BMEG3120 Final Exam Solutions

Problem 1.

(a) $\Pi_{tname}(\sigma_{pname=\text{“Michael Jordan”}}(\text{PLAYER} \bowtie \text{REGISTER} \bowtie \text{TEAM}))$

(b) $\Pi_{pname}(\sigma_{tname=\text{“Heat”} \wedge year=2012}(\text{PLAYER} \bowtie \text{REGISTER} \bowtie \text{TEAM}))$

(c)

$$T_1 \leftarrow \sigma_{pname=\text{“Michael Jordan”}}(\text{PLAYER} \bowtie \text{REGISTER}))$$
$$T_2 \leftarrow \sigma_{pname\neq\text{“Michael Jordan”}}(\text{PLAYER} \bowtie \text{REGISTER}))$$
$$\Pi_{T_2.pname}(\sigma_{T_1.tid=T_2.tid \,\wedge\, T_1.year=T_2.year}(T_1 \times T_2))$$

(d)

$$T_1 \leftarrow \sigma_{pnation=\text{“China”}}(\text{PLAYER} \bowtie \text{REGISTER}))$$
$$T_2 \leftarrow T_1$$
$$T_3 \leftarrow \Pi_{T_2.year}(\sigma_{T_1.year<T_2.year}(T_1 \times T_2))$$
$$\Pi_{year}(T_1) - T_3$$

(e)

$$T_1 \leftarrow \Pi_{year}(\sigma_{pname=\text{“Michael Jordan”}}(\text{PLAYER} \bowtie \text{REGISTER}))$$
$$T_2 \leftarrow \Pi_{pid,pname,year}(\sigma_{pname\neq\text{“Michael Jordan”}}(\text{PLAYER} \bowtie \text{REGISTER}))$$
$$\Pi_{pname}(T_2 \div T_1)$$

Problem 2.

(a) select pname from PLAYER where nation = ‘China’

(b)

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select pid, min(year), max(year) from REGISTER
group by pid
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(c)

```
select pid from REGISTER
where year >= 1996 and year <= 2005
group by pid
having count(*) = 10
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(d)

```
select year from REGISTER
where salary > 20000000
group by year
having count(*) >= 10
```

(e)

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select pid from (
    select pid, sum(salary) as wealth, count(year) as lifetime
    from REGISTER
    group by pid) as T
where not exists (
    select * from T
    where wealth < T.wealth and lifetime > T.lifetime)
```

Problem 3.
Find the pids of all such players p that p made more money in one year (it does not matter which year) than the wealth of every player from Japan.

Problem 4.
(a) $profId \to stuId$
(b) $stuId \to projId$
(c) $projId \to profId$

Problem 5.
(a) ABD
(b) From $D \to A$, we have $CD \to AC$ by augmentation. By transitivity on $CD \to AC$ and $AC \to E$, we have $CD \to E$.
(c) AC and DC
(d) R is not in 3NF. This is because of $A \to B$, which is not a trivial functional dependency, its left side does not contain any key, and its right side is not included by any key.
(e) No, because the common attribute C of R_1 and R_2 is a candidate key of neither. Note that R_1 has candidate keys AC and DC, whereas R_2 has only one candidate key CE.
(f) First, we decompose R using $A \to BD$ into $R_1(ABD)$ and $R_2(ACE)$. R_1 has candidate keys A and D. R_2 has only one candidate key AC. Both tables are already in BCNF.