



Discussion #3

Answers to Selected Problems of Chapter 5

Suppose each of the following update operations is applied directly to the database of Figure 1 bellow, discuss all integrity constraints violated by each operation, if any, and the different ways of enforcing these constraints:

(a) Insert < 'Robert', 'F', 'Scott', '943775543', '21-JUN-42', '2365 Newcastle Rd, Bellaire, TX', M, 58000, '888665555', 1 > into EMPLOYEE.

No constraint violations.

(b) Insert < 'ProductA', 4, 'Bellaire', 2 > into PROJECT.

Violates referential integrity because DNUM=2 and there is no tuple in the DEPARTMENT relation with DNUMBER=2.

We may enforce the constraint by:

- (i) rejecting the insertion of the new PROJECT tuple
- (ii) changing the value of DNUM in the new PROJECT tuple to an existing DNUMBER value in the DEPARTMENT relation
- (iii) inserting a new DEPARTMENT tuple with DNUMBER=2.

(c) Insert < 'Production', 4, '943775543', '01-OCT-88' > into DEPARTMENT.

Violates both the key constraint and referential integrity.

Violates the key constraint because there already exists a DEPARTMENT tuple with DNUMBER=4.

We may enforce the constraint by:

- (i) rejecting the insertion
- (ii) changing the value of DNUMBER in the new DEPARTMENT tuple to a value that does not violate the key constraint

Violates referential integrity because MGRSSN='943775543' and there is no tuple in the EMPLOYEE relation with SSN='943775543'

We may enforce the constraint by:

- (i) rejecting the insertion

- (ii) changing the value of MGRSSN to an existing SSN value in EMPLOYEE
- (iii) inserting a new EMPLOYEE tuple with SSN='943775543'.

(d) Insert < '677678989', null, '40.0' > into WORKS_ON.

Violates both the entity integrity and referential integrity.

Violates entity integrity because PNO, which is part of the primary key of WORKS_ON, is null.

We may enforce the constraint by:

- (i) rejecting the insertion
- (ii) changing the value of PNO in the new WORKS_ON tuple to a value of PNUMBER that exists in the PROJECT relation

Violates referential integrity because ESSN='677678989' and there is no tuple in the EMPLOYEE relation with SSN='677678989'.

We may enforce the constraint by:

- (i) rejecting the insertion
- (ii) changing the value of ESSN to an existing SSN value in EMPLOYEE
- (iii) inserting a new EMPLOYEE tuple with SSN='677678989'.

(e) Insert < '453453453', 'John', M, '12-DEC-60', 'SPOUSE' > into DEPENDENT.

No constraint violations.

(f) Delete the WORKS_ON tuples with ESSN= '333445555'.

No constraint violations.

(g) Delete the EMPLOYEE tuple with SSN= '987654321'.

Violates referential integrity because several tuples exist in the WORKS_ON, DEPENDENT, DEPARTMENT, and EMPLOYEE relations that reference the tuple being deleted from EMPLOYEE.

We may enforce the constraint by:

- (i) rejecting the deletion
- (ii) deleting all tuples in the WORKS_ON, DEPENDENT, DEPARTMENT, and EMPLOYEE relations whose values for ESSN, ESSN, MGRSSN, and SUPERSSN, respectively, is equal to '987654321'.

(h) Delete the PROJECT tuple with PNAME= 'ProductX'.

Violates referential integrity because two tuples exist in the WORKS_ON relations that reference the tuple being deleted from PROJECT

We may enforce the constraint by:

- (i) rejecting the deletion
- (ii) deleting the tuples in the WORKS_ON relation whose value for PNO=1 (the value for the primary key PNUMBER for the tuple being deleted from PROJECT).

(i) Modify the MGRSSN and MGRSTARTDATE of the DEPARTMENT tuple with DNUMBER=5 to '123456789' and '01-OCT-88', respectively.

No constraint violations.

(j) Modify the SUPERSSN attribute of the EMPLOYEE tuple with SSN= '999887777' to '943775543'.

Violates referential integrity because the new value of SUPERSSN='943775543' and there is no tuple in the EMPLOYEE relation with SSN='943775543'

We may enforce the constraint by:

- (i) rejecting the deletion
- (ii) inserting a new EMPLOYEE tuple with SSN='943775543'.

(k) Modify the HOURS attribute of the WORKS_ON tuple with ESSN= '999887777' and PNO= 10 to '5.0'.

No constraint violations.

Q2) Consider the following six relations for an order-processing database application in a company:

CUSTOMER (Cust#, Cname, City)

ORDER (Order#, Odate, Cust#, Ord_Amt)

ORDER_ITEM (Order#, Item#, Qty)

ITEM (Item#, Unit_price)

SHIPMENT (Order#, Warehouse#, Ship_date)

WAREHOUSE (Warehouse#, City)

Here, Ord_Amt refers to total dollar amount of an order; Odate is the date the order was placed; Ship_date is the date an order is shipped from the warehouse. Assume that an order can be shipped from several warehouses. Specify foreign keys for this schema, stating any assumptions you make.

Answer:

Strictly speaking, a foreign key is a *set* of attributes, but when that set contains only one attribute, then that attribute itself is often informally called a foreign key. The schema of this question has the following five foreign keys:

1. the attribute Cust# of relation ORDER that references relation CUSTOMER,
2. the attribute Order# of relation ORDER_ITEM that references relation ORDER,
3. the attribute Item# of relation ORDER_ITEM that references relation ITEM,
4. the attribute Order# of relation SHIPMENT that references relation ORDER, and
5. the attribute Warehouse# of relation SHIPMENT that references relation WAREHOUSE.

EMPLOYEE	FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	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	

DEPT_LOCATIONS	DNUMBER	DLOCATION
	1	Houston
	4	Stafford
	5	Bellaire
	5	Sugarland
		Houston

DEPARTMENT	DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
	Research	5	333445555	1988-05-22
	Administration	4	987654321	1995-01-01
	Headquarters	1	888665555	1981-06-19

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

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

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

Figure 1