第一题

1.

$\pi_{O.ordno,C.city,A.city}(\sigma_{O.cid=C.cid\wedge O.aid=A.aid\wedge C.city!=A.city}(C\times A\times O))$

2.

$\pi_{C.cname}(\pi_{cid}(C)-\pi_{cid}(\sigma_{O.ordyear>=2022}(O))\bowtie C)$

3.

$\pi_{aid,city}(O\bowtie C)\div\pi_{C.city}(C)$

不用除法的表示为：

令$T:=\pi_{aid,city}(O\bowtie C)$

$\pi_{aid}(T)-\pi_{aid}(\pi_{aid}(T)\times\pi_{city}(C)-T)$

4.

$(\pi_{aid}(O)\times\pi_{city}(C)-\pi_{aid,city}(\pi_{aid}(O)\times\pi_{cid,city}(C\bowtie O)))\cap\pi_{aid,city}(\pi_{cid,city,aid}(C\bowtie D))$

5.

不用除法：

令$M:=C,N:=C$

$T_1:=\pi_{N.cid}(\sigma_{M.dis<N.dis}(M\times N))$

$T_2:=\pi_{cid}(C)-T_1$

用除法

令$M:=C,N:=C$

$T_1(cyid,cid):=\pi_{M.cid,N.cid}(\sigma_{M.dis<=N.dis}(M\times N))$

$T_2:=T_1\div\pi_{cid}(C)$

第二题

1.

$\pi_{sno,sname}((\sigma_{dept='计算机系'}(C)\bowtie L)\bowtie\pi_{sno,sname}(S))$

2.

$\pi_{sno,sname}((L\bowtie C-L\bowtie(\sigma_{cname='数据库'}(C)))\bowtie\pi_{sno,sname}(S))$

3.

$\pi_{sno,sname}(\sigma_{score>=60}((\pi_{sno,cno}(L)\div\pi_{cno}(\sigma_{dept='计算机系'\wedge opt='必修'}(C)))\bowtie L)\bowtie S)$

4.

$$\pi_{sno,sname}((\pi_{S.sno,C.cno}(\sigma_{grade=2019 \wedge opt='必修'}(S \bowtie C)) - \pi_{sno,cno}(\sigma_{score \geq 60}(L))) \bowtie S)$$

5.

$$T := \pi_{L.sno,L.cno,L.score}(S \bowtie L)$$

$$\pi_{sno,sname}(S) \bowtie (\pi_{sno}(L) - \pi_{L.sno}(\sigma_{L.cno=T.cno \wedge L.score<T.score}(\pi_{L.sno,L.cno,L.score}(S \bowtie L) \times T)))$$