**CSC343 ASSIGNMENT 1**

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**PART 1: QUERIES**

1. - Patients who have had narcotics prescribed to them and the doctor who prescribed it:

*PrescribedNarcotics(patient, doctor) := Πpatient, doctor σschedule=“Narcotics”(Product ⨝ product.DIN=prescription.drug Prescription)*

* Have had more than two doctors prescribe the narcotics:

*Result(patient) := Πd1.patient σ (d1.doctor≠d2.doctor)*∧*(d2.doctor≠d3.doctor*)∧*(d1.doctor≠d3.doctor)*∧*(d1.patient=d2.patient)*∧*(d2.patient=d3.patient)*∧*(d1.patient=d3.patient)(ρd1 PrescribedNarcotics x ρd2PrescribedNarcotics x ρd3PrescribedNarcotics)*

1. *Neverfilled(RxID) := ΠRxIDσdate.year=2016 Prescription – ΠRxID σdate.year=2016 Filled*

*Result(patient, RxID, date, drug) :=* Π*patient, RxID, date, drug (Prescription ⨝ NeverFilled)*

1. *Cannot be expressed.*
2. *NarcoticsPrescribed(patient, doctor, date) := Πpatient, doctor, date σschedule=“Narcotics”(Product ⨝ product.DIN=prescription.drug Prescription)*

*Result(patient) := Πd1.patient* σ*(d1.doctor≠d2.doctor)*∧*(d1.patient=d2.patient)*∧*((d1.date≤d2.date)*∨*(d2.date≤d1.date))(ρd1 (NarcoticsPrescribed x ρd2(NarcoticsPrescribed))*

1. - All drugs that have codeine as their active ingredient*:*

*ActiveCodeine(DIN) := ΠDIN*σ*name=“codeine”(ActiveIngredient)*

* All prescriptions that include these drugs:

*AllCodeinePrescriptions(RxID) := ΠRxID(ActiveCodeine ⨝ ActiveCodeine.DIN=Prescription.drug Prescription)*

* Pharmacists who have filled codeine prescriptions:

*CodeineFilled(OCP) := Πpharmacist(Filled ⨝ AllCodeinePrescriptions)*

* Pharmacists who have NOT filled any codeine prescriptions:

*CodeineNotFilled(OCP) := ΠOCPPharmacist – CodeineFilled*

* Their filled prescriptions:

*PharmacistPrescriptions(RxID, OCP) := ΠRxID, OCP(CodeineNotFilled ⨝ Filled.pharmacist=CodeineNotFilled.OCP Filled)*

* The DIN of the drugs that they have filled:

*DrugsFilled (RxID, OCP, DIN):= ΠRxID, OCP, drug(PharmacistPrescriptions ⨝ Prescription)*

*Result(OCP, schedule) := ΠOCP, schedule(DrugsFilled⨝ Product)*

1. - Trained more than two people:

*NotMinorTrainer(P1, P2) := ΠT1.P1, T1.P2σ(T1.P1≠T2.P1)*∧*(T2.P1≠T3.P1)*∧*(T1.P1≠T3.P1)*∧*(T1.P2=T2.P2)*∧*(T2.P2=T3.P2)*∧*(T1.P2=T3.P2)(ρT1TrainedUnder x ρT2TrainedUnder x ρT3TrainedUnder)*

*MinorTrainer(P1, P2) := ΠP1, P2TrainedUnder – NotMinorTrainer*

* Minor Trainers are linked with their trainers:

*TrainerBecomesTrainee(P1, P2) := ΠMinorTrainer.P2,TrainedUnder.P2 (MinorTrainer ⨝ MinorTrainer.P2=TrainedUnder.P1 TrainedUnder)*

*Result(Trainer) :=* *ΠT1.P2*σ*(T1.P1≠T2.P1)*∧*(T2.P1≠T3.P1)*∧*(T1.P1≠T3.P1)*∧*(T1.P2=T2.P2)*∧*(T2.P2=T3.P2)*∧*(T1.P2=T3.P2) (ρT1TrainerBecomesTrainee x ρT2 TrainerBecomesTrainee x ρT3 TrainerBecomesTrainee)*

1. - Every pharmacist’s first prescription:

*FirstPrescription(pharmacist, RxID, date) := ΠP1.pharmacist, P1.RxID, P1.date*σ*(P1.pharmacist=P2.pharmacist)*∧*(P1.date>P2.date) (ρP1Filled x ρP2Filled)*

* Latest first prescription:

*Junior(pharmacist, RxID, date) := ΠP1.pharmacist, P1.RxID, P1.date*σ*(P1.pharmacist≠P2.pharmacist)*∧*(P1.date>P2.date)(ρP1FirstPrescription x ρP2FirstPrescription)*

*Result(pharmacist, RxID, dateFilled, dateWritten) := Πpharmacist, RxID, Junior.date, Prescription.date(Prescription ⨝Junior)*

1. - (Patients who got their homeopathic drug prescription filled) ∩ (Patients who did not get their other prescriptions filled)

* Patients who got their homeopathic drug prescription filled:

*HomeopathicDrugs(DIN) := ΠDINσschedule=“homeopathic”Product*

*HomeopathicPrescriptions(patient, RxID) := Πpatient, RxID(Prescription ⨝ Prescription.drug=HomeopathicDrugs.DIN HomeopathicDrugs)*

*FilledHomeopathic(Patient) := Πpatient(HomeopathicPrescriptions ⨝ Filled)*

* Patients who did not get their other drug prescriptions filled:

*NonHomeopathicDrugs(DIN) := ΠDINProduct – HomeopathicDrugs*

*NonHomeopathicPrescriptions(patient, RxID) := Π*patient, RxID*Prescription – HomeopathicPrescriptions*

*NotFilled(RxID) := ΠRxIDPrescription – ΠRxIDFilled*

*NotFilledNonHomeopathic(patient) := Πpatient(NonHomeopathicPrescriptions ⨝ NotFilled)*

*Result(patient) := FilledNonHomeopathic* ∩ *NotFilledNonHomeopathic*

1. - All narcotic drugs:

*Narcotics(DIN) :=*  Π*DIN*σ*schedule=“Narcotics”Product*

* Narcotic drugs with a single active ingredient with units in mg:

*ActiveAndNarcotic := ActiveIngredient ⨝Narcotics*

*OneActiveIngredient(DIN) := ΠDINσ(d1.name=d2.name)*∧*(unit=“mg”)(ρd1ActiveAndNarcotic) x (ρd2ActiveAndNarcotic)*

* Patients who received atleast two prescriptions for these drugs:

*PresAndActive := Prescription ⨝ Prescription.drug=OneActiveIngredient.DIN OneActiveIngredient*

*AtLeastTwo(date, patient, dosage) := Πdate, patient, dosage σ(d1.RxID≠d2.RxID)*∧*(d1.patient=d2.patient)(ρd1PresAndActive) x (ρd2 PresAndActive)*

* Dosage never decreased from one prescription to the next for the same patient:

*Result(patient) := ΠP1.patientσ(P1.patient=P2.patient)*∧*(P1.date≥P2.date)*∧*(P1.dosage≥ P2.dosage)*

*(ρP1 AtLeastTwo) x (ρP2 AtLeastTwo)*

1. *Cannot be expressed.*
2. - Trainee(s) who finished their training first:

*First(OCP, first) := Πd1.P2, d1.P1σ(d1.P2=d2.P2)*∧*(d1.completed<d2.completed) (ρd1TrainedUnder x ρd2TrainedUnder)*

* Trainees who finished their training last:

*Last(OCP, last) := Πd1.P2, d1.P1σ(d1.P2=d2.P2)*∧*(d1.completed>d2.completed) (ρd1TrainedUnder x ρd2TrainedUnder)*

*Result(OCP, first, last) := (First ⨝ Last)*

1. - All filled prescriptions:

*FilledPrescriptions(RxID, patient, fDate) := ΠRxID, patient, Filled.date (Filled ⨝Prescription)*

* People who had more than one prescription filled in a year:

*MoreThanOne(RxID, patient, fDate) := Πp1.RxID, p1.patient, p1.fDateσ(p1.RxID≠p2.RxID)*∧*(p1.patient=p2.patient)*∧*(p1.fDate.year=p2.fDate.year) (ρp1FilledPrescriptions x ρp2FilledPrescriptions)*

* People who had more than one prescription filled in a year **atleast twice:**

*AtleastTwice(RxID, patient, fDate) := Πp1.RxID, p1.patient, p1.fDateσ(p1.RxID≠p2.RxID)*∧*(p1.patient=p2.patient)*∧*(p1.fDate.year>p2.fDate.year) (ρp1MoreThanOne x ρp2MoreThanOne)*

* But they have not had a prescription filled since 2014:

*Result(patient, recentlyFilled) := Πpatient, fDateσfDate.year ≤ 2014 AtleastTwice*

**PART 2: Additional Integrity Constraints**

1. *CannotBeTrained(P1, P2) := Πt1.OCP, t2.OCP σt1.registered* ≤ *t2.registered (ρt1Pharmacist x ρt2Pharmacist)*

*TrainedUnderSubset := ΠP1, P2TrainedUnder*

*TrainedUnderSubset* ∩ *CannotBeTrained = Ø*

1. - All prescriptions with their schedules:

*AllPrescriptions(schedule, DIN, date, doctor)Π* schedule, DIN, date, doctor(Prescription *⨝ prescription.drug = Product.DIN Product)*

*PrescribedNarcotics(doctor, date) := Πdoctor, date σschedule=“Narcotics” AllPrescriptions*

*ThreeOTC(doctor, date1, date2, date3) := Πd1.doctor, p1.date, p2.date, p3.date σ(d1.schedule=d2.schedule=d3.schedule=“OTC”)*∧*(d1.DIN≠d2.DIN)*∧*(d2.DIN≠d3.DIN)*∧*(d1.DIN≠d3.DIN)*∧*(d1.doctor=d2.doctor)*∧*(d2.doctor=d3.doctor) (ρd1AllPrescriptions x ρd2AllPrescriptions x ρd3AllPrescriptions)*

* These OTC were prescribed before the narcotics:

*BeforeNarcotics(doctor) :=* σ*(date1<date)*∧*(date2<date)*∧*(date3<date)(PrescribedNarcotics ⨝ThreeOTC)*

Doctors who cannot prescribe narcotics:

*CannotPrescribe(doctor) := ΠdoctorAll Prescriptions – Π*doctor*PrescribedNarcotics – BeforeNarcotics*

*ΠdoctorPrescribedNarcotics ∩ CannotPrescribe = Ø*