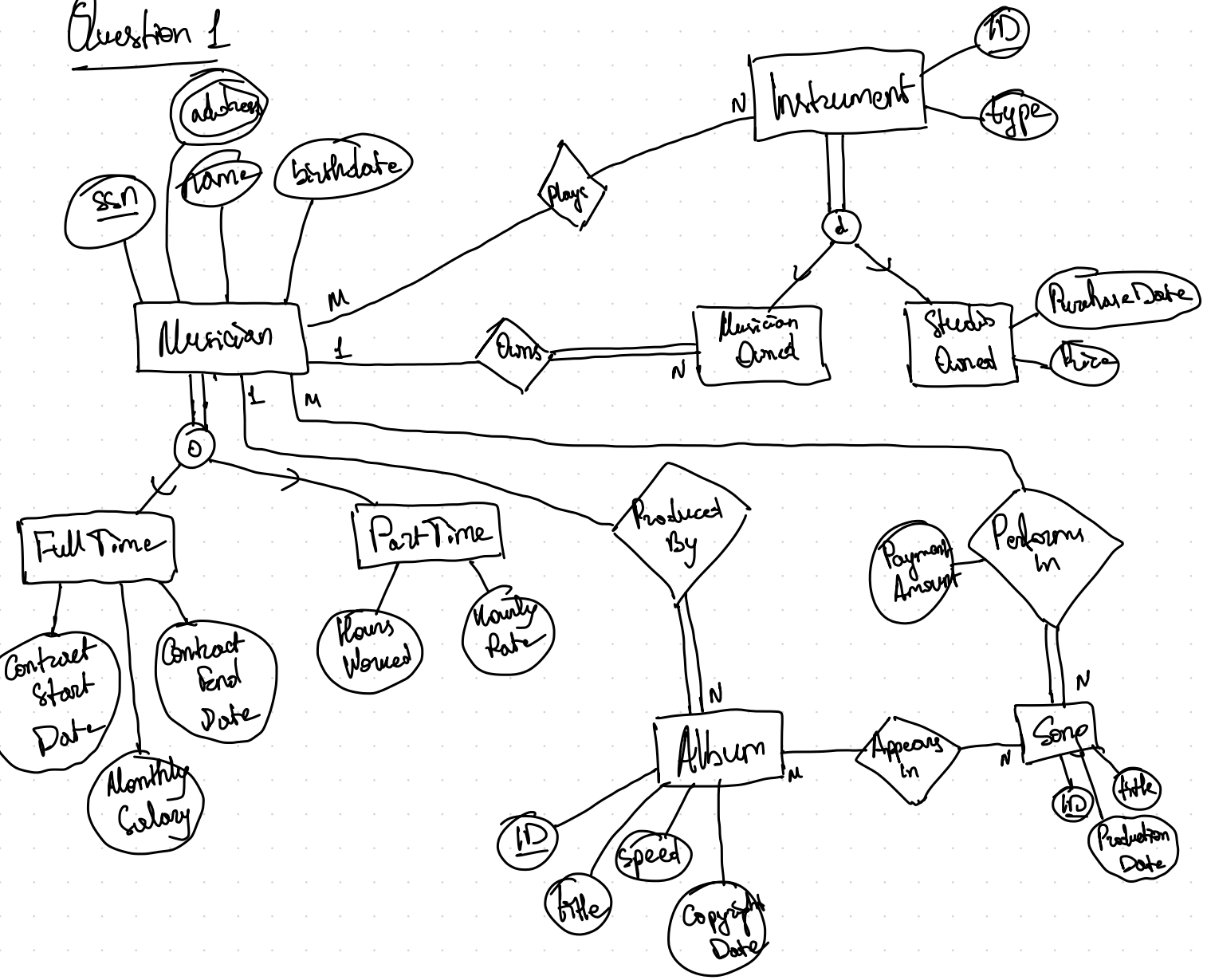
Question 1



- × Musician
  - – Full time
  - – Part time
- × Instrument
  - – Musician Owned
  - – Studio Owned
- × Album
- × Song

E

- × Plays
- × Owns
- × Produced By
- × Performs In
- × Appears In

R

Question 3.

E ← Employee, D ← Department, DL ← Dept_locations, P ← Project, W ← Works_On (shorthand applied to all answers)

a) $Sales \leftarrow \sigma_{Dname = 'Sales'}(D)$

$EmpDep \leftarrow (E \bowtie_{E.Dno = D.Dnumber} Sales)$

$EmpDep \leftarrow \sigma_{Bdate >= 01/01/1990}(EmpDep)$

Answer $\leftarrow \pi_{Fname, Birthdate, Address, Salary}(EmpDep)$

b) $Dep5 \leftarrow (\sigma_{Dnumber = 5}(D))$

$EmpDep \leftarrow (E \bowtie_{E.Dno = D.Dnumber}(D))$

$DataPrivacy \leftarrow \sigma_{Pname = 'DataPrivacy' \wedge Dnum = 5}(P)$

$DataPrivacy \leftarrow \pi_{Pnumber}(DataPrivacy)$

$Works \leftarrow (W \bowtie_{W.Essn = EmpDep.ssn} EmpDep) \bowtie_{Pnumber = Pno} DataPrivacy$

$Answer \leftarrow \sigma_{Hours > 20}(Works)$

Answer $\leftarrow \pi_{Fname, Minit, Lname}(Answer)$

c) $PD5 \leftarrow \pi_{Pno}(\sigma_{Dnumber = 5}(P \bowtie_{P.Dnum = D.Dnumber} D))$

$EveryProject \leftarrow \pi_{Essn, Pno}(W) / PD5$

$Emp \leftarrow E \bowtie_{E.ssn = EveryProject.Essn} EveryProject$

Answer $\leftarrow \pi_{Lname, Salary}(Emp)$

d) $NW \leftarrow \pi_{Essn}(P) - \pi_{ssn}(E)$

$E_1, E_2 \leftarrow \pi_{Salary, Lname, Super\_ssn}(NW \bowtie E)$

$J \leftarrow E_1 \bowtie_{E_1.Super\_ssn = E_2.ssn} E_2$

$\rho(D(3 \rightarrow Supervisor\_ssn, 6 \rightarrow Super\_Super), J)$

$\rho(D(2 \rightarrow Lname, 5 \rightarrow Super\_Lname), J)$

$\rho(D(1 \rightarrow Salary, 4 \rightarrow Super\_Salary), J)$

Answer $\leftarrow \pi_{Lname, Salary, Super\_Lname}(J)$

e) $D_1 \leftarrow \sigma_{Dlocation = 'Istanbul'}(D \bowtie_{Dnumber} DL)$

$P_1 \leftarrow \sigma_{Plocation = 'Istanbul'}(D \bowtie_{D.Dnumber = P.Dnum} P)$

$D_2 \leftarrow \pi_{Dnum}(P_1) \cup \pi_{Dnumber}(D_1)$

$D_3 \leftarrow D_2 \bowtie_{Dnumber} D$

Answer $\leftarrow \pi_{Dname}(D_3)$

(*) NOTE *

Treat E ← Employee etc.

as $\rho(E, Employee)$

it's easier to see them as variables

f) $R_1 \leftarrow (P \bowtie_{P.Pnumber = W.Pno} W) \bowtie_{E.ssn = ssn \wedge Lname = Gurusy} E$

$R_2 \leftarrow (R_1 \bowtie_{R_1.Dnum = D.Dnumber} D) \bowtie_{Mgr\_ssn = ssn \wedge Lname = Gurusy} E$

$\underline{Answer} \leftarrow \pi_{Pno}(R_2)$

g) $MG \leftarrow E \bowtie_{E.ssn = D.Mgr\_ssn} D$

$M_1 \leftarrow MG, \quad M_2 \leftarrow MG$

$R_1 \leftarrow \pi_{M_1.ssn}(M_1 \bowtie_{M_1.Mgr\_start\_date < M_2.Mgr\_start\_date} M_2)$

$R_2 \leftarrow \pi_{ssn}(MG) - R_1$

$R_3 \leftarrow R_2 \bowtie_{ssn} MG$

$R_4 \leftarrow \pi_{Lname, salary}(R_3)$ (Answer)

h) $E_1 \leftarrow Employee, \quad E_2 \leftarrow Employee$

$\Rightarrow$ Rename $E_1.Bdate$ as supervisee_bdate

$\rho(\rho(Bdate \rightarrow supervisee\_bdate), E_1)$,

$\Rightarrow$ Rename $E_2.Bdate$ as supervisor_bdate

$\rho(\rho(Bdate \rightarrow supervisor\_bdate), E_2), \rho(D(Fname \rightarrow Fname_2, Lname \rightarrow Lname_2), E_2)$

$S_1 \leftarrow E_1 \bowtie_{E_1.super\_ssn = E_2.ssn} E_2$

$S_2 \leftarrow \sigma_{supervisee\_bdate < supervisor\_bdate}(S_1)$

$Answer \leftarrow \pi_{Fname_2, Lname_2}(S_2)$