

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

To find primary key:

Set of Attribute(s) : Closure set

Essn : { Essn, name, address, bdate, sex, salary, dno, dname, mgr_ssn }

Dno : { dno, dname, mgr_ssn }

Pno : { pno, pname, pdno }

{Essn,dno} : { Essn,name, address, bdate, sex, salary, dno, dname, mgr_ssn }

{dno,pno} : { dno, dname, mgr_ssn ,pno, pname, pdno }

{Essn,pno} : { Essn,name, address, bdate, sex, salary, dno, dname, mgr_ssn, pno, pname, pdno, Hours }

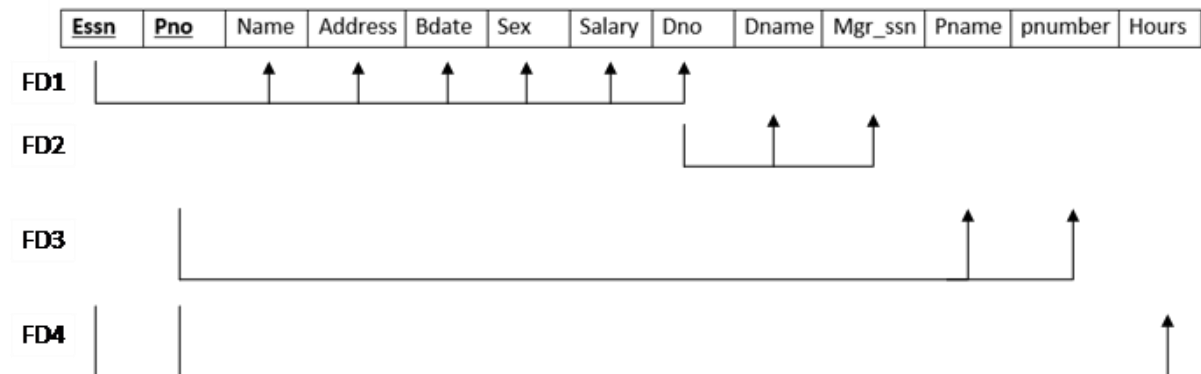
{Essn,dno,pno} : { Essn,name, address, bdate, sex, salary, dno, dname, mgr_ssn, pno, pname, pdno, Hours }

KEY

- SUPER KEY
 1. {empid, pno}
 2. {empid, pno, dno}
- CANDIDATE KEY AND PRIMARY KEY
 1. {empid, pno}

Relation:

- 1NF



Since there are no multi-valued or composite attributes it satisfies 1NF.

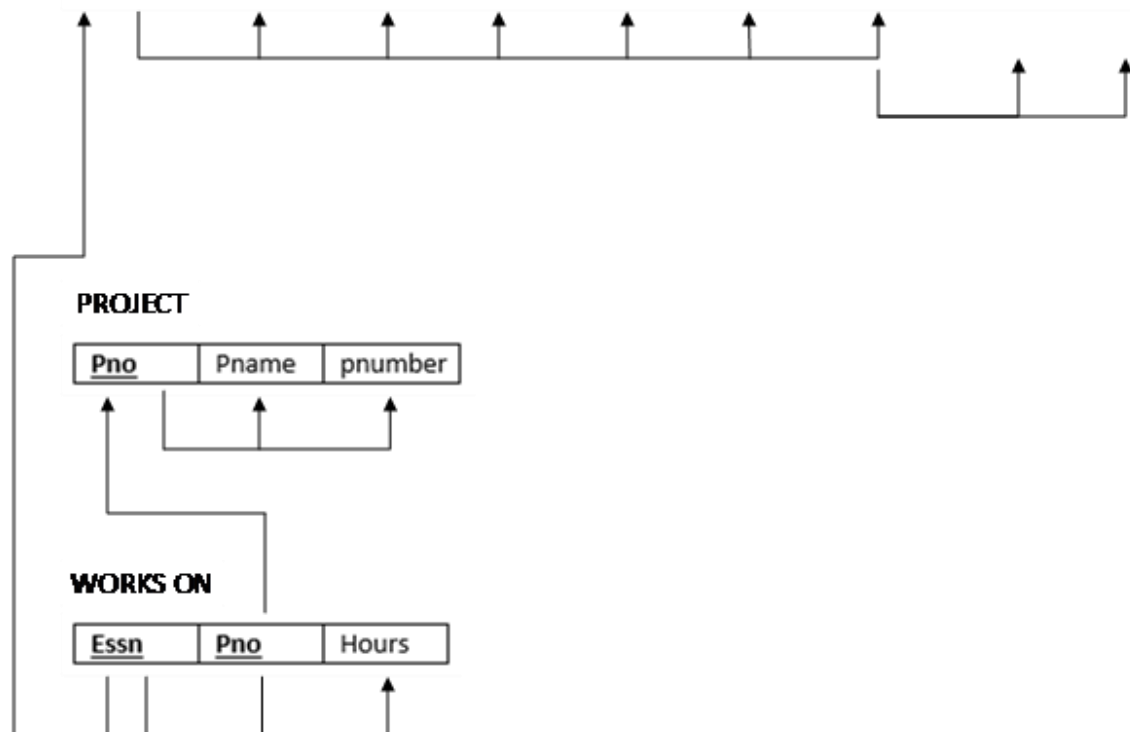
Before Decomposition :

Essn	Name	Address	DOB	Sex	Salary	Dno	Dname	Mgr_ssn	Pnumber	Pname	Dnumber	Hours
123456789	John	731,Fondren	9/1/1965	M	30000	5	Research	333445555	1	ProductX	5	32.5
123456789	John	731,Fondren	9/2/1965	M	30000	5	Research	333445555	2	ProductY	5	7.5
666884444	Ramesh	975,Fire Oak	9/3/1962	M	38000	5	Research	333445555	3	Productz	5	40
453453453	Joyce	5631,R Ice	9/4/1972	F	25000	4	Admin	987654321	1	ProductX	5	20
453453453	Joyce	5631,R Ice	9/5/1972	F	25000	4	Admin	987654321	2	ProductY	5	20
333445555	Franklin	638,Voss	9/6/1955	M	40000	5	Research	333445555	2	ProductY	5	10
333445555	Franklin	638,Voss	9/7/1955	M	40000	5	Research	333445555	3	Productz	5	10
333445555	Franklin	638,Voss	9/8/1955	M	40000	5	Research	333445555	10	Computer	4	10
333445555	Franklin	638,Voss	9/9/1955	M	40000	5	Research	333445555	20	Reorgaize	1	10
999887777	Alicia	3321,Castle	9/10/1968	F	25000	4	Admin	987654321	30	Benefits	4	30
999887777	Alicia	3321,Castle	9/11/1968	F	25000	4	Admin	987654321	10	Computer	4	10
987987987	Ahmad	980 Da llas	9/12/1969	M	25000	4	Admin	987654321	10	Computer	4	35
987987987	Ahmad	980 Da llas	9/13/1969	M	25000	4	Admin	987654321	30	Benef its	4	5
987654321	Jennifer	291,Berry	9/14/1941	F	43000	4	Admin	987654321	30	Benef its	4	20
987654321	Jennifer	291,Berry	9/15/1941	F	43000	4	Admin	987654321	20	Reorgan ize	1	15
888665555	James	450Stone	9/16/1937	M	55000	1	Hq	888665555	20	Reorgan ize	1	NULL

- 2NF

EMPLOYEE

<u>Essn</u>	Name	Address	Bdate	Sex	Salary	Dno	Dname	Mgr_ssn
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It satisfies **2NF** as there are no partial dependencies.

- 3NF

DEPARTMENT

Dno	Dname	Mgr_ssn
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EMPLOYEE

<u>Essn</u>	Name	Address	Bdate	Sex	Salary	Dno
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PROJECT

<u>Pno</u>	Pname	pnumber
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WORKS ON

<u>Essn</u>	<u>Pno</u>	Hours
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This is in **3NF** as there are no transitive dependencies for non-prime attributes.
 This is also in **BCNF** as every dependency is of the form:
 $X \rightarrow Y$, where X is a superkey.

To prove lossless decomposition and preservation of FD

All 4 functional dependencies are present in the final decomposed tables as indicated.
Hence, all FDs are preserved.

Relations after decomposition:

DEPARTMENT

Dnumber	Dname	mgr_ssn
1	HQ	888665555
2	Admin	987654321
5	Research	333445555

WORKS ON

Essn	Pnumber	Hours
123456789	1	32.5
123456789	2	7.5
666884444	3	40
453453453	1	20
453453453	2	20
333445555	2	10
333445555	3	10
333445555	10	10
333445555	20	10
99988777	30	30
99988777	10	10
98798798	10	35
98798798	30	5
98765432	30	20
98765432	20	15
888665555	20	NULL

EMPLOYEE

Essn	Name	Address	DOB	sex	salary	Dnumber
123456789	John	731,Fondren	9/1/1965	M	30000	5
666884444	Ramesh	975,Fire Oak	15-09-1962	M	38000	5
453453453	Joyce	5631,Rice	31-07-1972	F	25000	4
333445555	Franklin	638,Voss	8/12/1955	M	40000	5
999887777	Alida	3321,castle	19-01-1968	F	25000	4
987987987	Ahmad	980 Dallas	29-03-1969	M	25000	4
987654321	Jennifer	291,Berry	20-06-1941	F	43000	4
888665555	James	450Stone	10/11/1937	M	55000	1

PROJECT

Pnumber	Pname	Dnumber
1	ProductX	5
2	ProductY	5
3	ProductZ	5
10	Computer	4
20	Reorganize	1
30	Benefits	4

Joining all the decomposed tables:

(DEPARTMENT ⋈ EMPLOYEE ⋈ PROJECT ⋈ WORKS ON):

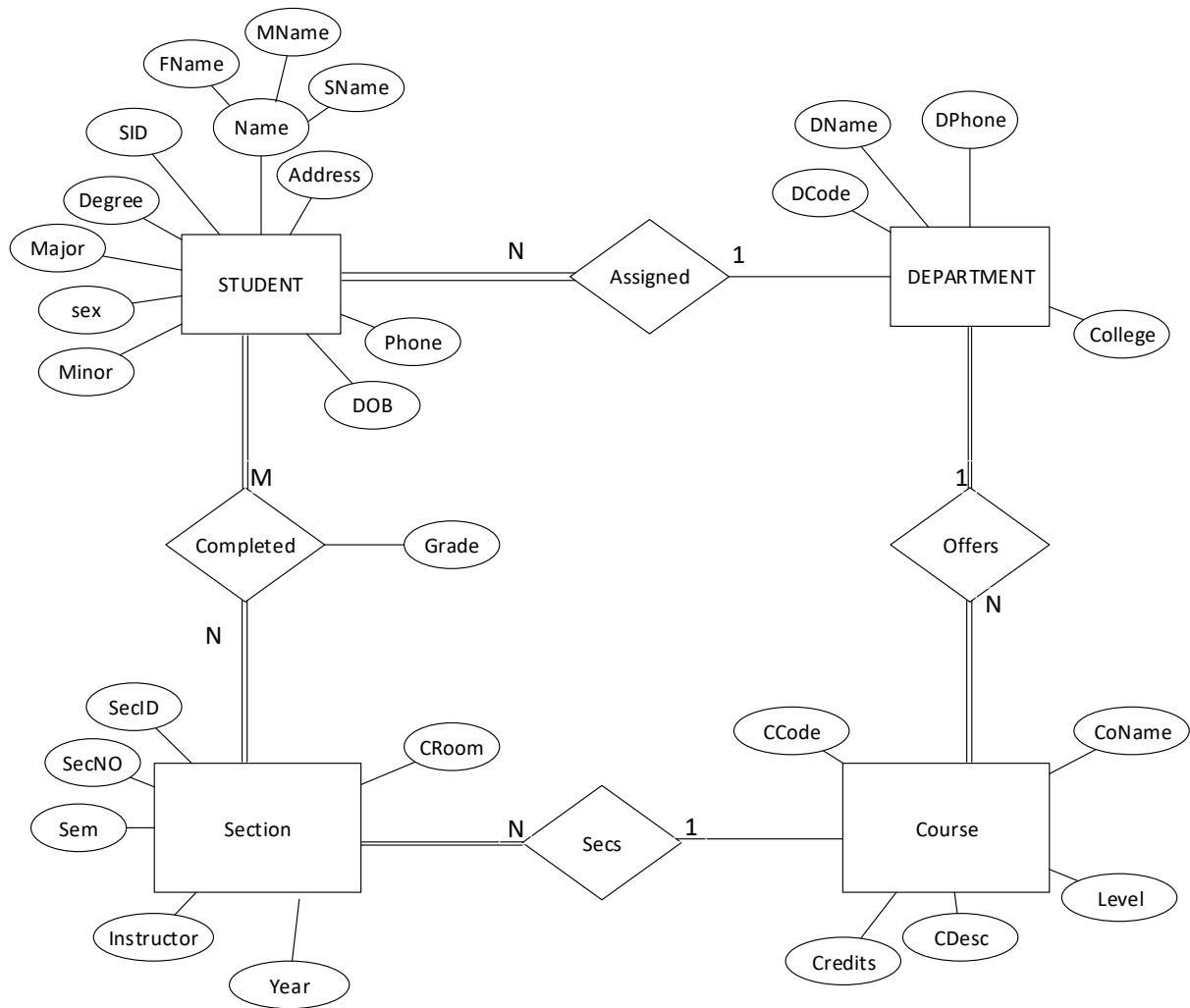
Dnumber	Dname	Mgr_ssn	Essn	Name	Address	DOB	Sex	Salary	pnumber	Pname	Dnumber	Hours
5	Research	333445555	123456789	John	731,Fondren	9/1/1965	M	30000	1	ProductX	5	32.5
5	Research	333445555	123456789	John	731,Fondren	9/2/1965	M	30000	2	ProductY	5	7.5
5	Research	333445555	666884444	Ramesh	975,Fire Oak	9/3/1962	M	38000	3	ProductZ	5	40
4	Admin	987654321	453453453	Joyce	5631,Rice	9/4/1972	F	25000	1	ProductX	5	20
4	Admin	987654321	453453453	Joyce	5631,Rice	9/5/1972	F	25000	2	ProductY	5	20
5	Research	333445555	333445555	Franklin	638,Voss	9/6/1955	M	40000	2	ProductY	5	10
5	Research	333445555	333445555	Franklin	638,Voss	9/7/1955	M	40000	3	ProductZ	5	10
5	Research	333445555	333445555	Franklin	638,Voss	9/8/1955	M	40000	10	Computer	4	10
5	Research	333445555	333445555	Franklin	638,Voss	9/9/1955	M	40000	20	Reorgaize	1	10
4	Admin	987654321	999887777	Alicia	3321,Castle	9/10/1968	F	25000	30	Benefits	4	30
4	Admin	987654321	999887777	Alicia	3321,Castle	9/11/1968	F	25000	10	Computer	4	10
4	Admin	987654321	987987987	Ahmad	980 Da llas	9/12/1969	M	25000	10	Computer	4	35
4	Admin	987654321	987987987	Ahmad	980 Da llas	9/13/1969	M	25000	30	Benef its	4	5
4	Admin	987654321	987654321	Jennifer	291,Berry	9/14/1941	F	43000	30	Benef its	4	20
4	Admin	987654321	987654321	Jennifer	291,Berry	9/15/1941	F	43000	20	Reorgan ize	1	15
1	Hq	888665555	888665555	James	450Stone	9/16/1937	M	55000	20	Reorgan ize	1	NULL

This is identical to the original relation.
Hence, the decomposition is loss-less.

Assignment 9B: Database Design using ER diagram

1. ER diagram:

University Database



2. Relational Mapping:

STUDENT

<u>SID</u>	FName	MName	Sname	Address	Phone	DOB	Sex	Degree	Major	Minor	DCode
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DEPARTMENT

<u>Dcode</u>	Dname	Dphone	College
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COURSE

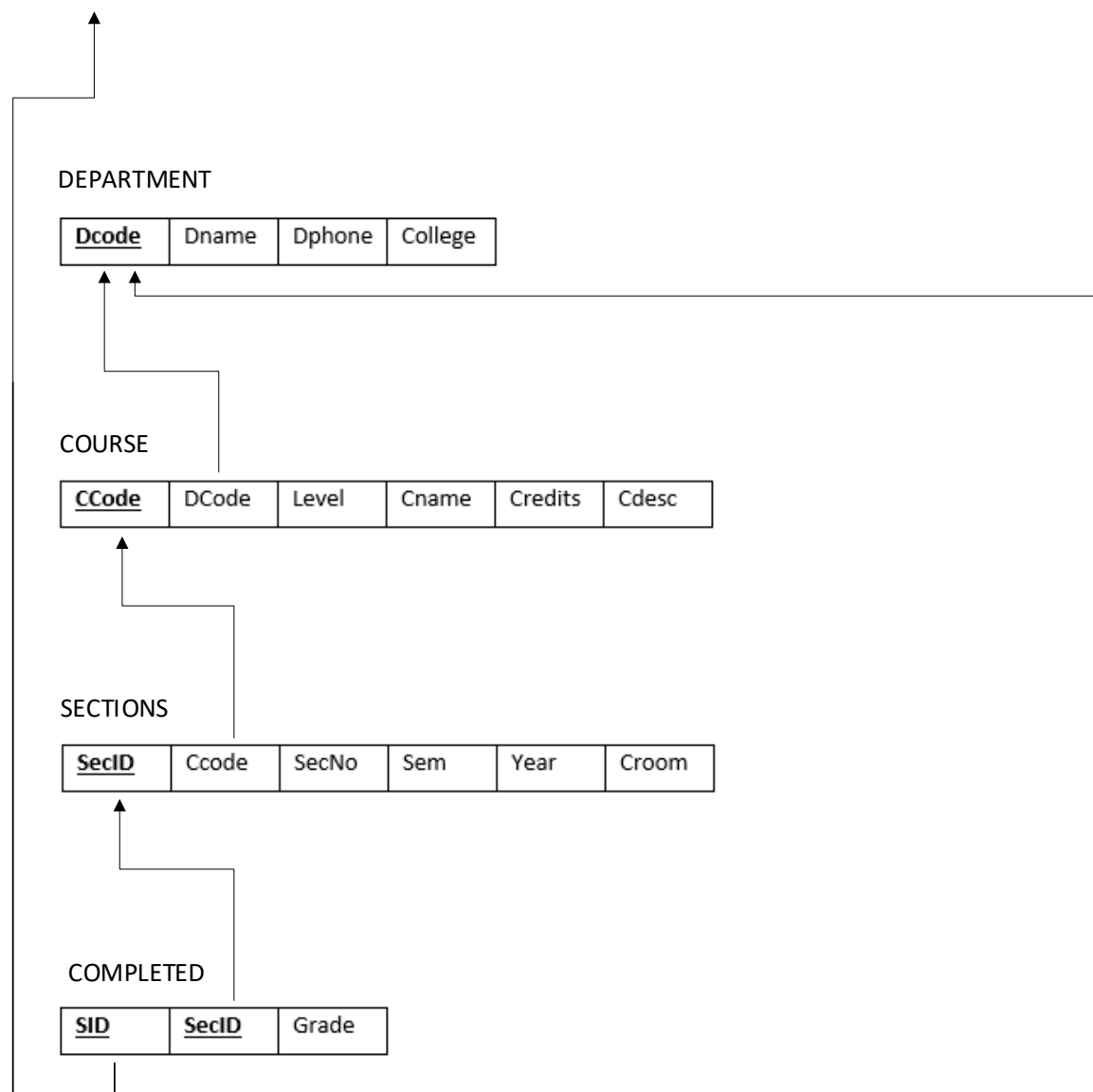
<u>CCode</u>	DCode	Level	Cname	Credits	Cdesc
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SECTIONS

<u>SecID</u>	Ccode	SecNo	Sem	Year	Croom
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COMPLETED

<u>SID</u>	<u>SecID</u>	Grade
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DONE BY

GOKHULNATH T
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