

Bases de Dados

Modelo Relacional - Álgebra relacional

Exercícios para a 4ª aula prática 2ª parte

Modelo Relacional - álgebra relacional

Considere as seguintes relações que são um subconjunto das relações da base de dados mundial: <https://www.dbis.informatik.uni-goettingen.de/Mondial/>:

- country(Code, capital, Province, Population) Country: the countries (and similar areas) of the world with some data.
 - name: the country name
 - code: the country code
 - capital: the name of the capital
 - province: the province where the capital belongs to area: the total area
 - population: the population number
- language(Country, Name, Percentage)
Language: information about the languages spoken in a country
 - country: the country code
 - name: name of the language
 - percentage: percentage of the language in this country
- religion(Country, Name, Percentage)
Religion: information about the religions in a country
 - country: the country code
 - name: name of the religion
 - percentage: percentage of the language in this country
- borders(Country1, Country2, Length)
borders: informations about neighboring countries. Note that in this relation, for every pair of neighboring countries (A,B), only one tuple is given
 - thus, the relation is not symmetric.
 - country1: a country code
 - country2: a country code
 - length: length of the border between country1 and country2

- continent(Name, Area),
Continent: Information about continents.
 - name: name of the continent
 - area: total area of the continent
- encompasses(Country, Continent, Percentage)
Encompasses: information to which continents a country belongs.
 - country: the country code
 - continent: the continent name
 - percentage: percentage, how much of the area of a country belongs to the continent

Indique a expressão de álgebra relacional que obtém a resposta às seguintes perguntas:

1. Quantos Brasileiros (Brazil) falam português?

$$\Pi_{percentage*population} \sigma_{country.code=country \wedge country.name='Brazil'}(language \bowtie country)$$

```
select percentage*population
from language, country
where country.code = country and country.name ='Brazil'
and language.name='Portuguese'
```

2. Quantos países fazem fronteira com a França (France)?

$$r \leftarrow \text{country as c1} \bowtie \text{country as c2} \bowtie \text{borders}$$

$$s \leftarrow \sigma_{(c1.code=country1 \wedge c2.code=country2 \vee c1.code=country2 \wedge c2.code=country1) \wedge c2.name='France'}(r)$$

$$\mathcal{G}_{count(c1.name)} \text{ as } n(s)$$

```
select count(c1.name)
from country as c1, country as c2, borders
where (c1.code=country1 and c2.code=country2 or
      c1.code=country2 and c2.code = country1) and
      c2.name='France'
```

3. Para cada país indique o número de países com que faz fronteira.

$$r \leftarrow \text{country as c1} \bowtie \text{country as c2} \bowtie \text{borders}$$

$$s \leftarrow \sigma_{(c1.code=country1 \wedge c2.code=country2 \vee c1.code=country2 \wedge c2.code=country1) \wedge c2.name='France'}(r)$$

$$c2.name \mathcal{G}_{count(c1.name)} \text{ as } n(s)$$

```

select c2.name, count(c1.name)
from country as c1, country as c2, borders
where (c1.code=country1 and c2.code=country2 or
      c1.code=country2 and c2.code = country1)
group by c2.name

```

4. Qual é número máximo de fronteiras que um país tem?

```

r ← country as c1 X country as c2 X borders

s ← σ(c1.code=country1 ∧ c2.code=country2 ∨ c1.code=country2 ∧ c2.code=country1) ∧ c2.name='France'(r)
t ← c2.name Gcount(c1.name) as n(s)
Gmax(n) as n(t)

with count_nfront(name, N) as (select c2.name, count(c1.name) as n
                                from country as c1,
                                country as c2,
                                borders
                                where (c1.code=country1 and
                                        c2.code=country2 or
                                        c1.code=country2 and
                                        c2.code = country1)
                                group by c2.name)

select max(n) as n
from count_nfront

```

5. Qual é o país que faz fronteira com mais países?

```

r ← country as c1 X country as c2 X borders

s ← σ(c1.code=country1 ∧ c2.code=country2 ∨ c1.code=country2 ∧ c2.code=country1) ∧ c2.name='France'(r)
t ← c2.name Gcount(c1.name) as n(s)
πname(Gmax(n) as n(t) ⋈ t)

with count_nfront(name, N) as (select c2.name, count(c1.name) as n
                                from country as c1,
                                country as c2,
                                borders
                                where (c1.code=country1
                                        and c2.code=country2 or
                                        c1.code=country2 and
                                        c2.code = country1)
                                group by c2.name)

select name
from (select max(n) as n
from count_nfront) as r , count_nfront
where r.n = count_nfront.n

```

6. Quais são as línguas faladas no Japão (Japan)?

$\pi_{language.name} \sigma_{language.country=code \wedge country.name='Japan'}(language \bowtie country)$

```
select language.name
from language, country
where language.country= code and country.name='Japan'
```

7. Quais são os países que falam todas as línguas faladas em Cuba (Cuba)?

$\pi_{country.name,language.name} \sigma_{language.country=code}(language \bowtie country) \div$

$\pi_{language.name} \sigma_{language.country=code \wedge country.name='Cuba'}(language \bowtie country)$

```
select Name
from country as c
where not exists (select distinct language.name
                  from language, country
                  where country.name = 'Cuba' and
                        language.country = country.code
                  except
                  select distinct language.name
                  from language
                  where country = C.code )
```

8. Para cada continente indique o número de países.

$continent \mathcal{G}_{count(country.name)} as n(encompasses X country)$

```
select continent, count(country.name)
from encompasses, country
where country=code
group by continent
```

9. Qual é o continente que tem mais países?

```
with count_np(name,n) as (select continent, count(country.name)
                           from encompasses, country
                           where country=code
                           group by continent)

select Name
from (select max(n) as n from count_np) as r, count_np
where r.n= count_np.n
```

10. Que países estão em mais do que um continente?

```

select name, count(continent) as n
from encompasses, country
where country=code
group by name
having count(continent)>1

```

11. Que países estão no mesmo continente que a Rússia (Russia)?

```

select name
from country as c
where not EXISTS (select continent
                  from encompasses, country
                  where code=country and name ='Russia'
                  except
                  select continent
                  from encompasses, country
                  where code=country and name = c.name)

```

12. Qual é o país que tem mais kms de fronteira com outros países?

```

with ptot (name,n) as (select name, sum(length)
                      from country, borders
                      where code=country1 or code=country2
                      group by name)

select Name
from (select max(n) as n from ptot) as r, ptot
where r.n= ptot.n

```

13. Qual é o país que tem menos kms de fronteira com outros países?

```

with ptot (name,n) as (select name, sum(length)
                      from country, borders
                      where code=country1 or code=country2
                      group by name)

select Name
from (select max(n) as n from ptot) as r, ptot
where r.n= ptot.n

```

14. Qual é o país que tem menos população?

```

select Name
from (select min(population) as n from country) as r, country
where r.n= population

```

15. Qual é o país que tem mais católicos (Catholic)?

```

with aux(name,n) as (select country.name, population*percentage
                      from country, religion
                      where code=country and religion.name='Catholic')

select name
from (select max(n) as n from aux) as r, aux
where r.n= aux.n

```

16. Quantas pessoas são praticantes da religião protestante (Protestant)?

```

select sum(population*percentage) from religion, country
where code=country and religion.name='Protestant'

```

17. Qual é religião que está em mais países?

```

select religion.name, count(country.name) from religion, country
where code=country
group by religion.name)
select name
from (select max(N) as n from aux) as r, aux
where r.n=aux.n

```

18. Qual é religião que tem mais praticantes?

```

with aux (name,n) as (
select religion.name, sum(population*percentage) from religion, country
where code=country
group by religion.name)
select name
from (select max(N) as n from aux) as r, aux
where r.n=aux.n

```