Problem Set #1 Sample Solution

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Problem1.
(a)Flight.ald is the foreign key reference to Airline.ald
  Flight.OriginAp is the foreign key reference to Airport.apCode
  Flight.destinAp is the foreign key reference to Airport.apCode
  Books.pld is the foreign key reference to Passenger.pld
  Books.(fnum,deptdate) is the foreign key reference to Flight.(fnum, depdate)
(b)
I. SELECT pName
   FROM Passenger NATURAL JOIN Books NATURAL JOIN Flight
   WHERE originAp in (SELECT apCode FROM Airport WHERE apCountry =
'Japan')
   AND destinAp in (SELECT apCode FROM Airport WHERE apCountry = 'United
States')
   AND deptdate = '2018-11-5';
II. WITH tem AS (
 SELECT pName, pld, fnum, deptdate, deptTime, arrTime
 FROM Books NATURAL JOIN Flight NATURAL JOIN Passenger);
 SELECT a.pName
 FROM tem a, tem b
 WHERE a.pld = b.pld AND a.deptdate = b.deptdate
 AND 0 < hour(b.deptTime) - hour(a.arrTime)
 AND hour(b.deptTime) - hour(a.arrTime) < 1;
III.
SELECT destinAp, COUNT(distinct pld) AS num
FROM Books RIGHT OUTER JOIN Flight ON Books.fnum=Flight.fnum AND
Books.deptdate=Flight.deptdate
WHERE originAp = 'JFK' AND year(deptTime) = 2017
GROUP BY destinAp, originAp;
IV.
SELECT aName
FROM Books NATURAL JOIN Flight NATURAL JOIN Airport NATURAL JOIN Airline
WHERE year(deptdate) = 2017
GROUP BY aID, aName
ORDER BY COUNT(*) DESC
LIMIT 1
V.
SELECT a.pName
FROM (SELECT pld, pName, COUNT(*) AS numofbook
    FROM Books NATURAL JOIN Flight NATURAL JOIN Passenger
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WHERE year(deptdate) = 2017
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AND originAp in (SELECT apCode FROM Airport WHERE apCountry = 'Japan')

AND destinAp in (SELECT apCode FROM Airport WHERE apCountry = 'United States')

GROUP BY pld, pName) a

WHERE a.numofbook >= 2;

VI.

SELECT b1.pld, b2.pld

FROM Books b1, Books b2

WHERE b1.pld < b2.pld AND b1.fnum = b2.fnum AND b1.deptdate = b2.deptdate AND year(b1.deptdate) = 2017

GROUP BY b1.pld, b2.pld

HAVING count(*) = (SELECT count(*) FROM Books WHERE year(deptdate) = 2017 AND pld = b1.pld)

AND count(*) = (SELECT count(*) FROM Books WHERE year(deptdate) = 2017 AND pld = b2.pld)

VII.

(SELECT distinct f2.destinAp as apCode

FROM Flight f1, Flight f2

WHERE f1.destinAp = f2.originAp AND f1.originAp = 'JFK' AND f2.destinAp <> 'JFK') UNION

(SELECT distinct destinAp as apCode

FROM Flight

WHERE originAp = 'JFK')

(c)Answer:

$$1.\textit{JP} \leftarrow \varPi_{apCode~as~jpAp}\,\sigma_{apCountry=~"Japan"}\,(Airport)$$

$$US \leftarrow \Pi_{apCode \ as \ usAp} \ \sigma_{apCountry = "USA"}(Airport)$$

 $T \leftarrow \varPi_{\textit{fnum}, \textit{deptdate}} \sigma_{\textit{Flight}, \textit{originAp}} = \jmath_{\textit{P}, \textit{jpAp}} \, \textit{AND Flight}. \textit{destinAp} = \textit{Us.usAp} \, \textit{and} \, \textit{year(deptdate)} = \textit{2017} \left(Flight \times \textit{JP} \times \textit{US} \right)$

$$\Pi_{nName}(Passengers \bowtie Books \bowtie T)$$

$$2.T \leftarrow \Pi_{pName,pId,fnum,deptdate,deptTime,arrTime}(Books \bowtie Flight \bowtie Passengers)$$

 $\Pi_{pName} \sigma_{Hour(b.deptTime-a.arrTime) > 0 \ AND \ Hour(b.deptTime-a.arrTime) < 1} (T \ a \bowtie_{a.FpID=b.pID \ AND \ adeptdate = b.deptdate} T \ b)$

$$3._{destinAp}G_{COUNT(*)\ as\ result}(\sigma_{originAp="JFK"\ AND\ YEAR(deptdate)=2017}(Books\bowtie Flight))$$

$$4.T \leftarrow {}_{aID}G_{COUNT(*)} \ {}_{as\ Sum} \left(\sigma_{YEAR(Books.deptdate)} = 2017 \left(Books \bowtie Flight)\right)$$

$$M \leftarrow G_{MAX(Sum) \ as \ Maximum}(T)$$

$$\Pi_{aName}\sigma_{Sum\,=\,Maximum}(Airline \bowtie T \times M)$$

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5.JP \leftarrow \Pi_{apCode\ as\ jpAp}\sigma_{apCountry="Japan"}(Airport)
                                 US \leftarrow \Pi_{apCode \ as \ usAp} \ \sigma_{apCountry = "USA"}(Airport)
T \leftarrow \varPi_{\mathit{fnum}, \mathit{deptdate}} \sigma_{\mathit{Flight}, \mathit{originAp} \ = \ \mathit{Jp}, \mathit{jpAp} \ \mathit{AND} \ \mathit{Flight}, \mathit{destinAp} \ = \ \mathit{Us.usAp} \ \mathit{and} \ \mathit{year}(\mathit{deptdate}) \ = \ \mathit{2017}} (\mathit{Flight} \times \mathit{JP} \times \mathit{US})
              \Pi_{\mathit{pName}}\sigma_{\mathit{countNum}\,>\,=\,2}\big(\,_{\mathit{pID},\mathit{pName}}G_{\mathit{count}(^*)\,\,as\,\,\mathit{countNum}}(Passengers\bowtie Books\bowtie T)\big)
6.T1 \leftarrow \sigma_{year(b1.deptdate) = 2017}(Books\ b1 \bowtie_{b1.fnum = b2.fnum\ AND\ b1.deptdate = b2.deptdate\ and\ b1.pID < b2.pID}Books\ b2)
                                        T2 \leftarrow {}_{b1.pID,b2.pID}G_{COUNT(*) as sum}(T1)
  \Pi_{b1.pID,b2.pID}\sigma_{sum = (G_{COUNT(``as\,sum1}(\sigma_{ycar(deptdate) = 2017\,AND\,pId = b1.pId}(Books)))}\,{}_{AND\,sum = (G_{COUNT(``as\,sum2}(\sigma_{ycar(deptdate) = 2017\,AND\,pID = b2.pId}(Books)))}(T2)
                      7.T1 \leftarrow \Pi_{destinAp\ as\ des1} \sigma_{originAp\ =\ "JFK"}(Flight)
              T2 \leftarrow \Pi_{destinAp\ as\ des2} \sigma_{Flight.originAp\ =\ T1.des1} (Flight \times T1)
\Pi_{avCode}\sigma_{avCode=des1~OR~avCode=des2~AND~avCode~!="JFK"}(Airport	imes T1	imes T2)
(d) Answer:
\{t \mid \exists p \in Passenger (t[pName] = p[pName] \land A
    \exists b \in Books (b[pId] = p[pId] \land b[deptdate] = "2018-11-05" \land
    \exists f \in Flight (b[fnum] = f[fnum] \land b[deptdate] = f[deptdate] \land
    \exists a1 \in Airport (a1[apCode] = f[originAp] \land a1[apCountry] = "Japan" \land
    \exists a2 \in Airport (a2[apCode] = f[originAp] \land a2[apCountry] = "United"
States")))))}
2.
\{t \mid \exists p \in Passenger (t[pName] = p[pName] \land A
     \exists b1 \in Book (p[pId] = b1[pId] \land
     \exists b2 \in Book (p[pId] = b2[pId] \land b1[deptdate] = b2[deptdate] \land
     \exists f1 \in Flight(f1[fnum] = b1[fnum] \land f1[deptdate] = b1[deptdate] \land
     \exists f2 \in Flight(f2[fnum] = b2[fnum] \land f2[deptdate] = b2[deptdate] \land
                     hour(f1[deptTime]) - hour(f2[arrTime]) > 0 \land
                     hour(f1[deptTime]) - hour(f2[arrTime]) <1)))))
3.
Can't express it in TRC or DRC due to the aggregation function.
4.
Can't express it in TRC or DRC due to the aggregation function.
5.
\{t \mid \exists p1 \in Passenger (t[pName] = p1[pName] \land A\}
    \exists b1 \in Books (b1[pId] = p1[pId] \land year(b1[deptdate]) = "2017" \land
    \exists f1 \in Flight (b1[fnum] = f1[fnum] \land b1[deptdate] = f1[deptdate] \land
    \exists a1 \in Airport (a1[apCode] = f1[originAp] \land a1[apCountry] = "Japan" \land
    \exists a2 \in Airport (a2[apCode] = f1[originAp] \land a2[apCountry] = "United States"
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\wedge
   \exists p2 \in Passenger (p1[pId] = p2[pId] \land
   \exists b2 \in Books (b2[pId] = p2[pId] \land year(b2[deptdate]) = "2017" \land
                (b2[fnum] != b1[fnum] \lor b2[deptdate] != b1[deptdate])
   \exists f2 \in Flight (b2[fnum] = f2[fnum] \land b2[deptdate] = f2[deptdate] \land
   \exists a3 \in Airport (a3[apCode] = f2[originAp] \land a3[apCountry] = "Japan" \land
   \exists a4 \in Airport (a4[apCode] = f2[originAp] \land a4[apCountry] = "United"
States" )))))))))))
6.
\{t \mid \exists b1 \in Books(t[pId1] = b1[pId]) \land year(b1[deptTime]) = "2017" \land
\exists b2 \in Books (t[pId2] = b2[pId] \land b1[pId] != b2[pId] \land year(b2[deptTime]) =
"2017" \land (\forall b \in Books(b[pId]=b2[pId] =>
         \exists b3 \in Books(b1[pId]=b3[pId] \land b3[fnum] = b[fnum] \land b3[deptTime] =
    b[deptTime])
    ))
\land (\forall b' \in Books(b'[pId]=b1[pId] =>
         \exists b4 \in Books(b2[pId]=b4[pId] \land b4[fnum] = b'[fnum] \land b4[deptTime] =
    b'[deptTime])
    ))}
7.
\{t \mid \exists f \in Flight (t[apCode] = fl[destinAp] \land fl[originAp] = "JFK")
   \vee ∃ f2 ∈ Flight (t[apCode] = f1[destinAp] \wedge
      \exists f3 \in Flight(f3[destinAp] = f2[originAp] \land f3[originAp] = "JFK" \land
        f2[destionAp] != "JFK"))}
Problem 2:
(a)
Property(pid, pstname, pstnum, pstnum, pneighbor, pcity, pzip,pprice)
Agent(aid, aname, aphone)
Openhouse(oid, pid, aid, odate, ostart, oend)
Consumer(cid, cname, cphone)
Reserve(cid, oid)
Openhouse.pid is the foreign key reference to Property.pid
Openhouse aid is the foreign key reference to Agent aid
Reserve.cid is the foreign key reference to Consumer.cid
Reserve.oid is the foreign key reference to Openhouse.oid
(b)
1.
Select Property.pid
 From Property natural join Openhouse
 Where pneighbor = "park slope"
 Group by pid
 Having COUNT(distinct aid) >=5;
2.
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Select Property.pid, pstname, pstnum
From Property natural join Openhouse
Where pneighbor = "Park Slope" AND odate = "2018-10-10"

3.
Select distinct cname
From Consumer natural join Reserve natural join Openhouse
Where aid=61734