CSC343 2022W

Assignment 1

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Our constraints

- $\Pi_{pID} Staff - \Pi_{pID} Patient = \emptyset$
- $(\Pi_{adID} Vaccination \cup \Pi_{atID} Vaccination) \subseteq \Pi_{sID} Staff$
- $\Pi_{specialty} Staff \subseteq \{'RN','RPN','MD','Pharmacist'\}$
- $\Pi_{pID} Vaccination \subseteq \Pi_{pID} Patient$
- $\Pi_{bID} Vial - \Pi_{bID} Batch = \emptyset$
- $\Pi_{covidStatus} Vaccination \subseteq \{'positive','negative'\}$
- $\Pi_{reaction} Vaccination \subseteq \{'true','false'\}$
- $\Pi_{mID} Batch \subseteq \Pi_{mID} Manufacturer$

- $\Pi_{bID} Tracking - \Pi_{bID} Batch = \emptyset$
- $\Pi_{vID} Vaccination - \Pi_{vID} Vial = \emptyset$

1. Every medical staff should also be patient who receive vaccination

2. Everyone who administrate vaccination to the patient or attend patient after their vaccination should be one of the medical staff

3. All medical staff should have a specialty within ‘RN’, ‘RPN’, ‘MD’ or ‘Pharmacist’

4.Only patients can receive vaccination

5. All vial used should be in a batch have a valid batch number

6. At vaccination time the patient had an infection status of either “positive” or “negative”

7.After receiving the vaccination, each patient should either have reaction to the vaccine or have no reaction to the vaccine

8. All batches of vaccine should be manufactured by companies listed in Manufacturer relation

9. No batch that was tracked by Canada is outside the existing batch

10. All vial used for vaccination should be part of the Vial were removed from cold storage (listed in vial relation

Queries

Query: Find pID of all patients who have received a dose of a two-dose vaccine, followed by any other vaccine after the minimum interval of the former vaccine, and who are currently within the duration of protection of some vaccine.

//get the information framing the info for two doses

$Dose1Manufacture(1stDoesvID, 1stDoseName, 1stDoesSequence\ ,1stDoseinterval) \coloneqq \pi_{(\text{vID,name},sequence\_length,intervalMin)}(Viral \bowtie \text{batch} \bowtie \text{Manufacture})$

$Dose2Manufacture(2ndDoesvID, 2ndDoseName) \coloneqq \pi_{(\text{vID},name)}(Viral \bowtie \text{batch} \bowtie \text{Manufacture})$

//get the patient who had at least two does

$TwoDoesPatient(pID, 1stDoesvID, 1stDoseDate, pID, 2ndDoesvID, 2ndDoseDate,) \coloneqq \pi_{(V1.pID,V1.date,V1.vID,V2.date,V2.vID)}\left(\sigma_{V1.pID=V2.pID \wedge V1.date<V2.date}(\rho_{V1}Vaccinaton \times \rho_{V2}Vaccination)\right)$

//get the patient whose 1st and 2nd doses satisfy condition and the Patient who is in the protection

$DoesOKPatient(\text{pID}) \coloneqq \pi_{pID}(\sigma_{(1stDoesSequence=2 \wedge 1stDoseName \neq 2ndDoseName \wedge 1stDoseDate+1stDoseinterval<2ndDoseDate)}(TwoDoesPatient \bowtie Dose1Manufacture \bowtie Dose2Manufacture))$

$StillInProtectionPatient(pID) \coloneqq \pi_{pID}\left(\sigma_{Date+duration \geq Today}(Vaccination \bowtie Viral \bowtie batch \bowtie Manufacture)\right)$

//get the answer from the union

$Answer(pID) \coloneqq FirstDoseOKPatient \cap StillInProtectionPatient$

Query: Find the specialties of every staff who has administered vaccines from every batch that was used in British Columbia after April 2021.

//get all the batch that satisfy all the time and location condition

$\text{BatchinTimePlace(bID)} \coloneqq \pi_{bID}\left(\sigma_{(date>April,2021 \wedge locationName=\text{British Columbia})}(Vaccination \bowtie Batch \bowtie Tracking)\right)$

//use combination to find the combination of staff and batch and using exclusion to find the staff not in the batch condition

$ShouldHaveMatch(sID, bID) \coloneqq \pi_{(sID,bID)}\ (BatchinTimeSpace \times \text{Staff})$

$AllStaffBatch(sID, bID) \coloneqq \pi_{(adID,bID)}(Vaccination \times Batch)$

$StaffNotWithBatch(sID, bID) \coloneqq ShouldHaveMatch - AllStaffBatch$

//get the match answer

$Answer(sID, speciality) \coloneqq \pi_{(sID,speciality)}\big((AllStaffBatch - StaffNotWithBatch) \bowtie Staff\big)$

Query: Find pID of all patients whose latest positive test is after the duration of their latest vaccine expired.

//get the list of the patient and vaccination which is not the last vaccine and use the entire vaccination to get the info //of the last vaccine

$$NotLastVaccine(pID, vID, date) \coloneqq \pi_{(V2.pID,V2.vID,V2.date)}\left(\sigma_{(V1.pID=V2.pID \wedge V1.date<V2.date)}(\rho_{V1}Vaccinaton \times \rho_{v2}Vaccination)\right)$$

$$LastVaccine(pID, vID, date) \coloneqq (\pi_{(pID,vID,date)}Vaccination) - NotLastVaccine$$

//get the info for the vaccine of the last dose and using condition to get the answer

$$VirusManufacture(pID, vID, date, duration) \coloneqq \pi_{(pID,vID,date,duration)}(LastVaccine \bowtie Viral \bowtie Batch \bowtie Manufacture)$$

$$Answers(pID) \coloneqq \pi_{pID}\left(\sigma_{(date+duration<latestPostivetive)}(VirusManufacture \bowtie Patient)\right)$$

Query: Find sID of all staff who administered a vaccination from a vial that had thawed longer than recommended by the manufacturer or administered a vaccine earlier than the mininum interval from an earlier vaccine.

//get the relationship between vaccination and manufacture

$$VaccineManufacture(pID, adID, date, vID, thawTime, thawMax, intervalMin) \coloneqq \pi_{(pID,adID,date,vID,thawTime,thawMax,intervalMin)}\,(Vaccination \bowtie Viral \bowtie Batch \bowtie Manufacture)$$

//get the staff who administrate vaccine thawed longer than expected

$$LongerThaw(sID) \coloneqq \pi_{adID}(\,\sigma_{date>thawTime+thawMax} VaccineManufacture)$$

//get the stuff who administrate vaccine with interval less than required

$$LessThanInverval(sID) \coloneqq \pi_{(V2.adID)}\Big(\sigma_{(V1.pID=V2.pID \wedge V1.date<V2.date \wedge V1.date+V1.intervalMin>V2.date)}(\rho_{V1} VaccineManufacture \times \rho_{v2} VaccineManufacture)\Big)$$

//get the answer with the union relationship of two situation above

$$Answer(sID) \coloneqq LongerThaw \cup LessThanInverval$$

Query: Find vID of all vials that had 2 doses or fewer used by the time they had exceeded the maximum time recommended by the manufacturer after thawing.

//get the relationship between vaccine and manufacture and the viral that has dose used before thawing

$$VaccineManufacture(pID, date, vID, thawTime, thawMax) :=$$
$$\Pi_{(pID,date,vID,thawTime,thawMax)}\,(Vaccination \bowtie Viral \bowtie Batch \bowtie Manufacture)$$

$$ViralUsedaBeforeThraw(pID, vID, date) := \Pi_{pID,vID,date}(\sigma_{date-thawTime<thawMax} VaccineManufacture)$$

//get the vial id that has three or more does used and get the compliment as the answer

$$ThreeDoesVial(vID) :=$$
$$\Pi_{(V1.vID)}\left(\sigma_{(V1.vID=V2.vID \wedge V1.date>V2.date \wedge V1.vID=V3.vID \wedge V2.date>V3.date)}(\rho_{V1} ViralUsedaBeforeThraw \times \rho_{V2} ViralUsedaBeforeThraw \times \rho_{V3} ViralUsedaBeforeThraw)\right)$$

$$Answers(vID) := \Pi_{vID} ViralUsedBeforeThraw - ThreeDoesVial$$

Query: Find vID of all vials that had all their doses used by the time they had exceeded the maximum time recommended by the manufacturer after thawing.

//get the vial id for all vials that all end up used till count = 0

$$allUsedDose(vID) \coloneqq \pi_{vID}\sigma_{doseCount=0}\, Vial$$

//cast all useful info for into one big relation

$$allVaccineInfo(vID, date, thawTime, thawMax) \coloneqq \pi_{vID,date,thawTime,thawMax}(Vaccination \bowtie Vial \bowtie Batch \bowtie Manufacturer)$$

//find the vials that end up used till count = 0 but expired

$$expiredUsedDose(vID) \coloneqq \pi_{vID}(\sigma_{date>thawTime+thawMax}(allUsedDose \bowtie allVaccinationInfo))$$

//Use all used vid – expired to obtain non-expired

$$Answers(vID) \coloneqq \pi_{vid}allUsedDose - \pi_{vid}expiredUsedDose$$

Query: Staff sID1 is exposed to covid-positive staff sID2 if one or more of (a), (b), or (c) occurred:

(a) staff sID2 administered or attended staff sID1's vaccination,

(b) staff sID1 administered or attended staff sID2's vaccination,

(c) or if some staff exposed to sID2 administered or attended sID1's, or had a vaccination administered or attended by sID1. vaccination.

Find sID of all staff exposed to the covid-positive staff with sID 42.

Cannot Express

Query: Find the staff who gave the most recent vaccine that had a reaction. Keep ties.

//obtain all pID and adID who has a reaction after vaccination

$$everyReactionStaff(pID, \text{ad}ID, date) \coloneqq \pi_{pID,adID,date}\sigma_{reaction=true}Vaccination$$

//get the vaccinations that is not the recent to the staff

$$NotRecentReactionStaff(\text{ad}ID) \coloneqq \pi_{\text{B}.adID}(\sigma_{A.date>B.date}(\rho_A everyReactionStaff \times \rho_B everyReactionStaff))$$

//get the staff whose most recent vaccine has a reaction

$$Answers(sID) \coloneqq \pi_{\text{adID}}everyReactionStaff - NotRecentReactionStaff$$

Query: Find all patients who did not have a positive covid status when they were first vaccinated, but did have a positive test at some later date.

//obtain info for everyone who has at least two does, and return the info for the very first shot

$$firstVaccination(pID, date, covidStatus) \coloneqq \pi_{A.pID,A.date,A.covidStatus}(\sigma_{(A.pID=B.pID \wedge A.date<B.date)}(\rho_A Vaccination \times \rho_B Vaccination))$$

//obtain all pID who has only one shot

$$onlyFrstDose(pID) \coloneqq \pi_{pID} Vaccination - \pi_{pID}\ firstVaccination$$

//obtain all info for patient who only receive one shot

$$\text{onlyFirstDoseInfo}(\text{pID}, \text{date}, \text{covidStatus}) \coloneqq \pi_{\text{pID,date,covidStatus}}(\text{onlyFirstDose} \bowtie \text{Vaccination})$$

//integrate info with first dose info of two dose or more patient and the dose info for the patient only receive one dose

$$totalPatient(pID, date, covidStatus) \coloneqq firstVaccination \cup onlyFirstDoseInfo$$

//Latest Positive test is late than the date in info (which means positive) and the status was negative when vaccinated

$$Answers(pID) \coloneqq \pi_{pID}(\sigma_{LatestPositiveTest>date \wedge covidStatus=negative}(Patient \bowtie totalPatient))$$

Your Constraint

1. No batch is from two different manufacturers.
2. Every manufacturer has produced at least one vial.
3. Every manufacturer's vaccine has arrived in Canada.
4. All staff receive at least two doses.

1. $\sigma_{(V1.mID \neq V2.mID \wedge V1.bID = V2.bID)}(\rho_{V1} Viral \times \rho_{V2} Viral) = \emptyset$
2. $\Pi_{mID} Manufacture \subseteq \Pi_{mID}(Vial \bowtie Batch)$
3. $\Pi_{mID} Manufacturer - \Pi_{mID} Tracking \bowtie Batch = \emptyset$
4. Assume that pID is a key and no staff could share the same pID otherwise it could not be expressed

   $TwoDosePatient(pID) \coloneqq \Pi_{A.pID} \sigma_{A.pID = B.pID \wedge A.date \neq B.date} (\rho_A Vaccination \times \rho_B Vaccination)$

   Π_{pID} Staff $\bowtie$ Patient $-$ TwoDosePatient $= \emptyset$