1. Find every department that has a location in Chicago

π ((DEPT\_LOCATION))

D\_NUMBER (D\_LOCATION = “Chicago”)

1. Find every project managed by a department with a location in Chicago

π ((PROJECT \* DEPT\_LOCATIONS))

PROJECT.p\_number (PROJECT.d\_number = D\_EPT\_LOCATIONS.d\_number)

and (DEPT\_LOCATIONS.d\_location = “Chicago”)

1. Find every department whose manager works on a project managed by a department with a location in Chicago

π ( (DEPARTMENT \* WORKS\_ON \* PROJECT \* DEPT\_LOCATIONS))

DEPARTMENT.d\_number (DEPARTMENT.mgrssn = WORKS\_ON.essn)

AND (WORKS\_ON.pno = PROJECT.p\_number)

AND (PROJECT.d\_number = DEPT\_LOCATIONS.d\_number)

AND (DEPT\_LOCATIONS.d\_location = “Chicago”)

1. Find every department that doesn’t have a location in Chicago

π(DEPARTMENT) - [π ( (DEPT\_LOCATIONS))]

D\_NUMBER D\_NUMBER (D\_LOCATION = “Chicago”)

1. Find every department that manages at least two projects

π ((rPROJ1(PROJECT) \* rPROJ2(PROJECT)))

PROJ1.dnum (PROJ1.pnumber != PROJ2.p\_number)

AND (PROJ1.dnum = PROJ2.dnum)

1. Find every employee who manages at least three departments

π ((rDEPT1(DEPT) \* rDEPT2(DEPT \* rDEPT3(DEPT)))

DEPT1.mgrssn (DEPT1.mgrssn = DEPT2.mgrssn)

AND (DEPT2.mgrssn = DEPT33.mgrssn)

AND (DEPT1.dnumber != DEPT2.dnumber)

AND (DEPT2.dnumber != DEPT3.dnumber)

AND (DEPT1.dnumber != DEPT3.dnumber)

1. Find every employee who neither has any supervisees nor manages any department

[ π (EMPLOYEE) - π (EMPLOYEE)]

ssn superssn

Ç [ π (EMPLOYEE) - π (DEPARTMENT)]

ssn mgrssn

1. Find every employee who either has no supervisees or manages no department (or both)

[ π (EMPLOYEE) - π (EMPLOYEE)]

ssn superssn

 [ π (EMPLOYEE) - π (DEPARTMENT)]

ssn mgrssn

1. Find every employee who supervisees e\*actly two other employees

[ π ((rEMP1(EMP) \* rEMP2(EMP))) ]

EMP1.superssn (EMP1.superssn = EMP2.superssn)

AND (EMP1.ssn != EMP2.ssn)

AND (EMP1.superssn != EMP1.ssn)

AND (EMP2.superssn != EMP2.ssn)

**-** [ π ((rEMP1(EMP) \* rEMP2(EMP \* rEMP3(EMP)))]

EMP1.superssn (EMP1.superssn = EMP2.superssn)

AND (EMP2.superssn = EMP3.superssn)

AND (EMP1.ssn != EMP2.ssn)

AND (EMP2.ssn != EMP3.ssn)

AND (EMP1.ssn != EMP3.ssn)

AND (EMP1.superssn != EMP1.ssn)

AND (EMP2.superssn != EMP2.ssn)

AND (EMP3.superssn != EMP3.ssn)