List of Queries

Given are the following queries in natural language:

1. Get all shipments where the quantity is between 400 and 850 inclusive.

2. Get all pairs of city names such that a supplier in the first city supplies a project in the second city with quantity at least 200.

3. Get project numbers for projects supplied by at least one supplier not in the same city.

4. Get project names for projects supplied by supplier S3.

5. Get part numbers for parts supplied to any project in London.

6. Get supplier numbers for suppliers supplying at least one part supplied by at least one supplier who supplies at least one red part.

7. Get supplier numbers for suppliers with a status lower than that of supplier S1.

8. Get part numbers for parts supplied to all projects in London.

9. Get project numbers and cities where the city has an “l” as the first or an “a” as the second letter of its name.

10. Get project numbers for projects supplied with part P1 in an average quantity greater than the greatest quantity in which any part is supplied to project J1.

11. Get project numbers for projects supplied with at least all parts available from supplier S1.
12. Get project numbers for projects that are supplied by every supplier who supplies some red part.

Solutions

(a) Formulate the queries (1) to (12) in SQL.

(1) \[\text{SELECT SID, PID, JID, QTY FROM SPJ WHERE QTY} \geq 400 \text{ AND QTY} \leq 850;\]

(2) \[\text{SELECT DISTINCT SUPPLIER.CITY, PROJECT.CITY FROM S as SUPPLIER, SPJ as SHIPMENT, J as PROJECT WHERE SUPPLIER.SID=} \text{SHIPMENT.SID AND SHIPMENT.JID=} \text{PROJECT.JID AND SHIPMENT.QTY} \geq 200;\]

(3) \[\text{SELECT DISTINCT PROJECT.JID FROM SPJ as SHIPMENT, S as SUPPLIER, J as PROJECT WHERE SUPPLIER.SID=} \text{SHIPMENT.SID AND SHIPMENT.JID=} \text{PROJECT.JID AND SUPPLIER.CITY} \neq \text{PROJECT.CITY;}\]

(4) \[\text{SELECT PROJECT.JNAME FROM J as PROJECT WHERE PROJECT.JID IN (SELECT PROJECT.JID FROM SPJ as SHIPMENT WHERE SHIPMENT.SID} = 'S3');\]

(5) \[\text{SELECT DISTINCT SHIPMENT.PID FROM SPJ as SHIPMENT WHERE SHIPMENT.JID IN (SELECT SHIPMENT.JID FROM J as PROJECT WHERE PROJECT.CITY} = 'London');\]

(6) \[\text{SELECT DISTINCT SHIPMENT.SID FROM SPJ as SHIPMENT WHERE SHIPMENT.PID IN (SELECT SHIPMENT2.SID FROM SPJ as SHIPMENT2 WHERE SHIPMENT2.SID IN (SELECT SHIPMENT3.SID FROM SPJ as SHIPMENT3 WHERE SHIPMENT3.PID IN (SELECT SHIPMENT4.PID FROM SPJ as SHIPMENT4 WHERE SHIPMENT4.JID IN (SELECT PROJECT.JID FROM J as PROJECT WHERE PROJECT.CITY} = 'London'))));}\]
FROM SPJ as SHIPMENT3
WHERE SHIPMENT3.PID IN
  (SELECT PROJECT.PID
   FROM P as PROJECT
   WHERE PROJECT.COLOR='Red')));

(7) SELECT SUPPLIER.SID
FROM S as SUPPLIER
WHERE STATUS <
  (SELECT SUPPLIER2.STATUS
   FROM S as SUPPLIER2
   WHERE SUPPLIER2.SID='S1');

(8) SELECT DISTINCT SHIPMENT.PID
FROM SPJ as SHIPMENT, SPJ as SHIPMENT2
WHERE NOT EXISTS
  (SELECT *
   FROM J as PROJECT
   WHERE PROJECT.CITY='London'
   AND NOT EXISTS
     (SELECT *
      FROM SPJ as SHIPMENT3, SPJ as SHIPMENT4
      WHERE SHIPMENT4.PID = SHIPMENT2.PID
      AND SHIPMENT4.JID = PROJECT.JID));

(9) SELECT PROJECT.JID, PROJECT.CITY
FROM J as PROJECT
WHERE PROJECT.CITY LIKE 'l\%' OR PROJECT.CITY LIKE '_a\%';

(10) SELECT SHIPMENT.JID
FROM SPJ as SHIPMENT
WHERE SHIPMENT.PID='P1'
GROUP BY SHIPMENT.JID
HAVING AVG (QTY) >
  (SELECT MAX(QTY)
   FROM SPJ as SHIPMENT2
   WHERE SHIPMENT2.JID='J1');

(11) SELECT DISTINCT SHIPMENT.JID
FROM SPJ as SHIPMENT, SPJ as SHIPMENT2
WHERE NOT EXISTS
  (SELECT SHIPMENT3.PID
   FROM SPJ as SHIPMENT3, SPJ as SHIPMENT4
   WHERE SHIPMENT3.SID='S1'
AND NOT EXISTS

(SELECT *
  FROM SPJ, SPJ as SHIPMENT5
  WHERE SHIPMENT5.PID=SHIPMENT4.PID
  AND SHIPMENT5.JID = SHIPMENT2.JID));

(12) SELECT DISTINCT SHIPMENT.JID
  FROM SPJ as SHIPMENT, SPJ as SHIPMENT2
  WHERE NOT EXISTS
    (SELECT *
     FROM SPJ, SPJ as SHIPMENT3
     WHERE EXISTS
       (SELECT *
        FROM SPJ, SPJ as SHIPMENT4
        WHERE SHIPMENT4.SID=SHIPMENT3.SID
        AND SHIPMENT4.PID IN
          (SELECT PROJECT.PID
           FROM P as PROJECT
           WHERE PROJECT.COLOR='Red')
        AND NOT EXISTS
          (SELECT *
           FROM SPJ, SPJ as SHIPMENT5
           WHERE SHIPMENT5.SID=SHIPMENT3.SID
           AND SHIPMENT5.JID=SHIPMENT2.JID));

(b) Formulate the queries (1), (5), (6), and (8) in the relational algebra.

1. \( \sigma_{QTY \geq 400 \land QTY \leq 850}(SPJ) \)
2. \( \pi_{\text{PID}}(SPJ \bowtie (\sigma_{\text{CITY} = 'London'}(J))) \)
3. \( \pi_{\text{SID}}(\pi_{\text{PID}}(\pi_{\text{SID}}(SPJ \bowtie \pi_{\text{PID}}(\sigma_{\text{Color} = 'Red'}(P)) \bowtie SPJ)) \bowtie SPJ) \)
4. \( \pi_{\text{PID}, \text{JID}}(SPJ \div \pi_{\text{JID}}(\sigma_{\text{CITY} = 'London'}(J))) \)
(c) Formulate the queries (1), (2), (7), and (8) in the tuple relational calculus.

(1) \( \{ P | \exists X \in SPJ (X.QTY \geq 400 \land X.QTY \leq 850 \land X.SID = P.SID \land X.PID = P.SID \land X.JID = P.JID \land X.QTY = P.QTY) \} \)

(2) \( \{ P | \exists X \in S \exists Y \in J \exists Z \in SPJ (Z.SID = X.SID \land Z.JID = Y.JID \land Z.QTY \geq 200 \land X.CITY = P.CITY1 \land Y.CITY = P.CITY2) \} \)

(7) \( \{ P | \exists X \in S \exists Y \in S (Y.SID = 'S1' \land X.STATUS < Y.STATUS \land X.SID = P.SID) \} \)

(8) \( \{ P | \exists X \in SPJ \forall Y \in J (X.CITY = 'London' \Rightarrow (\exists Z \in SPJ (Z.PID = X.PID \land Z.JID = Y.JID \land X.PID = P.PID))) \} \)

(d) Formulate the queries (1), (3), (4), and (8) in the domain relational calculus.

(1) \( \{ (SX, PX, JX, QTYX) | (SX, PX, JX, QTYX) \in SPJ \land QTYX \geq 400 \land QTYX \leq 850 \} \)

(3) \( \{ (JX) | \exists JNX, JCX ((JX, JNX, JCX) \in J \land \exists SY, SNY, SSY, SCY ((SY, SNY, SSY, SCY) \in S \land \exists PZ, QTYZ ((SY, PZ, JX, QTYZ) \in SPJ \land JCX \neq SCY)) \} \)

(4) \( \{ (JNX) | \exists JX, JCX ((JX, JNX, JCX) \in J \land \exists SY, PY, JY, QTYY ((SY, PY, JY, QTYY) \in SPJ \land JX = JY \land SY = 'S1') \} \)

(8) \( \{ (PX) | \forall JY, JNY, JCY ((JY, JNY, JCY) \in J \land JCY = 'London') \Rightarrow \exists SZ ((SZ, PX, JY) \in SPJ) \} \)