CS-353 Section 2

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Q.1 [36 pts, 6 pts each] Given the following relational schema about music albums:

Song(s-title, written-by, length)
Singer(s-name, birth-year, nationality)
Album(a-title, s-name, rating, year)
FK: s-name references Singer
SongInAlbum(s-title, a-title, track-number)
FK: s-title references Song
FK: a-title references Album

Give the corresponding **Relational Algebra** queries for each of the following.

(a) Give the name and nationality of the singers who are younger than 25 and had an album in 2022.

$$\Pi_{\text{s-name, nationality}}\left(\sigma_{\text{birth-year} > 1998 \wedge \text{year}=2022}(\text{Singer} \bowtie \text{Album})\right)$$

(b) Give the title and writer of the songs from the albums released in 2022 and have a rating higher than 4.0.

$$\text{desAlbum} \leftarrow \sigma_{\text{year}=2022 \wedge \text{rating} > 4.0}(\text{Album})$$
$$\text{combined} \leftarrow (\text{desAlbum} \bowtie \text{SongInAlbum}) \bowtie \text{Song}$$
$$\Pi_{\text{s-title, written\_by}}(\text{combined})$$

(c) Give the name of the Turkish singers who do not have an album in 2022.

$$\text{turkSinger} \leftarrow \sigma_{\text{nationality} = \text{"Turkish"}}(\text{Singer})$$
$$\text{nameSinger} \leftarrow \Pi_{\text{s-name}}(\text{turkSinger})$$
$$\text{nameOfAlbumOwners} \leftarrow \Pi_{\text{s-name}}(\sigma_{\text{year}=2022}(\text{Album}))$$
$$\text{nameSinger} - \text{nameOfAlbumOwners}$$

(d) Give the title and singer name of the highest rated album of 2022.

notMax ← $\Pi_{a1.a\text{-}title,\ a1.s\text{-}name,\ a1.rating}$ (ρ_{a1} (Album) ⋈ ρ_{a2} (Album))
$a1.rating < a_2.rating$

ratings that are less than some other ratings (not maximum)

maxAlbum ← $\Pi_{a\text{-}title,\ s\text{-}name,\ rating}$ (Album) − notMax

$\Pi_{a\text{-}title,\ s\text{-}name}$ (maxAlbum)

(e) Give the title of the albums from 2022 which have more than 10 songs.

haveTenPlusSong ← $\sigma_{album\text{-}size > 10}$ (a-title $\mathcal{G}_{Count(s\text{-}title)\ as\ album\text{-}size}$ (SongInAlbum))

a-title	album-size
⋮	⋮

desiredAlbum ← $\sigma_{year = 2022}$ (Album ⋈ haveTenPlusSong)

$\Pi_{a\text{-}title}$ (desiredAlbum)

(f) Give the title and track number of the shortest song in the album entitled "ABC".

desAlbumSong ← ($\sigma_{a\text{-}title = "ABC"}$ (SongInAlbum)) ⋈ Song

notShortest ← $\Pi_{s1.s\text{-}title,\ s1.track\text{-}number}$ (ρ_{s1} (desAlbumSong) ⋈ ρ_{s2} (desAlbumSong))
$s1.length > s2.length$

$\Pi_{s\text{-}title,\ track\text{-}number}$ (desAlbumSong) − notShortest

Q.2 [64 pts, 8 pts each] Given the following relational schema for a prescription system:

Doctor(TCK, name, specialty, phone, city)
Patient(TCK, name, phone, birthyear, primary-doctor-TCK)
    FK: primary-doctor-TCK references Doctor(TCK)
Drug(name, company, price, production-year)
Prescription(id, date, doctor-TCK, patient-TCK)
    FK: doctor-TCK references Doctor(TCK)
    FK: patient-TCK references Patient(TCK)
DrugInPrescription(presc-id, drug-name)
    FK: presc-id references Prescription(id)
    FK: drug-name references Drug(name)

Give the corresponding **Relational Algebra** queries for each of the following.

(a) Give the name and price of the drugs that Pfizer produced in the last year (i.e., 2022).

$\Pi_{name, price}\left(\sigma_{company = "Pfizer" \wedge production\text{-}year = 2022}(Drug)\right)$

(b) Give the TCK and name of the patients who had a prescription written by their primary doctors yesterday (i.e., 20/02/2023).

$desPres \leftarrow \sigma_{date = "20/02/2023"}(Prescription)$

$Combined \leftarrow Patient \bowtie_{Patient.TCK = desPres.patient\text{-}TCK \wedge Patient.primary\text{-}doctor\text{-}TCK = desPres.doctor\_TCK} desPres$

$\Pi_{TCK, name}(combined)$

(c) Give the name and company of the drugs which were placed in yesterday's prescriptions.

$yesPres \leftarrow \sigma_{date = "20/02/2023"}(Prescription)$

$combined \leftarrow \rho_d\left(yesPres \bowtie_{yesPres.id = DrugInPrescription.presc\_id} DrugInPrescription\right) \bowtie_{d.drug\text{-}name = Drug.name} Drug$

$\Pi_{name, company}$ (combined)

(d) Give the TCK and name of the patients who are older than 70 and had a prescription yesterday from a doctor in Ankara.

yesPres ← $\sigma_{date = "20/02/2023"}$ (Prescription)

AnkaraPres ← $\sigma_{city = "Ankara"}$ (yesPres ⋈ Doctor)
yesPres.doctor-TCK = Doktor.TCK

$\Pi_{TCK, name}$ ($\sigma_{birthyear < 1953}$ (AnkaraPres ⋈ Patient))
AnkaraPres.patient-TCK = Patient.TCK

↳ it should also given

(e) For each production year, give the name and company of the drug with the highest price.

highest ← $_{production\text{-}year}\mathcal{G}_{max(price)\ as\ max\text{-}price}$ (Drug)

$\Pi_{highest.production\text{-}year, name, company}$ (highest ⋈ Drug)
highest.production-year = Drug.production-year
highest.max-price = Drug.price

(f) Give the id of the prescription with the TCK of the doctor who wrote it, which has the highest number of drugs in yesterday's prescriptions.

yesPres ← $\sigma_{date = "20/02/2023"}$ (Prescription)

withDrug ← yesPres ⋈ DrugInPrescription
yesPres.id = DrugInPrescription.presc-id

docPresNum ← $_{doctor\text{-}TCK}\mathcal{G}_{count(id)\ as\ pres\text{-}Num}$ (yesPres)

notMax ← $\Pi_{p1.doctor\_TCK, p1.pres\text{-}Num}$ (ρ_{p1}(docPresNum) ⋈ ρ_{p2}(docPresNum))
p1.pres-Num < p2.pres-Num

MaxDoc ← docPresNum − notMax

$\Pi_{id, doctor\text{-}TCK}$ (Prescription ⋈ maxDoc)

highest number of drugs in yesterday's prescriptions.

(g) Give the name and company of the drugs which appeared at least 100 times in yesterday's prescriptions.

$$temp \leftarrow {}_{drug\text{-}name}\mathcal{G}_{count(presc\text{-}id)\ as\ cnt}(DrugInPrescription)$$

To get presc-id back:

$$cntDrug \leftarrow temp \bowtie DrugInPrescription$$

drug-name	cnt
⋮	⋮

$$yesPres \leftarrow \sigma_{date = "20/02/2023"}(Prescription)$$

$$yesDrug \leftarrow yesPres \bowtie_{yesPres.id = cntDrug.presc\text{-}id} (\sigma_{cnt \geq 100}(cntDrug))$$

$$\pi_{name, company}(yesDrug \bowtie_{yesDrug.drug\text{-}name = Drug.name} Drug)$$

(h) Give the TCK and name of the oldest patients for whom at least 10 prescriptions have been written.

$$patientCnt \leftarrow \sigma_{cnt \geq 10}({}_{patient\text{-}TCK}\mathcal{G}_{count(id)\ as\ cnt}(Prescription))$$

$$\pi_{TCK, name}(Patient \bowtie_{Patient.TCK = patientCnt.patient\text{-}TCK} patientCnt)$$