**CSC343: Assignment 1**

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**Part 1: Our constraints**

* Πspecies(Artifact) - Πspecies (Species) = Ø

**Explanation:**

* Πrank(Staff) ⊆ {‘technician’,’student’,’pre-tenure’,’tenure’}

**Explanation:**

* Πfamily(Genus) - Πfamily (COL) = Ø

**Explanation:**

* Πgenus(Species) ⊆ Πgenus(Genus)

**Explanation:**

* ΠCID(Collected) = ΠCID(Collection)

**Explanation:**

* ΠAN(Artifact) = ΠAN(Collected)

**Explanation:** This implies that each artifact in the relation ‘Artifact’ must also be present in the relation ‘Collected’ and it is required to ensure that all the collected artifacts and recorded.

* ΠSID(Collection) ⊆ ΠSID(Staff)

**Explanation: :** This implies that every SID in relation collection must be present in the relation Staff and it means that the collector must be a staff but not all staff members have collected an artifact and it is required to track the collection to the staff who made it.

* Π SID(Artifact) ⊆ ΠSID(Staff)

**Explanation:** This implies that every SID in relation artifact must be present in the relation Staff and that not all staff members necessarily collect/maintain artifacts and it is required to track the artifact to the staff related to it.

* Πtype(Artifact) ⊆ {‘tissue,’image’,’model’,’live’}

**Explanation:** This implies that the attribute ‘type’ in the relation ‘Artifact’ can only contain the following values: {‘tissue,’image’,’model’,’live’} and it is required to ensure proper categorization of the artifacts.

* ΠAN(Published) ⊆ ΠAN(Artifact)

**Explanation:** This implies that every artifact in the published relation must be present in the artifact relation and that not all artifacts are published in a journal and it is required to make sure an artifact is only published after it has been recorded in the system.

**Part 2: Queries**

**1.) Find the most recent collection date of any artifact collected by a staff member who has held their current rank the longest. Keep ties.**

**Solution:**

**2.) Find all staff who maintain all artifacts in at least one collection.**

**Solution:**

*//we retrieve the required staff data of staff who maintain artifacts*

StaffData(CID,AN,SID):= Π CID, AN, SID (Collection ⋈ Artifact);

*//find the collections which are maintained by at least 2 staff members*

AtleastTwo(CID):= Π T1.CID(σ T1.CID ≠T2.CID ∧T1.SID ≠T2.SID (ρT1 StaffData × ρT2 StaffData));

*//we find the collections which are maintained by 1 staff by taking the difference between all the collections and collections which are maintained by two people*

OneCollection(CID):= Π CID (Collected)-AtleastTwo;

*//then we find the staff who maintains that collection by natural joining*

Answer(SID):= ΠSID(StaffData ⋈ OneCollection)

**3.) Find all artifacts that were collected by the same staff who maintains them.**

**Solution:**

*//retrieve the required information from collection and collection. Rename collector SID to differentiate from maintainer SID.*

CollectData(CID,date,cSID):= Π CID, date, SID (Collection ⋈ Collected);

*//get answer by selection tuples where collector SID = maintainer SID*

Answer(AN):= ΠAN(σ*cSID=SID* (CollectData ⋈ Artifact))

**4.)Find all staff who have collected at least 3 artifacts from every species in some family.**

**Solution:**

**5.) Find all publications that have used exactly 2 of our artifacts.**

**Solution:**

*//get required data from published relation*

Publication(AN,Journal):= Π AN,Journal(Published);

*//find publications that have used at least 2 artifacts*

AtleastTwo(Journal):= Π T1.Journal(σ T1.Journal ≠T2.Journal ∧T1.AN <T2.AN (ρT1 Publication × ρT2 Publication));

*//find publications that have used at least 3 artifacts*

AtleastThree(Journal):= Π T1.Journal(σ T1.Journal ≠T2.Journal≠T3.Journal ∧T1.AN <T2.AN<T3.AN (ρT1 Publication × ρT2 Publication × ρT3 Publication));

*//difference between AtleastTwo – AtleastThree are the publications that have used exactly 2 artifacts*

Answer(Journal):= AtleastTwo – AtleastThree;

**6.) Find all locations where at least one artifact from every family has been collected.**

**Solution:**

**7.) Find all staff who have collected only tissue samples.**

**Solution:**

*//retrieve the required information from collection and collection. Rename collector SID to differentiate from maintainer SID*

CollectorData(cSID,AN):= Π SID, AN, (Collection ⋈ Collected);

//get data about what types of samples collectors have collected. Rename cSID to SID for convenience.

TypesData(SID,Type):= Π cSID,type (CollectorData ⋈ Artifact);

//find staff who have collected artifacts excluding tissue type.

NotTissues(SID):= ΠSID(σ*type*≠”tissue” (TypesData));

//find staff who have collected tissue samples(including other sample types)

Tissues(SID):= ΠSID(σ*type=*”tissue” (TypesData));

//difference gives us staff who have collected ONLY tissue samples.

Answer(SID):= Tissues – NotTissues;

**8.) Find all staff pairs who have worked only with each other on collections.**

**Solution:**

**9.) Staff member SID1 is in influenced by staff member SID2 if (a) they have ever worked together on a collection or (b) if SID1 has ever worked with a staff member who is in influenced by SID2. Find SIDs of staff members in influenced by SID 42.**

**Solution:** Cannot be expressed.

**Part 3: Your Constraints**

1. No species is also a genus.

**Solution:**

species (Species)  genus(Genus) = Ø

2. No genus belongs to more than one family.

**Solution:**

genus(σ*genus\_a.genus = genus\_b.genus ^ genus\_a.family <> genus\_b.family* (ρgenus\_a (Genus) x )) = Ø

3. All publications must be published after all artifacts they use have been collected.

**Solution:**

*//get all the artifacts and its respective collection date*

ArtifactData(AN,CollectionDate):= Π AN,date (Collection ⋈ Collected);

*//find artifacts published dates*

PublicationData(AN,PublishDate):= Π AN,date(Published)

//find instances when artifact was published before it was collected

R = σ CollectionDate>PublicationDate (ArtifactData ⋈ PublicationData)

//result should be Ø

R= Ø

4. Students may not catalogue live artifacts.

**Solution:**

R:= σ *type=*”tissue” ∧ rank=”student” (Artifact ⋈ Staff)

R = Ø