UNIT II

Relational Model & Relational Algebra

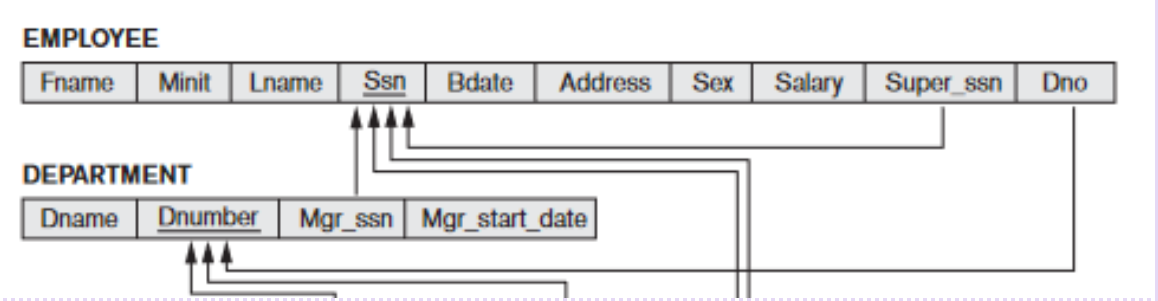
Update Operations, Transactions & Dealing with Constraint Violations

- The operations of the relational model can be categorized into **retrievals and updates**.
- **Modification or update operations** :
  - **There are three basic operations that can change the states of relations in the data-base: Insert, Delete, and Update (or Modify).**
  - **Insert** is used to insert one or more new tuples in a relation,
  - **Delete** is used to delete tuples, and
  - **Update**(or Modify) is used to change the values of some attributes in existing tuples.
- Whenever these operations are applied, the integrity constraints specified on the relational database schema should not be violated.

The Insert Operation

- The Insert operation provides a list of attribute values for a new tuple that is to be inserted into a relation R.
- **Insert can violate any of the four types of constraints:**
  - **Domain constraints** can be violated if an attribute value is given that does not appear in the corresponding domain or is not of the appropriate data type.
  - **Key constraints** can be violated if a key value in the new tuple t already exists in another tuple in the relation r(R).
  - **Entity integrity** can be violated if any part of the primary key of the new tuple t is NULL.
  - **Referential integrity** can be violated if the value of any foreign key in t refers to a tuple that does not exist in the referenced relation. Here are some examples to illustrate this discussion.

The Insert Operation:



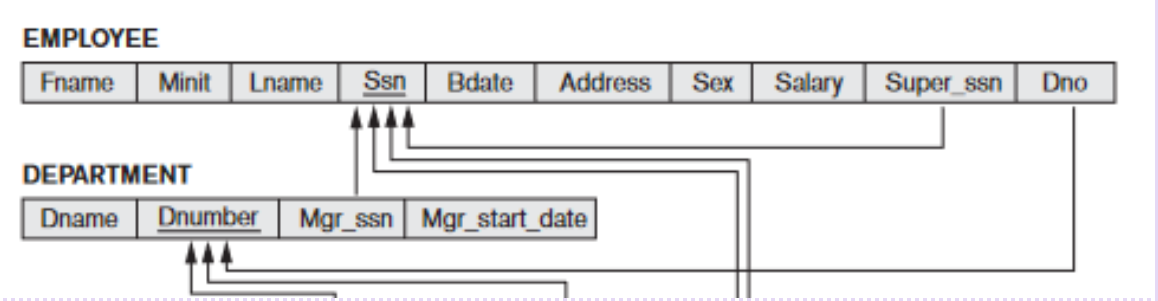
1) Insert <'Cecilia', 'F', 'Kolonsky',NULL, '1960-04-05', '6357 Windy Lane, Katy,TX', F, 28000,NULL, 4> into EMPLOYEE.

This insertion violates the entity integrity constraint (NULL for the primary key Ssn), so it is rejected

2) Insert <'Alicia', 'J', 'Zelaya', '999887777', '1960-04-05', '6357 Windy Lane, Katy,TX', F, 28000, '987654321', 4> into EMPLOYEE.

This insertion violates the key constraint because another tuple with the same Ssn value already exists in the EMPLOYEE relation, and so it is rejected.

The Insert Operation:



3) Insert <‘Cecilia’, ‘F’, ‘Kolonsky’, ‘677678989’,‘1960-04-05’,‘6357 Windswept,Katy, TX’, F, 28000, ‘987654321’, 7> into EMPLOYEE.

This insertion violates the referential integrity constraint specified on Dno in EMPLOYEE because no corresponding referenced tuple exists in DEPARTMENT with Dnumber= 7.

4) Insert <‘Cecilia’, ‘F’, ‘Kolonsky’, ‘677678989’,‘1960-04-05’,‘6357 Windy Lane,Katy, TX’, F, 28000,NULL, 4> into EMPLOYEE.

This insertion satisfies all constraints, so it is acceptable.

The Insert Operation:

If an insertion violates one or more constraints :

- the default option is to reject the insertion. In this case, it would be useful if the DBMS could provide a reason to the user as to why the insertion was rejected.
- Another option is to attempt to correct the reason for rejecting the insertion, but this is typically not used for violations caused by Insert

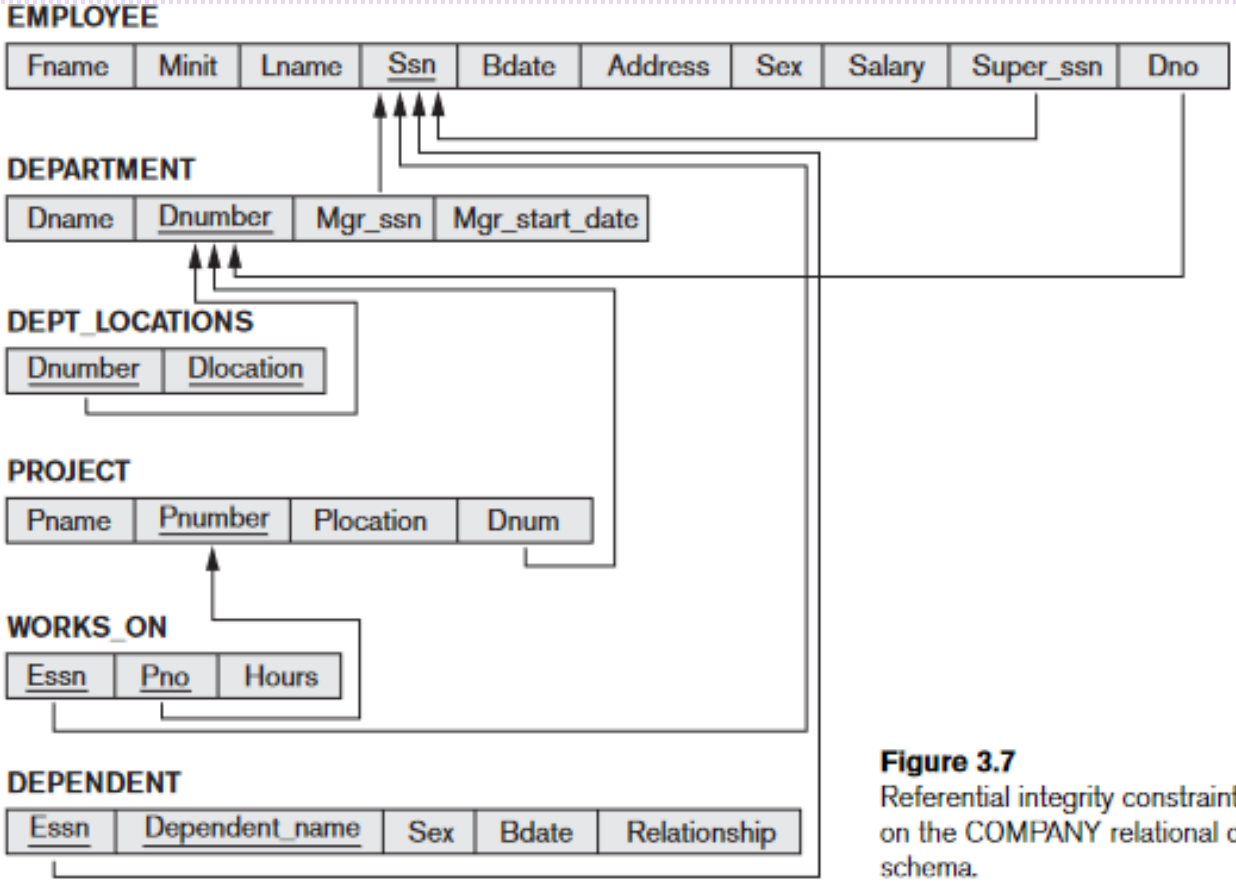


Figure 3.7
Referential integrity constraints displayed on the COMPANY relational database schema.

The Delete Operation

- The DELETE statement is used to delete rows from a table. Generally, DELETE statement removes one or more records form a table.
- **The Delete operation can violate only referential integrity.**
  - This occurs if the tuple being deleted is referenced by foreign keys from other tuples in the database.
  - To specify deletion, a condition on the attributes of the relation selects the tuple (or tuples) to be deleted.
  - Here are some examples :

1) Operation: Delete the WORKS_ON tuple with Essn= '999887777' and Pno= 10.

This deletion is acceptable and deletes exactly one tuple.

2) Delete the EMPLOYEE tuple with Ssn= '999887777'

- This deletion is not acceptable, because there are tuples in WORKS_ON that refer to this tuple.
- Hence, if the tuple in EMPLOYEE is deleted, referential integrity violations will result.

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

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

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

3) Delete the EMPLOYEE tuple with Ssn= ‘333445555’.

- This deletion is not acceptable
- This deletion will result in even worse referential integrity violations, because the tuple involved is referenced by tuples from the **EMPLOYEE,DEPARTMENT,WORKS_ON, and DEPENDENT** relations.

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

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

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

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

The Delete Operation:

Several options are available if a deletion operation causes a violation.

1) **Reject t**he deletion.

2) **Cascade**, is to attempt to cascade (or propagate) the deletion by deleting tuples that reference the tuple that is being deleted.

For example, in operation 2, the DBMS could automatically delete the offending tuples from WORKS_ON with Essn= '999887777'.

3) **set null or set default**, is to modify the referencing attribute values that cause the violation; each such value is either set to NULL or changed to reference another default valid tuple. Notice that if a referencing attribute that causes a violation is part of the primary key, it cannot be set to NULL; otherwise, it would violate entity integrity.

4) Combinations of these three options are also possible.

The Update Operation

The Update (or Modify) operation is used to change the values of one or more attributes in a tuple (or tuples) of some relation R.

It is necessary to specify a condition on the attributes of the relation to select the tuple (or tuples) to be modified.

Here are some examples

1) Update the salary of the EMPLOYEE tuple with Ssn= '999887777' to 28000.

Acceptable.

2) Update the Dno of the EMPLOYEE tuple with Ssn= '999887777' to 1.

Acceptable.

3) Update the Dno of the EMPLOYEE tuple with Ssn= '999887777' to 7.

Unacceptable, because it violates referential integrity.

4) Update the Ssn of the EMPLOYEE tuple with Ssn= '999887777' to'987654321'.

Unacceptable, because it violates primary key constraint by repeating a value that already exists as a primary key in another tuple; it violates referential integrity constraints because there are other relations that refer to the existing value of Ssn

The Update Operation

Updating an attribute that is neither part of a primary key nor of a foreign key usually causes no problems; the DBMS need only check to confirm that the new value is of the correct data type and domain. Modifying a primary key value is similar to deleting one tuple and inserting another in its place because we use the primary key to identify tuples.

Dealing with constraint violations:

Similar options exist to deal with referential integrity violations caused by Update as those options discussed for the Delete operation.