Database Management Systems – MCIS 5133
Dr. Cheng Hong
Homework 2 – Spring 2022

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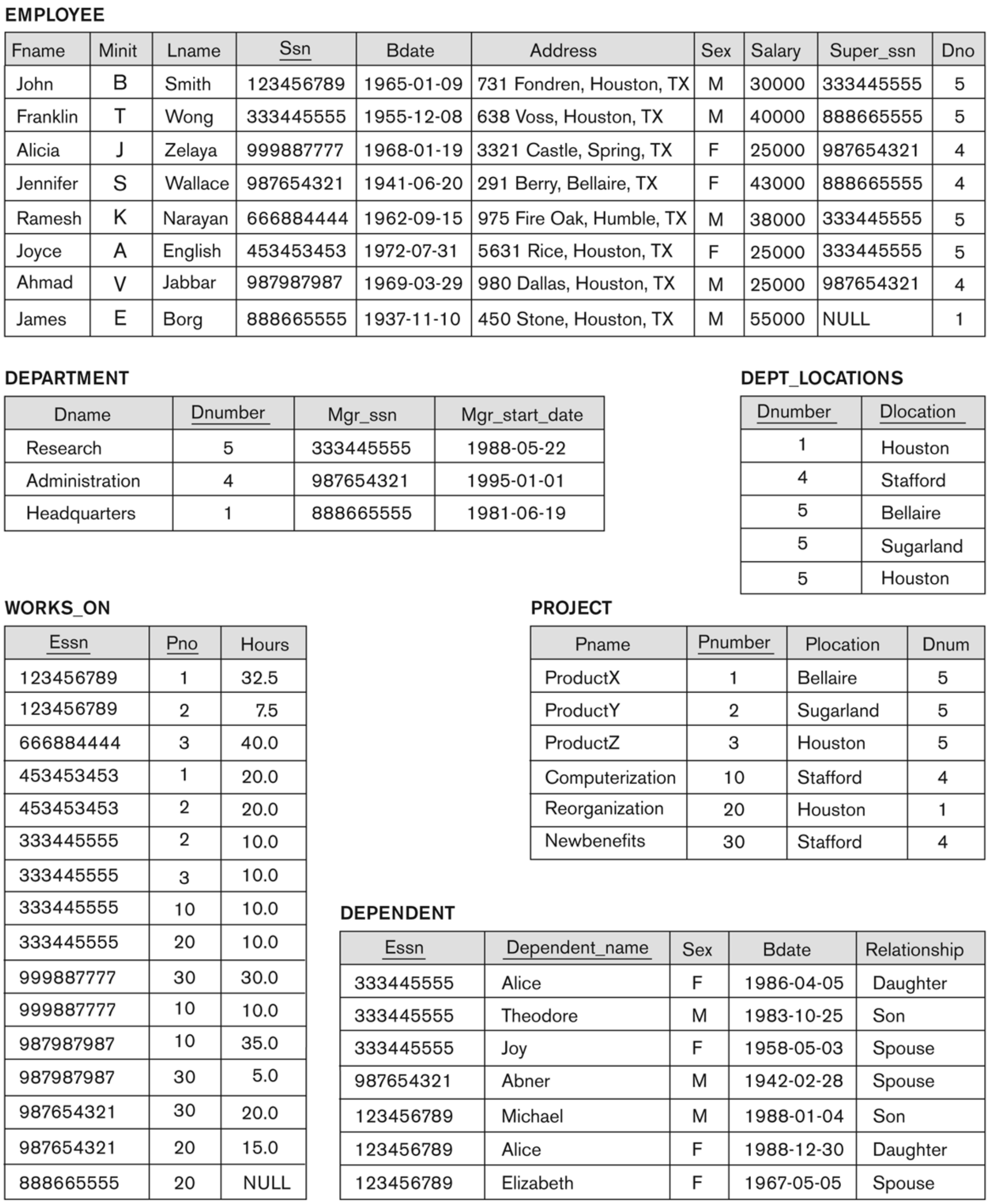
Section: 001

1.

Figure 5.6
One possible database state for the COMPANY relational database schema.



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

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

Suppose each of the following update operations is applied directly to the database of Figure 5.6. Discuss all integrity constraints violated by each operation, if any.

(a) Insert < 'Robert', 'F', 'Scott', ‘123456789’, '1942-06-21', '2365 Newcastle Rd, Bellaire, TX', M, 58000, ‘345678912’, 1 > into EMPLOYEE.

Answer: 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.

(b) Insert < 'ProductA', 4, 'Bellaire', 6 > into PROJECT.

Answer: This insertion violates **the referential integrity constraint** specified on Dnum in PROJECT because no corresponding referenced tuple exists in DEPARTMENT with Dnumber = 6.

We may enforce the constraint by:

1. rejecting the insertion
2. changing the value of Dnum in the new PROJECT tuple to a value of Dnumber that exists in the DEPARTMENT relation

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(c) Insert < 'Production', 6, '9123335555', '1988-10-01' > into DEPARTMENT.

Answer: This insertion violates **the referential integrity constraint** specified on Mgr_ssn in DEPARTMENT because no corresponding referenced tuple exists in EMPLOYEE with Ssn = '9123335555'.

We may enforce the constraint by:

1. rejecting the insertion
2. changing the value of Mgr_ssn in the new DEPARTMENT tuple to a value of Ssn that exists in the EMPLOYEE relation

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(d) Insert < 123456789, null, '20.0' > into WORKS_ON.

Answer: This insertion violates **the entity integrity** because Pno which is part of the primary key of WORKS_ON, is NULL.

We may enforce the constraint by:

1. rejecting the insertion
2. changing the value of Pno in the new WORKS_ON tuple to a value of Pnumber that exists in the PROJECT relation

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(e) Insert < '453666453', 'John', M, '1960-12-10', 'SPOUSE' > into DEPENDENT.

Answer: This insertion violates **the referential integrity constraint** specified on Essn in DEPENDENT because no corresponding referenced tuple exists in EMPLOYEE with Ssn = 453666453.

We may enforce the constraint by:

1. Rejecting the insertion
2. Changing the value of Essn in the new DEPENDENT tuple to a value of Ssn that exists in the EMPLOYEE relation

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(f) Delete the WORKS_ON tuples with ESSN= ‘123456789’.

Answer: This deletion is **acceptable** and deletes all the tuples with Essn = ‘123456789’ in the WORKS_ON relation

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(g) Delete the EMPLOYEE tuple with SSN= ‘123456789’.

Answer: This deletion will result in **the referential integrity violations**, because the tuple involved is referenced by tuples from the WORKS_ON, and DEPENDENT relations.

We may enforce the constraint by:

1. Rejecting the deletion
2. Cascading the deletion to all tuples in the WORKS_ON and DEPENDENT relations whose values fo ESSN is equal to ‘123456789'

(h) Delete the DEPARTMENT tuple with DNAME= ‘Research’.

Answer: This deletion will result in **the referential integrity violations**, because the tuple involved is referenced by tuples from the EMPLOYEE, DEPT_LOCATIONS and PROJECT relations.

We may enforce the constraint by:

1. Rejecting the deletion
2. Cascading the deletion to all tuples in the EMPLOYEE, DEPT_LOCATIONS and PROJECT relations whose values for Dnumber =5 which corresponds to the Dname = ‘Research’

(i) Modify the MGRSSN and MGRSTARTDATE of the DEPARTMENT tuple with DNUMBER=5 to '345678912' and '1988-10-01', respectively.

Answer: This update operation will result in **the referential integrity violations**, because the attribute MGRSSN to be updated is a foreign key that should be referring to the Ssn from the EMPLOYEE relation. The new value specified ‘345678912’ is not available in the EMPLOYEE relation.

We may enforce the constraint by:

1. Rejecting the Update
2. Modifying the value of MGRSSN to a value that exists in the Ssn of the EMPLOYEE relation.

(j) Modify the SUPERSSN attribute of the EMPLOYEE tuple with SSN= '999887777' to '123456789'.

Answer: This is Acceptable. No constraints are violated

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

Answer: This is Acceptable. No constraints are violated.

2. 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)

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. Draw a diagram like slide 5-16 in Chapter 5-2 showing referential integrity constraints for this schema, stating any assumptions you make

Assumptions:

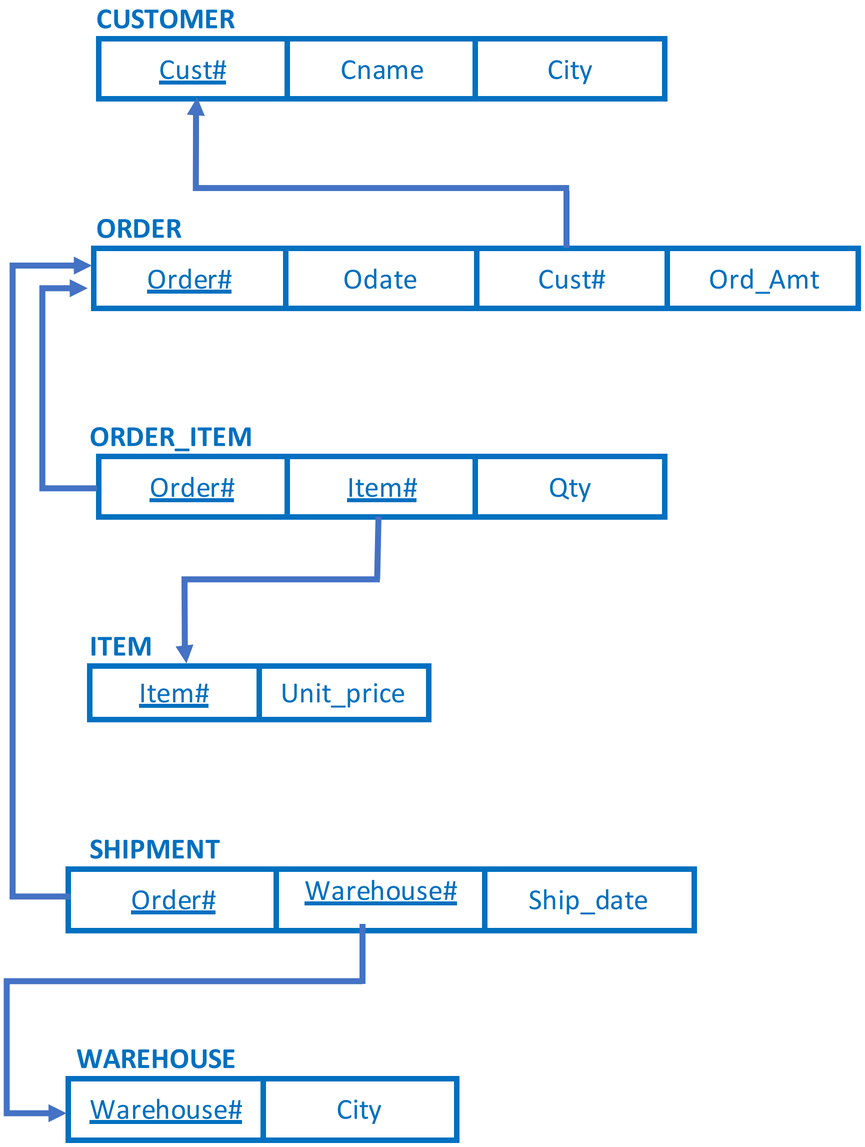
Referential Integrity constraints

1. Cust# in the relation ORDER is a foreign key referring to Cust# in the relation CUSTOMER
2. Order# in the relation ORDER_ITEM is a foreign key referring to Order# in the relation ORDER
3. Item# in the relation ORDER_ITEM is a foreign key referring to Item# in relation ITEM
4. Order# in the relation SHIPMENT is a foreign key referring to Order# in the relation ORDER
5. Warehouse# in the relation SHIPMENT is a foreign key referring to Warehouse# in WAREHOUSE

Semantic Integrity constraints

6. Ship_date in the relation SHIPMENT should be later than the Odate in the ORDER relation
7. Ord_Amt in the relation ORDER would be derived value based on the following calculation, for every unique value of Order# in ORDER_ITEM.

   a. Take the Order# in the relation ORDER for which the Ord_Amt has to be calculated
   b. Search for this Order# in the relation, ORDER_ITEM. Take the corresponding Item# in the relation ORDER_ITEM.
   c. Search for this Item# in the relation, ITEM and retrieve the Unit_price.
   d. Take the Unit_price and multiply with the Qty of the tuple from ORDER_ITEM retrieved in step b.
   e. Perform a sum of all such values for each tuple obtained as a part of step b.


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