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UCS1412: Database Lab
Assignment 9A: Database Design using Normal Forms

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Consider the following relation Company with the set of functional dependencies:
COMPANY(empid, name, address, bdate, sex, salary, dno, dname, mgr_id, pno, pname, pdno, hrs)
fd1: empid -> name, address, bdate, sex, salary, dno
fd2: dno -> dname, mgr_id
fd3: pno -> pname, pdno where pdno is the department controlling the project.
fd4: empid, pno -> hrs

Identify the primary key. Given the FD, key attributes now decompose the Company relation into various Normal forms.
To prove that the decomposition is correct: apply the two properties
a) The lossless-join decomposition.
b) Preservation of FD.

For lossless-join decomposition, use the instances as shown below to populate your Company relation before decomposition.

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

From the above instances, its clear that the relation Company has 16 tuples. Join all the decomposed relations and prove that the join results in loss-less join decomposition.

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Assignment 9B: Database Design using ER diagram
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Consider the following set of requirements for a UNIVERSITY database that is used to keep track of students' transcripts.

(a) The database will keep student data (STUDENT) and stores each student's name (Sname, composed of first name (FName), last name (LName)), student id (Sid, unique for every student), address (Addr), phone (Phone), major code (Major), and date of birth (DoB), sex, degree (Degree) program (B.A., B.S., ..., Ph.D.) and minor (Minor) department (if any). A student is assigned to one primary academic department. It is required to keep track of the student's grades in each section the student has completed.

(b) Each department (DEPARTMENT) has a unique name (DName), a unique code number (DCode) and phone (Dphone) and college (College)

(c) A department offers a number of courses (COURSE), each of which has a unique course name (CoName), a unique code number (CCode), a course level (Level: this can be coded as 1 for freshman level, 2 for sophomore, 3 for junior, 4 for senior, 5 for MS level, and 6 for PhD level), a course credit hours (Credits), and a course description (CDesc).

(d) Courses are offered as sections (SECTION). Each section is related to a single course and a single instructor and has a unique section identifier (SecId). A section also has a section number (SecNo: this is coded as 1, 2, 3, . . . for multiple sections offered during the same semester/year), semester (Sem), year (Year), classroom (Croom).

Notice that for the SECTION entity type, only SecID showed as an underlined key, but because of the miniworld constraints, other combinations of values have to be unique for each section entity. For example, consider the following:
(SecNo, Sem, Year, CCode (of the COURSE related to the SECTION)): This specifies that the section numbers of a particular course must be different during each particular semester and year.

1) Draw ER diagram for the above requirements. Mention the constraints in the diagram.
2) Convert the ER into the corresponding relations using ER-Relational Mapping.

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