1. **Answer**:

(a) T1 × T2

P	Q	T1.R	A	B	T2.R
10	a	5	10	b	6
10	a	5	25	c	3
10	a	5	10	b	5
15	b	8	10	b	6
15	b	8	25	c	3
15	b	8	10	b	5
25	a	6	10	b	6
25	a	6	25	c	3
25	a	6	10	b	5

(b) T1 $\bowtie_{T1.P=T2.A}$ T2

P	Q	T1.R	A	B	T2.R
10	a	5	10	b	6
10	a	5	10	b	5
25	a	6	25	c	3

(c) T1 $\bowtie_{T1.Q=T2.B}$ T2

P	Q	T1.R	A	B	T2.R
15	b	8	10	b	6
15	b	8	10	b	5

(d) T1 $\bowtie_{T1.R>T2.R}$ T2

P	Q	T1.R	A	B	T2.R
15	b	8	10	b	6
15	b	8	25	c	3
15	b	8	10	b	5
25	a	6	25	c	3
25	a	6	10	b	5
10	a	5	25	c	3

(e) T1 ∗ T2

P	Q	R	A	B
10	a	5	10	b
25	a	6	10	b

2. **Answer**:

(a) Find the SSn (social security number) of all employees who are not supervisors

π_{ssn} (EMPLOYEE) $-\pi_{Super\_ssn}$ (EMPLOYEE)

(b) Find the SSn of all employees who either work in department 5 or directly supervise an employee who works in department 5.

$(\pi_{Ssn}\ (\sigma_{Dno=5}$ (EMPLOYEE)) $\cup\ \pi_{Super\_ssn}\ (\sigma_{Dno=5}$ (EMPLOYEE)))
$-\ (\pi_{Ssn}\ (\sigma_{Dno=5}$ (EMPLOYEE)) $\cap\ \pi_{Super\_ssn}\ (\sigma_{Dno=5}$ (EMPLOYEE)))

(c) List the names and numbers of all departments located in 'Houston'.

$\pi_{Dname,Dnumber}\ (\sigma_{Dlocation='Houston'}$ (DEPARTMENT $*$ DEPT_LOCATIONS))

(d) List the first names of all employees who have a dependent with the same first name as themselves

π_{Fname} (EMPLOYEE $\bowtie_{Ssn=Essn\ \mathbf{AND}\ Fname=Dependent\_name}$ DEPENDENT))

(e) Retrieve the salary of all employees in department 5 who work more than 10 hours per week on the project named 'ProjectX'

WORK_ON_ProjX_10 ←
$\sigma_{\text{hours>10 AND Pname='ProjectX'}}$(WORKS_ON $\bowtie_{Pnumber=Pno}$ PROJECT)

EMP_ProjX ← EMPLOYEE $\bowtie_{Essn=Ssn}$ WORK_ON_ProjX_10

$\pi_{Salary}\ (\sigma_{\text{Dno=5}}$ (EMP_ProjX))