HW2 Solution [1]

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Problem 1

1. $\pi_{Card}\sigma_{Location=Boston}Issuer \ltimes Bank\_Location$
2. $\pi_{Card}Issuer - \pi_{Card}\sigma_{Location=NY}Issuer \ltimes Bank\_Location$
3. $\pi_{Bank}Issuer \ltimes \sigma_{Max\_Limit<100{,}000}Max\_limits$
4. $\rho(I1, Issuer)$, $\rho(I2, Issuer)$
   $\pi_{Bank}Issuer - \pi_{Bank}I1 \ltimes_{I1.Bank=I2.Bank \wedge I1.Card \neq I2.Card} I2$
5. $\pi_{Bank}\sigma_{Card=MasterCard}Issuer \cap \pi_{Bank}\sigma_{Card=Visa}Issuer -$
   $\pi_{Bank}(\sigma_{Card\neq MasterCard \wedge Card \neq Visa}Issuer)$
6. $Issuer/\pi_{Card}(Max\_limits)$

Problem 2

1. $\pi_{cname}(\sigma_{sname=\text{Macy Downtown SLC}}Visits)$;
2. $\pi_{sname}\sigma_{pname=iPhone8}(Serves) \bigcap \pi_{sname}\sigma_{pname=Galaxy10}(Serves)$;
3. $\pi_{sname}(\sigma_{price\leq 100}(Serves \bowtie (\pi_{pname}(\sigma_{cname=John}Likes))))$
4. $\pi_{sname,pname}Serves - \pi_{sname,pname}(Visits \bowtie Likes \bowtie Serves)$
5. $\pi_{cname}Visits - \pi_{cname}(\pi_{cname,sname}(Visits) - \pi_{cname,sname}(Likes \bowtie Serves))$
6. $\pi_{cname}Visits - \pi_{cname}(\pi_{cname,sname}(Likes \bowtie Serves) - \pi_{cname,sname}Visits)$
7. $\pi_{cname,sname}Visits/\pi_{sname}(\sigma_{cname=Alice}Visits)$
8. $\pi_{cname,sname}Visits/\pi_{sname}(\sigma_{cname=Alice}Visits)$
   $-\pi_{cname}(\pi_{cname,sname}Visits - \pi_{cname}Customer \times \pi_{sname}(\sigma_{cname=Alice}Visits))$
9. $\rho(S1, Serves)$, $\rho(S2, Serves)$, $\pi_{sname,pname}Serves$
   $-\pi_{S1.sname,S1.pname}(S1 \bowtie_{S1.sname\neq S2.sname \bigwedge S1.pname=S2.pname \bigwedge S1.price>S2.price} S2)$
10. $\pi_{cname,sname}Visits/(\pi_{cname}(\sigma_{address='SLC'}Customer))$

Problem 3

The spec implies a 1-M Relationship set between a Club Entity set and an Athlete Entity set. That said, the schema of Club will be Club(cid, title, address); the schema of Athlete will be Athlete(aid, name, login, rating, cid).

The keys for Club will be {cid} and {title}; and the keys for Athlete will be {aid}, {login}, and {rating, cid} (athletes from the same club must have different ratings).

There are no foreign key for the Club schema, and cid is the foreign key for the Athlete table (referencing back to the Club table).

For each schema, we can choose one of its keys as the primary keys, the rest of keys (if any) will each be a candidate key.

For each schema, all its keys are also superkeys, AND any one or more attributes from that schema combined with a key of that schema will lead to a new superkey.

Problem 4

A	Q	R	A	B	C
20	a	5	20	b	6
20	a	5	20	b	5

5.1

A	Q	R	A	B	C
25	b	8	20	b	6
25	b	8	20	b	5

5.2

A	Q	R	B	C
20	a	5	b	6
20	a	5	b	5

5.3

A	Q	R	A	B	C
20	a	5	20	b	5

5.4

Table 1: Problem 4