UNIVERSIDADE DE ÉVORA

Curso de Engenharia Informática

Bases de Dados

Modelo Relacional - Álgebra relacional - SQL

Relatório do 1º Trabalho

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Exercícios e Resoluções

1. Indique as superchaves, chaves candidatas e chaves estrangeiras das relações:

economy (Country, GDP, Agriculter, Industry, Inflaction, Unemployment)

organization (Name, Abbreviation, City, Country, Province)

isMember (Organization, Country, Type)

economy (Country, GDP, Agriculter, Industry, Inflaction, Unemployment)

- Superchaves:
  {Country}, {GDP}, …[1]
- Candidatas:
  {Country}, {GDP}
- Primary:
  {Country}
- Estrangeira:
  {}

organization (Name, Abbreviation, City, Country, Province)

- Superchaves:
  {Name}, {Abbreviation}, …[2]
- Candidatas:
  {Name}, {Abbreviation}
- Primary:
  {Abbreviation}
- Estrangeira:
  Country da relação economy

isMember (Organization, Country, Type)

- Superchaves:
  {Country, Organization}, {Organization, Country, Type}
- Candidatas:
  {Country, Organization}
- Primary:
  {Country, Organization}
- Estrangeira:
  Country da relação economy

2. Suponha que se pretende criar uma rede social com membros caracterizados por um nome, um email, o ano de nascimento e a lista de países de que gosta. Para representar os membros usam-se as relações:
   • membro (Nome, Email, Ano)
   • gostaDe (Nome, Country)

[1] Combinações das Chaves Candidatas com os outros atributos (Agriculter, Industry, Inflaction, Unemployment).
[2] Combinações das Chaves Candidatas com os outros atributos (City, Country, Province).

(a) Indique as superchaves, chaves candidatas e chaves estrangeiras destas relações, membro e gostaDe.

membro (Nome, Email, Ano)

- Superchaves

  {Email}, {Email, Nome}, {Email, Ano}, {Email, Ano, Nome}

- Chave candidata

  {Email}

- Chave primaria

  {Email}

- Chave estrangeira

  {}

gostaDe (Nome, Country)

- Superchaves

  {Nome, Country}

- Chave candidata

  {Nome, Country}

- Chave primaria

  {Nome, Country}

- Chave estrangeira

  Country da relação economy

(b) Indique o código SQL para criar estas relações no SQL.

```
create table membro (
        nome char (20),
        email char (20),
        ano integer,
        primary key (email));

create table gostaDe (
        nome char (20),
        country varchar (4),
```

primary key (nome, country));

(c) Insira 15 membros na relação membro com nome, email e ano de nascimento inventados. Os primeiros cinco membros devem gostar de todos os países da europa. Os cinco membros seguintes devem gostar de todos os países que são membros da União Europeia. E os últimos cinco gostam de todos os países que têm uma percentagem da população que fala português.

(A resposta encontra-se no ficheiro Inserção Valores em anexo)

3. Indique a expressão em Álgebra relacional e em SQL para responder às seguintes questões:

(a) Quais os nomes dos países que pertencem à União Europeia?

Álgebra Relacional:

$$\pi_{country.name}\left(\sigma_{\substack{code = isMember.country \\ \wedge abbreviation = isMember.organization \\ \wedge\ organization.name = Union\ European}}(country \times isMember \times organization)\right)$$

SQL:

SELECT country.name

from country, organization, isMember

where code = isMember.country and organization.name = 'European Union' and abbreviation = isMember.organization

(b) Que países estão na Europa, mas não pertencem à União Europeia?

Álgebra Relacional:

$$r = \pi_{country.name}\left(\sigma_{\substack{code = isMember.country \\ \wedge abbreviation = isMember.organization \\ \wedge\ organization.name = Union\ European}}(country \times isMember \times organization)\right)$$

$$\pi_{country.name}\left(\sigma_{\substack{code = encopasses.country \\ \wedge continent = Europe}}(country \times encompasses)\right) - r$$

SQL:

SELECT country.name

FROM country, encompasses

WHERE country.code = encompasses.country and encompasses.continent='Europe'

EXCEPT

SELECT country.name

FROM country, organization, isMember

WHERE code = isMember.country and organization.name = 'European Union' and abbreviation = isMember.organization

(c) Para cada país da União Europeia indique o seu produto interno bruto (GDP)?

Álgebra Relacional:

$$\pi_{country.name,GDP}\left(\sigma_{\substack{organization.name = European\ Union \\ \wedge abbreviation = isMember.organization \\ \wedge code = isMember.country\ \wedge economy.country = code}}\left(\begin{matrix} country \times isMember \times \\ organization \times economy \end{matrix}\right)\right)$$

SQL:

SELECT country.name, economy.gdp

FROM country, economy, isMember, organization

WHERE code = economy.country and code = isMember.country and organization.name = 'European Union' and abbreviation = isMember.organization

(d) Qual é o país da Europa que tem o menor produto interno bruto?

Álgebra Relacional:

$$\pi_{country.name}\left(\mathcal{G}_{min}(economy.GDP)\ as\ n\left(\sigma_{\substack{code = economy.country \\ \wedge continent = Europe}}\left(\begin{matrix} country \times \\ continent \times economy \end{matrix}\right)\right)\right)$$

SQL:

SELECT country.name

FROM country, continent, economy

WHERE code = economy.country and continent.name = 'Europe' and economy.gdp = (SELECT MIN (economy.gdp) FROM economy);

(e) Para cada organização indique o número de países membros.

Álgebra Relacional:

$$organization.name\ \mathcal{G}_{count}(isMember.country)\ as\ n\left(\sigma_{isMember.organization=abbreviation}\begin{pmatrix}isMember\\ \times\ organization\end{pmatrix}\right)$$

SQL:

SELECT organization.name, count(ismember.country)

FROM ismember, organization

WHERE ismember.organization = organization.abbreviation

GROUP BY organization.name

(f) Para cada país indique o número de organizações a que pertence.

Álgebra Relacional:

$$country.name\ \mathcal{G}_{count}(isMember.organization)\ as\ n\left(\sigma_{isMember.country=code}\begin{pmatrix}isMember\\ \times\ country\end{pmatrix}\right)$$

SQL:

SELECT country.name, count (ismember.organization)

FROM country, ismember

WHERE code = ismember.country

GROUP BY country.name

(g) Qual é o país que pertence a mais organizações?

Álgebra Relacional:

$$\pi_{name}\left(\mathcal{G}_{max}(n)\ as\ n\ (t)\ \bowtie\ t\right)$$

$$t = name\ \mathcal{G}_{count}(isMember.organization)\ as\ n\left(\sigma_{isMember.country=code}\begin{pmatrix}isMember\\ \times\ country\end{pmatrix}\right)$$

SQL:

WITH count_nfront (name, N) as (SELECT country.name, count (ismember.organization) as n

FROM country, ismember

WHERE (code = ismember.country)

GROUP BY country.name)

SELECT name

FROM (select max (n) as n

FROM count_nfront) as country, count_nfront

WHERE country.n = count_nfront.n

(h) Qual é organização que tem menos países?

Álgebra Relacional:

$$\pi_{organization.name}\left(organization.name\mathcal{G}_{min}(n)\ as\ n\ (t) \bowtie t\right)$$

$$t = organization.name\ \mathcal{G}_{count}(isMember.country)\ as\ n(s)$$

$$s = \sigma_{abbreviation=isMember.organization}\begin{pmatrix} isMember \\ \times\ organization \end{pmatrix}$$

SQL:

WITH count_nfront (name, N) as (SELECT organization.name, count (ismember.country) as n

FROM organization, ismember

WHERE organization.abbreviation = ismember.organization

GROUP BY organization.name)

SELECT name

FROM (SELECT min(n) as n

FROM count_nfront) as organization, count_nfront

WHERE organization.n = count_nfront.n

(i) Qual é o país que tem o maior produto interno?

Álgebra Relacional:

$$\pi_{country.name}\left(\mathcal{G}_{max}(economy.GDP)\ as\ n\ (t)\right)$$

$$t = \sigma_{code=economy.country}\begin{pmatrix} country \\ \times\ economy \end{pmatrix}$$

SQL:

SELECT country.name

FROM country, economy

WHERE code = economy.country and economy.gdp = (SELECT MAX (economy.gdp) FROM economy);

(j) Que países são membros de todas as organizações de que Marrocos é membro?

Álgebra Relacional:

$$\pi_{country.name,isMember.organization}\left(\sigma_{code=isMember.country}\left(\begin{matrix}country\\ \times\ isMember\end{matrix}\right)\right) \div t$$

$$t = \pi_{isMember.organization}\left(\sigma_{code=isMember.country\ \wedge\ country.name=Marrocos}\left(\begin{matrix}country\\ \times\ isMember\end{matrix}\right)\right)$$

SQL:

```
SELECT name
FROM country as c
WHERE not EXISTS (SELECT DISTINCT ismember.organization
        FROM country, ismember
        WHERE (code = ismember.country and country.name = 'Morocco')
        EXCEPT
        SELECT DISTINCT ismember.organization
        FROM ismember
        WHERE ismember.country = c.code )
```

(k) Que organizações têm como membros todos os países que estão no Benelux?

Álgebra Relacional:

$$\pi_{organization.name,country.name}\left(\sigma_{\begin{matrix}code=isMember.country\\ \wedge abbreviation=isMember.organization\end{matrix}}\left(\begin{matrix}country \times isMember\\ \times\ organization\end{matrix}\right)\right) \div t$$

$$t = \pi_{country.name}\left(\sigma_{\begin{matrix}code=isMember.country\\ \wedge organization.name=Benelux\\ \wedge abbreviation=isMember.organization\end{matrix}}\left(\begin{matrix}country \times isMember \times\\ organization\end{matrix}\right)\right)$$

SQL:

```
SELECT name
FROM organization as c
WHERE not EXISTS (SELECT DISTINCT country.name
        FROM country, ismember, organization
        WHERE (code = ismember.country and organization.name = 'Benelux' and
abbreviation = ismember.organization)
```

```
        EXCEPT
        SELECT DISTINCT country.name
        FROM country, ismember
        WHERE ismember.country = code and c.abbreviation =
ismember.organization )
```