIONS

CREATE TABLE EMPLOYEE
```
    (
    ENAME           VARCHAR(30) NOT NULL,
    ESSN            CHAR(9),
    BDATE           DATE,
    DNO             INTEGER  DEFAULT 1,
    SUPERSSN        CHAR(9),
    PRIMARY KEY (ESSN),

        FOREIGN KEY (DNO) REFERENCES DEPARTMENT
        ON DELETE SET DEFAULT ON UPDATE CASCADE,

        FOREIGN KEY (SUPERSSN) REFERENCES EMPLOYEE
        ON DELETE SET NULL ON UPDATE CASCADE

);
```

SQL CONSTRAINTS

- Assigning Names to Constraints

  CONSTRAINT deptPK PRIMARY KEY(Dnumber)

  CONSTRAINT deptSK UNIQUE(Dname)

CHECK Constraint

  CHECK (Dept_create_date <= Mgr_start_date)

DROP COMMAND

- Drop Command is used to delete schema or named schema elements such as table, domains, or constraints

Example:

DROP TABLE DEPENDENT;
DROP TABLE EMPLOYEE CASCADE;
DROP SCHEMA COMPANY;

In SQL-Server (T-SQL), DROP TABLE cannot be used to drop a table that is referenced by a FOREIGN KEY. The referencing FOREIGN KEY or the referencing table must first be dropped.

ALTER COMMAND

- The definition of table can be changed using ALTER command

- ALTER can be used to add an attribute to the relation
  - Initially, the new attribute will have NULLs in all the tuples of the relation
  - NOT NULL constraint is *not allowed* for such an attribute

Example :

ALTER TABLE EMPLOYEE ADD JOB   VARCHAR(12);

The database user have to enter a value for the new attribute JOB for each EMPLOYEE tuple.

ALTER TABLE

- ALTER command can be used to add or drop constraints

- **Example:**

  - **ALTER TABLE** EMPLOYEE **add constraint** unEmp **UNIQUE(**NAME**);**

  - **ALTER TABLE** EMPLOYEE **drop constraint** unEmp ;