Assignment 4
Relation Algebra

Following are the all RA Expressions of SQL queries submitted in assignment.

Q.1

$(\pi_A (N \bowtie_{W_1.A = W_2.A \wedge W_1.B <> W_2.B} W_2))$
$\cup$
$(\pi_A(W) - (\pi_{W_3.A} (W_3 \times (W_1 \bowtie_{W_1.A = W_2.A \wedge W_1.B <> W_2.B} W_2))))$

Q.2
(a)

$E_1 = \pi_{Sid} (cites \bowtie buys)$

$F = \pi_{Sid, Sname} (Student \bowtie E_1)$

(b)

$E_1 = \pi_{Sid} (major \bowtie_{m_1.Sid = m_2.Sid \wedge m_1.major <> m_2.major} Major_2)$

$F = \pi_{Sid, Sname} (Student \bowtie E_1)$

(c)

$\pi_{Sid} (buys) - \pi_{Sid} (buys \bowtie_{bs_1.Sid = bs_2.Sid \wedge bs_1.bookno <> bs_2.Bookno} buys_2)$

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(d)

~~$\sigma_{p} \quad \sigma_{B_1 \cdot Price < = B_2 \cdot Price}$~~

$E_1 = \sigma_{\neg(B_1 \cdot Price <= B_2 \cdot Price)} (Book_1 \times Book_2)$

$E_2 = \Pi_{bookno, title} (E_1)$

$E_3 = \sigma_{\neg(E_{11} \cdot Price <= E_{12} \cdot Price)} (E_{11} \times E_{12})$

$E_4 = \Pi_{bookno, title} (E_3)$

$F = E_2 - E_3$

(e)

$E_1 = \Pi_{sid} (\sigma_{sid = 1001} (Student)) \times \Pi_{Bookno} (Book)$

$E_2 = \Pi_{Bookno} (Buys - E_1)$

$E_3 = \Pi_{Bookno} (Book) - E_2$

$F = \Pi_{Bookno, title} (E_3 \bowtie Book)$

(f)

$E_1 = \Pi_{Bookno} (\sigma_{Price < 50} (Book))$

$E_2 = Buys \bowtie E_1$

$E_3 = E_{21} \bowtie_{E_{21} \cdot Sid = E_{22} \cdot Sid \wedge E_{21} \cdot Bookno <> E_{22} \cdot Bookno} E_{22}$

$F = \Pi_{Sid, sname} (S \bowtie E_3)$

(g)

$E_1 = \Pi_{sid} (\sigma_{major='cs'} (major))$

$E_2 = E_1 \times \Pi_{bookno} (Book)$

$F = \Pi_{Bookno} (E_2 - Buys)$

(h)

$\Pi_{Bookno} (Book) - \Pi_{Citedbookno} (\sigma_{Price>50} (Cites \bowtie Book))$

(i)

$E_1 = \Pi_{Bookno} (\sigma_{Price<30} (Book))$

$E_2 = \Pi_{sid} (Student) \times E_1$

$F = \Pi_{sid} (Buys - E_2)$

(j)

$E_1 = Buys \times \Pi_{Bookno} (Cites)$

$E_2 = \Pi_{Bs.sid, bs.bookno, C.Citedbookno} (Buys \bowtie_{bs.bookno = C.Bookno} Cites)$

$F = \Pi_{sid, Citedbookno} (E_1 - E_2)$

(k)

$E_1 = \Pi_{sid, bookno}(Buys \bowtie \sigma_{majorics'}(major))$

$\overline{E_1} = \overline{E_1} \times \Pi_{bookno}(Book)$

$\overline{E_1} = \Pi_{bookno, sid}(E_1)$

$E_2 = \overline{E_1} \times \Pi_{bookno}(Book)$ as bbookno

$E_3 = \Pi_{bookno} \times E_1 \quad \Pi_{bookno}(Book)_{as\ bbookno} \times E_1$

$E_4 = E_2 - E_3$

$E_5 = E_3 - E_2$

$E_6 = \Pi_{bbookno, bookno}(E_4 \cup E_5)$

$E_7 = \Pi_{b1.bookno, b2.bookno}(Book_1 \bowtie_{b1.bookno <> b2.bookno} Book_2)$

$F = E_7 - E_6$

(l)

$E_1 = \text{Buys} \times \Pi_{sid}(\text{Student})$

$\overline{\text{Buys}} = \Pi_{bookno, sid}(\text{Buys})$

$E_2 = \Pi_{sid}(\text{Student}) \times \overline{\text{Buys}}$

$E_3 = \Pi_{\overline{sid}, sid}(E_2 - E_1)$

$E_4 = \Pi_{s1.sid, s2.sid}(\text{Student}_1 \underset{s1.sid <> s2.sid}{\bowtie} \text{Student}_2)$

$F = E_4 - E_3$

(m)

$E_1 = \Pi_{citedbookno, bookno}(\text{cites} \underset{b.bookno <> c.bookno}{\bowtie} \Pi_{bookno}(\text{Book}))$

$E_2 = \Pi_{citedbookno}(E_{11} \underset{E_{11}.Citedbookno = E_{12}.Citedbookno \wedge E_{11}.bookno <> E_{12}.bookno}{\bowtie} E_{12})$

$F = \Pi_{citedbookno}(\text{cites}) - E_2$

Q.3

(a)

$E_1 = \text{Buys} \underset{BS.bookno = B.bookno}{\bowtie} (\sigma_{Price < 20}(Book))$

$E_2 = \text{major} \underset{M.sid = E_1.sid}{\bowtie} (E_1)$

$E_3 = \Pi_{sid, major}(E_2)$

(b)

$E_1 = \Pi_{sid, bookno, Price}(\text{Buys} \underset{BS.bookno = B.bookno}{\bowtie} Book)$

$E_2 = \text{Buys} \underset{BS.bookno = B.Bookno}{\bowtie} Book$

$E_3 = \sigma_{(E_{21}.Price <= E_{22}.Price)}(E_{21} \underset{E_{21}.Sid = E_{22}.Sid}{\bowtie} E_{22})$

$E_4 = \Pi_{sid, bookno, Price}(E_3)$

$F = \Pi_{sid, bookno}(E_1 - E_4)$

(c)

$E_1 = \sigma_{20 <= Price \wedge Price <= 40}(Book)$

$E_2 = E_1 \underset{B.bookno = C.Cited bookno}{\bowtie} Cite$

$F = \Pi_{bookno, title}(E_2)$

(c)

$$E_1 = \sigma_{20 <= Price \wedge Price <= 40}(Book)$$

$$E_2 = E_1 \bowtie_{E_1.bookno = C.Citedbookno} Cites$$

$$F = \pi_{bookno, title}(E_2)$$

(d)

$$E_1 = \sigma_{major = 'cs'}(major)$$

$$E_2 = Student \bowtie_{S.Sid = E_1.Sid} E_1$$

$$E_3 = E_2 \bowtie_{E_2.Sid = BS.Sid} Buys$$

$$E_4 = E_3 \bowtie_{E_3.bookno = C.Citedbookno} Cites$$

$$E_5 = Book_1 \bowtie_{B_1.Price > B_2.Price} Book_2$$

$$E_6 = E_4 \bowtie_{(Citedbookno = B_1.Bookno \wedge Bookno = B_2.Bookno)} (Book_1 \bowtie_{B_1.Price > B_2.Price} Book_2)$$

$$F = \pi_{Sid, Sname}(E_5)$$

(e)

$E_1 = \sigma_{major = 'cs'} (Major)$

$E_2 = \Pi_{Bookno, title, sid} (Book \times E_1)$

$E_3 = (E_1 \underset{E_1.sid = B5.sid}{\bowtie} Buys)$

$E_4 = Book \underset{B.Bookno = E_3.Bookno}{\bowtie} E_3$

$E_6 = \Pi_{Bookno, title, sid} (E_4)$

~~Book~~ @

$F = \Pi_{Bookno, title} (E_2 - E_6)$

(f)

$E_1 = \sigma_{major = 'cs'} (Major)$

$E_2 = Student \underset{S.sid = E_1.sid}{\bowtie} E_1$

$E_3 = \sigma_{major = 'Math'} (Major)$

$E_4 = E_2 \underset{E_4.sid = E_3.sid}{\bowtie} E_3$

$E_5 = Book \times E_4$

$E_6 = \Pi_{Bookno, title, Price, sid, major} (E_5)$

$E_6 = \Pi_{Bookno, title, Price, sid, sname, major} (E_5)$

$E_7 = \text{Book} \bowtie_{B.\text{Bookno} = BS.\text{Booking}} \text{Boys}$

$E_8 = E_7 \bowtie_{E_7.\text{sid} = E_4.\text{sid}} E_4$

$E_9 = \Pi_{\text{Bookno, title, price, sid, sname, major}} (E_8)$

$E_{10} = \Pi_{\text{Bookno, title, price}} (E_6 - E_9)$

$F = \Pi_{\text{Bookno, title}} (\text{Book} - E_{10})$