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Question 1

1.

NoCalgary ← (σ city ≠ 'Calgary' AUTHOR)

R2 ← (NoCalgary ⋈ $_{aEmail = authorId}$ AUTHOR_PAPER)

ρ $_{myId ← paperId}$ ((R2))

newReviewer ← (ρ $_{revfName, revlName ← fName, lName}$ ((REVIEWER)))

R4 ← (R2 ⋈ $_{myId = paperId}$ PAPER_REVIEW)

R5 ← (R4 ⋈ $_{reviewerId = rEmail}$ newReviewer)

Names ← π $_{revfName, revlName}$ R5

2.

R1 ← ($_{paperId}$ F $_{AVG\_score}$ (PAPER_REVIEW))

R2 ← ($_{paperId}$ F $_{AVG\ submissionDate - invitationDate}$ (PAPER_REVIEW))

R3 ← σ $_{AVG\_score >= 7}$ (R1)

R4 ← σ $_{AVG\_submissionDate\_invitationDate\_difference < 30}$ (R2)

R5 ← (R3 ⋈ $_{R3.paperId = R4.paperId}$ R4)

PAPERS ← π $_{revfName, revlName}$ R5

3.

R1 ← $_{authorId}$ F $_{COUNT\ paperId}$ (AUTHOR_PAPER)

R2 ← σ $_{R1.Count\_paperId >3}$ (R1)

R3 ← σ $_{(CurrentDate - bdate) > 30}$ (AUTHOR)

R4 ← (R2 ⋈ $_{R2.authorId= R3.aEmail}$ R3)

Names ← π $_{R4.fName, R4.lName}$ R4

4.

R1 ←(σ $_{score < 6}$ PAPER_REVIEW))

R2 ← π $_{reviewerId}$ (R1)

R3 ← ((REVIEWER) – R2))

RESULT ← $\pi_{R3.fName, R3.lName}$ (R3)

5.

R1 ← ($_{paperId}$ F $_{COUNT\ authorId}$ (AUTHOR_PAPER))

R2 ←($\sigma_{Count\_authorId\ >\ 3}$) (R1)

R3 ← (R2 ⋈ $_{AUTHOR\_PAPER.paperId\ =\ PAPER.paperId}$ PAPER) ⋈ $_{AUTHOR\_PAPER.paperId\ =\ PAPER\_REVIEW.paperId}$ PAPER_REVIEW

TITLES ← $\pi_{PAPER.Title}$ R3

AUTHORCOUNT← $_{paperId}$ F $_{COUNT\ PAPER\_REVIEW.reviewerId}$ R3

6.

R1 ← $\sigma_{submissionDate\ >=\ date('2018-02-30')\ AND\ submissionDate\ <=\ date('2019-03-30')}$ (PAPER)

R2 ← R1 ⋈ $_{R1.paperId\ =\ AUTHOR\_PAPER.paperId}$ AUTHOR_PAPER

R3 ← $\sigma_{isContact\ =\ True}$ (R2)

R4 ← ($_{R3.authorId}$ F $_{COUNT\ R3.PAPER.paperId}$ R3)

R5 ← $\sigma_{Count\_R3.PAPER.PaperId\ >1}$(R4)

Result ← $\pi_{fname,\ lname}$ (R5 ⋈ $_{AUTHOR\_PAPER.authorId\ =\ aEmail}$ AUTHOR)

7.

RESULT ← $\sigma_{phoneNumber\ like\ '403\%'}$ REVIEWER

8.

R1 ←((((AUTHOR ⋈ $_{aEmail\ =\ authorId}$ AUTHOR_PAPER) ⋈$_{AUTHOR\_PAPER.paperId\ =\ PAPER\_REVIEW.paperId}$PAPER_REVIEW) ⋈$_{PAPER\_REVIEW.reviewerId\ =\ REVEIWER.rEmail}$REVIEWER)

R2 ← $\pi_{AUTHOR\_PAPER.paperId}$ ($\sigma_{AUTHOR.city=REVIEWER.city}$ (R1))

RESULT ← R2 ⋈ $_{AUTHOR\_PAPER.paperId\ =\ PAPER.paperId}$PAPER

Question 2

1.

RESULT ← π_{pName} ($\sigma_{price\ \geq\ 20}$ (PARTS))

2.

R1 ← σ $_{Sum\_price \leq 50}$ ($_{oNo}$ $\mathcal{F}$ $_{SUM\ PARTS.price*ODETAILS.qty}$ (PARTS ⋈$_{PARTS.pNo=ODETAILS.pNo}$ODETAILS))

RESULT ← π $_{EMPLOYEES.eName,\ ZIP\_CODES,city}$ (((R1⋈$_{ODETAILS.oNo=ORDERS.oNo}$ORDERS)
⋈$_{ORDERS.eNo=EMPLOYEES.eNo}$ EMPLOYEES) ⋈$_{EMPLOYEES.zip=ZIP\_CODES.zip}$ ZIP_CODES)

3.

R1 ← CUSTOMERS⋈$_{CUSTOMERS.zip=ZIP\_CODES.zip}$ ZIP_CODES

R2 ← (ρ $_{cNo1←CUSTOMER.cNo,\ city1←ZIP\_CODE.city,\ zip1←CUSTOMER.zip}$ (R1)) × (ρ $_{cNo2←CUSTOMER.cNo,\ city2←ZIP\_CODE.city,}$ $_{zip2←CUSTOMER.zip}$ (R1)))

RESULT ← π $_{cNo1,\ cNo2}$ (σ $_{city1\ =\ city2\ and\ zip1=zip2\ and\ cNo1 \neq cNo2}$ ((R2))

4.

R1 ← σ $_{city\ =\ 'Wichita'}$ (EMPLOYEES⋈$_{EMPLOYEES.zip=ZIP\_CODES.zip}$ ZIP_CODES)

RESULT ← π $_{cName}$ ((R1 ⋈$_{EMPLOYEES.eNo=ORDERS.eNo}$
(ORDERS)) ⋈$_{ORDERS.cNo=CUSTOMERS.cNo}$ (CUSTOMERS))

5.

R1 ← σ $_{Sum\_price\ \leq 20}$ ($_{oNo}$ $\mathcal{F}$ $_{SUM\ PARTS.price*ODETAILS.qty}$ ((PARTS ⋈$_{PARTS.pNo=ODETAILS.pNo}$ ODETAILS)))

RESULT ← π $_{CUSTOMERS.cName}$ ((R1 ⋈$_{ODETAILS.oNo=ORDERS.oNo}$ ORDERS) ⋈$_{ORDERS.cNo=CUSTOMERS.cNo}$
CUSTOMERS)

6.

RESULT ←
π $_{CUSTOMERS.cName}$ ((CUSTOMERS)) – (π $_{ORDERS.cNo}$ (CUSTOMERS⋈$_{CUSTOMERS.cNo=ORDERS.cNo}$ORDERS)

7.

R1 ← σ $_{received\ =\ false}$(ORDERS)

R2 ← $_{cNo}$ $\mathcal{F}$ $_{COUNT\ oNo}$ R1

R3 ← σ $_{COUNT\_oNo=2}$(R2)

RESULT ← π $_{CUSTOMERS.cName}$ (R3 ⋈$_{ORDERS.cNo=CUSTOMERS.cNo}$ CUSTOMERS)

Question 3

1.

{s1.stno | (Street(s1) ^ (∀cit) ((City(cit) ^ cit.countryName = 'Canada' ^ (s1.cityName = cit.cityName)))→ (∀cit2) (∀s2) (City(cit2) ^ (cit2.countryName = 'Canada')^Street(s2) ∧ (cit2.cityName = s2.cityName) ^ (s2.cityName =cit2.cityName)^ (s2.length > s1.length))}

2.

{h1.ownerName | House(h) ^ (∀c) ((City(cit) ^ cit.countryName = 'Canada')→

((∃cit1) (∃s) (∃h2) (City(cit1) ^ Street (s) ^ House(h1) ^ (cit1.countryName = 'Canada')^ (cit1.cityName = s.cityName) ^ (s.cityName = cit.cityName) ^ (s.stNo = h1.stNo) ^ h1.ownerName = h.ownerName)))}

3.

{h.ownerName | House(h) ^ !(((∃con1) (∃cit1) (∃s1) (∃h1) (Country(con1) ^City(cit1) ^Street(s1) ^ House(h1) ^ con1.name != 'USA' ^ cit1.countryName = con1.name ^ cit1.cityName = s1.cityName ^ s1.stNo = h1.stNo)

^ ((∃con2) (∃cit2) (∃s2) (∃h2) (Country(con2) ^City(cit2) ^Street(s2) ^ House(h2) ^ con2.name != 'USA' ^ cit1.countryName = con2.name ^ cit2.cityName = s2.cityName ^ s2.stNo = h2.stNo)

^((∃con3) (∃cit3) (∃s3) (∃h3) (Country(con3) ^City(cit3) ^Street(s3) ^ House(h3) ^ con3.name != 'USA' ^ cit3.countryName = con3.name ^ cit3.cityName = s3.cityName ^ s3.stNo = h3.stNo)

^((∃con4) (∃cit4) (∃s4) (∃h4) (Country(con4) ^City(cit4) ^Street(s4) ^ House(h4) ^ con4.name != 'USA' ^ cit4.countryName = con4.name ^ cit4.cityName = s4.cityName ^ s4.stNo = h4.stNo)

^ (h.ownerName=h1.ownerName =h2.ownerName =h3.ownerName=h4.ownerName))

^ ((∃con5) (∃cit5) (∃s5) (∃h5) (Country(con5) ^ City(cit5) ^ Street(s5) ^ House(h5) ^ con5.name = 'USA' ^ cit5.countryName = con5.name ^ cit5.cityName = s5.cityName ^ s5.stNo = h5.stNo ^ h.ownerName = h5.ownerName))}

4.

{count.name | Country(count) ^ ∃b1 (Border(b1) ^ (b.countryName2 = "Germany" ^ count.name = b.countryName1) ∨ (count.name = b.countryName2 ^ b.countryName1 = "Germany")))}

5.

{h.ownerName | House(h) ^ (∀b) ((Border(b) ^ b.countryName2 = "Spain") →

! ((∃con1) (∃con2) (∃cit1) (∃cit2) (∃s1) (∃s2) (∃h1) (∃h2) (Country(con1) ^ Country(con2) ^ City(cit1) ^ City(cit2) ^Street(s1) ^ Street(s2) ^ House(h1) ^ House(h2)

^ con1.name = b.countryName1 ^ con2.name = b.countryName1 ^ cit1.countryName = con1.name ^ cit2.countryName = con2.name ^ cit1.cityName = s1.cityName ^ cit2.cityName = s2.cityName ^ s1.stNo = h1.stNo ^ s2.stNo = h2.stNo ^

h.ownerName=h1.ownerName=h2.ownerName)))} ^

 (∀b2) ((Border(b2) ^ b.countryName1 = "Spain")) →

! ((∃cit3) (∃cit4) (∃con3) (∃con4) (∃h3) (∃h4) (∃s3) (∃s4) (City(cit3) ^ City(cit4) ^Country(con3) ^ Country(con4) ^ Street(s3) ^ Street(s4) ^ House(h3) ^ House(h4)

^(con4.name = b2.countryName2) ^ (con3.name = b2.countryName2) ^ (cit3.countryName = con3.name) ^ (cit4.countryName = con4.name) ^ (cit3.cityName = s3.cityName) ^ (cit4.cityName = s4.cityName) ^ (s3.stNo = h3.stNo) ^ (s4.stNo = h4.stNo)

^ (h.ownerName=h3.ownerName=h4.ownerName))}