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CSC343 Assignment 1

1. Find the tallest item(s) that is tagged with Fenian Raids, weapon, and British. Report the catalogue number, donors full name, and the donation date.

```
BritishRaidWeapons := \sigma_{phrase="Fernian" \land phrase="British" \land phrase="weapons"} \text{ Tags} \bowtie \text{Object}
SmallerWeapons := \sigma_{B1.height \lt B2.height}(\rho_{B1}BritishRaidWeapons \times \rho_{B2}BritishRaidWeapons)
TallestObject(CN) := \pi_{CN}(\text{BritishRaidWeapons} - \text{SmallerWeapons})
Now we will retrieve the answer,
\pi_{CN,date,surname,firstname}(\text{Contains} \bowtie \text{TallestObject} \bowtie \text{Donations} \bowtie \text{Donors})
```

2. Lets say a small donation is one that included no more than two items. Find all donors who have made 3 or more small donations. (They may have made other donations that were larger.) Report the donor ID and the date of their first and last small donations.

```
ContainsDonation(NID, DID, CN, date) := \pi_{NID,DID,CN,date}(Donation \bowtie Contains)

BigDonations(DID, date) := \pi_{DID,date}\sigma_{D1.DID=D2.DID=D3.DID\land D1.CN\neq D2.CN\land D2.CN\neq D3.cn\land D1.CN\neq D3.CN\land D1.NID=D2.NID=D3.NID}[(\rho_{D1}ContainsDonation) \times (\rho_{D2}ContainsDonation) \times (\rho_{D3}ContainsDonation)]

SmallDonations(DID, date) := \pi_{DID,date}[\pi_{DID}(Donation) - BigDonations]

ThreeSmallDonations(DID, date)v := \pi_{DID,date}\sigma_{D1.NID\neq D2.NID\land D2.NID\neq D3.NID\land D1.NID\neq D3.NID\land D1.DID=D2.DID=D3.DID}[(\rho_{D1}SmallDonations) \times (\rho_{D2}SmallDonations) \times (\rho_{D3}SmallDonations)]

FirstDonation(DID, firstdate) := \pi_{DID,firstdate}\rho_{firstdate=date}[ThreeSmallDonations - (\pi_{D1.DID,D1.date}\sigma_{D1.date \triangleleft D2.date}((\rho_{D1}ThreeSmallDonations) \times (\rho_{D2}ThreeSmallDonations)))]

LastDonation(DID, lastdate) := \pi_{DID,lastdate}\rho_{lastdate=date}[ThreeSmallDonations - (\pi_{D1.DID,D1.date}\sigma_{D1.date \triangleleft D2.date}((\rho_{D1}ThreeSmallDonations) \times (\rho_{D2}ThreeSmallDonations))))]

Answer(DID, firstdate, lastdate) := \pi_{DID,firstdate,lastdate}(FirstDonation \bowtie LastDonation)
```

3. Find all permanent staff who (a) have started on or after July 1st 2014, or (b) have catalogued items from at most 2 different donations. Report the staff ID and email address.

```
\begin{aligned} & \operatorname{PermStaff}(\operatorname{SID}) := \pi_{SID} \sigma_{type = 'permanent'}(Staff) \\ & \operatorname{StartAfter}(\operatorname{SID}) := \pi_{SID} \sigma_{date.year} \geq 2014 \wedge date.month \geq 7 \wedge date.day \geq 1 \\ & (PermStaff \bowtie Staff) \end{aligned} & \operatorname{DonationX}(\operatorname{CN},\operatorname{NID},\operatorname{SID}) := \pi_{CN,NID,SID} \\ & (Object \bowtie_{who = SID} Staff \bowtie Contains) \end{aligned} & \operatorname{AtLeastThrice}(\operatorname{SID}) := \pi_{D1.SID} \\ & \sigma_{D1.SID} \end{aligned} & \sigma_{D1.NID \neq D2.NID \wedge D2.NID \neq D3.NID \wedge D1.NID \neq D3.NID \wedge D1.CN \neq D2.CN \wedge D2.CN \neq D3.CN \wedge D1.CN \neq D3.CN \wedge D1.SID = D2.SID = D3.SID \\ & ((\rho_{D1}DonationX) \times (\rho_{D2}DonationX) \times (\rho_{D3}DonationX)) \end{aligned} & \operatorname{AtMostTwice}(\operatorname{SID}) := \pi_{SID}(PermStaff) - \operatorname{AtLeastThrice} \\ & \operatorname{Answer}(\operatorname{SID}, \operatorname{email}) := \pi_{SID,email}((\operatorname{AtMostTwice} \cup \operatorname{StartAfter}) \bowtie \operatorname{Staff}) \end{aligned}
```

4. Lets say a staff member is experienced if they have catalogued something in every Chenhall category. Find all the experienced staff members. Produce a relation with attributes called sID and primary. For each of the experienced staff members, include a row for every primary term under which theyve catalogued an item.

```
\begin{split} & \operatorname{Catalogued}(\operatorname{secondary},\operatorname{sID}) := \pi_{type,who}\operatorname{Object} \\ & \operatorname{StaffCataloguedChenhall} := \\ & (\operatorname{Catalogued} \bowtie \operatorname{SecondaryTerm} \bowtie \operatorname{PrimaryTerm} \bowtie \operatorname{Chenhall}) \\ & \operatorname{UnexperiencedStaff}(\operatorname{sID},\operatorname{category}) := \\ & (\pi_{sID}StaffCataloguedChenhall \times \pi_{category}StaffCataloguedChenhall) \\ & - \operatorname{StaffCataloguedChenhall} \\ & \operatorname{ExperiencedStaff}(\operatorname{sID},\operatorname{categorey}) := \\ & (\pi_{sID,category}\operatorname{StaffCataloguedChenhall}) - \operatorname{UnexperienceStaff} \\ & \operatorname{Now to produce a relation of sID and primary}, \\ & \sigma_{sID,primary}\operatorname{StaffCataloguedChenhall} \end{split}
```

This produces a relation of sID and primary for all experienced staff members. This also produces a row of primary terms under which they've catalogued an item. 5. Find all donations for which every item was catalogued by the same staff member and that staff member was of type temp. Report the donation ID, as well as the staff ID, surname, and firstname of the staff person who catalogued it.

```
AllTempStaff := \sigma_{type="temp"}Staff

ObjInDonation := Contains \bowtie Object

SameDonationSamePerson := \sigma_{S1.NID=S2.NID \land S1.CN \neq S2.CN \land S1.who=S2.who}(\rho_{S1}\text{ObjInDonation} \times \rho_{S2}\text{ObjInDonation})

Answer := \pi_{NID,sID,surname,firstname} (\pi_{who,NID}\text{SameDonationSamePerson} \bowtie \text{AllTempStaff})
```

6. Find all objects that have no tags. Report the catalogue number, donor email, and the object name, as well as its Chenhall secondary term, primary term and category.

$$ObjectWithNoTags(CN) := \pi_{CN}(Object) - \pi_{CN}(Tags)$$

Since Tags[CN] \subset Object[CN]

 $\pi_{CN,email,name,secondary,primary,category}(ObjectsWithNoTags \bowtie_{type=secondary} SecondaryTerm \bowtie PrimaryTerm \bowtie Contains \bowtie Donation \bowtie Donor)$

7. Lets say that two people have catalogued together if they have each, on the same day, catalogued items that come from the same donation. Find all volunteers who have been on staff since 2000 or earlier, and have catalogued together with every permanent staff member. Report the volunteer name, address and start date.

VolunteersBefore2000 := $\sigma_{type="volunteer" \land date < 2000}$ Staff

PermanentStaff := $\sigma_{type="permanent"}$ Staff

 $V1 := VolunteersBefore2000 \bowtie Object \bowtie Contains$

 $P1 := PermanentStaff \bowtie Object \bowtie Contains$

$$T1 := \sigma_{V1.NID=P1.NID \land VI.date=P2.date}(V1 \times P1)$$

PeopleNotInAnswer :=
$$(\pi_{volunteer}T1 \times \pi_{permanent}T1)$$
 - T1

$$Answer := (V1 \times P1) - PeopleNotInAnswer$$

8. Find all pairs of permanent staff members who have catalogued items from the same donation as each other, but never on the same day. Report their staff IDs, full names, and email addresses.

$$PermStaff(SID) := \pi_{SID}\sigma_{type="permanent"}(Staff)$$

```
ObjectContainsStaff(SID, date, NID) := \pi_{SID,date,NID}
                                           (Object \bowtie_{who=SID} Staff \bowtie Contains)
  PermStaffShardNIDsNotDate(SID) :=
    \pi_{SID}\sigma_{O1.SID}\neq_{O2.SID}\wedge_{O1.date}\neq_{O2.date}\wedge_{O1.NID}=_{O2.NID}
       ((\rho_{O1}ObjectContainsStaff) \times (\rho_{O2}ObjectContainsStaff))
  Answer(SID, firstname, surname, email) :=
      \pi_{SID.firstname.surname.email}(PermStaffShardNIDsNotDate \bowtie Staff)
9. Find all donors who have, at least twice, made more than one donation
 in a year, but havent donated anything since 2009. Report the donors full
 name and address, and the date of their most recent donation.
  AtLeastTwice(DID) := \pi_{D1.DID}\sigma_{D1.NID\neq D2.NID^D1.date.year=D2.date.year^D1.DID=D2.DID}
                                           ((\rho_{D1}Donation) \times (\rho_{D2}Donation))
 DonatedAfter2009(DID) := \pi_{DID}\sigma_{date.uear > 2009}(Donation)
  DIDsThatMatch(DID) := [(\pi_{DID}Donation) - DonatedAfter 2009] \cap AtLeastTwice
  MostRecentDonation(DID, date) := \pi_{DID.date}Donation-
       \pi_{D1.DID.D1.date}\sigma_{D1.date}\sigma_{D2.date}[(\rho_{D1}Donation) \times (\rho_{D2}Donation)]
   Answer(firstname, surname, address, date) :=
   \pi_{firstname, surname, address, date}(Donation \bowtie DIDsThatMatch \bowtie MostRecentDonation)
```

10. Find all donors who have made only one donation, and it was before 2008, and their donation included some art: i.e., some item whose secondary term, primary term, or category included the substring art. Report their donor ID and every Chenhall category in which they've donated an item. Put the information into a relation with attributes called DID and category. You may use the notation substring(x, art) within a selection condition to say that attribute x contains the substring art.

```
DonationsBefore2008 := \sigma_{date < 2008}Donation

2orMoreDonations := \sigma_{D1.DID=D2.DID \land D1.NID \neq D2.NID} ((\rho_{D1}DonationBefore2008) × (\rho_{D2}DonationBefore2008))

1DonationDonors(DID) := (\pi_{DID}DonationsBefore2008 - \pi_{D1.DID}2orMoreDonations)

AllObjectsDonatedB42008 := Object \bowtie Contains \bowtie DonationsBefore2008

SecondaryArt := \sigma_{type(x,"art")}AllObjectsDonatedB42008
```

```
\begin{aligned} & \text{CategoryArt} := \sigma_{category(x,"art")} \\ & \text{AllObjectsDonatedB42008} \bowtie \text{SecondaryTerm} \bowtie \text{PrimaryTerm} \\ & \text{AllArtDonatedB42008} := \text{SecondaryArt} \cup \text{PrimaryArt} \cup \text{CategoryArt} \\ & \text{DonorAnswer(DID)} := ((\pi_{DID}\text{AllArtDonatedB42008}) \bowtie \text{1DonationDonors}) \\ & \text{Answer(DID, category)} := \pi_{DID,chenhall}(\text{DonorAnswer} \bowtie \\ & \text{AllObjectsDonatedB42008} \bowtie \text{SecondaryTerm} \bowtie \text{PrimaryTerm}) \end{aligned}
```

PART 2:

1. Staff members of type temp cannot catalogue objects

$$\sigma_{type="temp"}(Object \bowtie_{who=SID} Staff) = \emptyset$$

2. The first things volunteers are allowed to catalogue must be in Chenhall category Personal Artifacts. Once they have catalogued three such objects, they are allowed to also catalogue objects in Chenhall category Furnishings. They are never allowed to catalogue other sorts of items.

VolunteerStaff(SID) := $\pi_{SID}\sigma_{type}(Staff)$

```
SIDPersonalArtifacts(SID, CN) := \pi_{who,CN} \sigma_{category="PersonalArtifacts"}(Object \bowtie SecondaryTerm \bowtie PrimaryTerm)
```

VolunteerPersonalArtifacts(SID, CN) :=
$$\pi_{SID,CN}\sigma_{type="Volunteer"}(SIDPersonalArtifacts \bowtie Staff)$$

$$\begin{aligned} \text{AtLeast3Inputs}(\text{SID}) &:= \pi_{V1.SID} \sigma_{V1.CN \neq V2.CN \wedge V2.CN \neq V3.CN \wedge V1.CN \neq V3.CN \wedge V1.SID = V2.SID = V3.SID} [(\rho_{V1} Volunteer Personal Artifacts) \times \\ & (\rho_{V2} Volunteer Personal Artifacts) \times (\rho_{V3} Volunteer Personal Artifacts)] \end{aligned}$$

$$VolunteerStaff[SID] \subset \pi_{who}\sigma_{category="PersonalArtifacts"}(Object \bowtie SecondaryTerm \bowtie PrimaryTerm)$$

If
$$VolunteerStaff[SID] \not\subset AtLeast3Inputs[SID] \Rightarrow \pi_{who}\sigma_{category=`Furnishings' \land type=``volunteer''}(Object \bowtie SecondaryTerm \bowtie PrimaryTerm \bowtie Staff) = \emptyset$$

3. For donations made prior to July 1st, 2001, all items in the donation had to be catalogued by the same person.

$$\sigma_{D1.CN \neq D2.CN \land D1.NID = D2.NID \land D1.SID \neq D2.SID \land D1.date = D2.date \land D1.date < July/1/2001}$$

$$(\rho_{D1}(Contains \bowtie \rho_{who=SID}Object) \times \rho_{D2}(Contains \bowtie \rho_{who=SID}Object)) = \emptyset$$