Exercise 2

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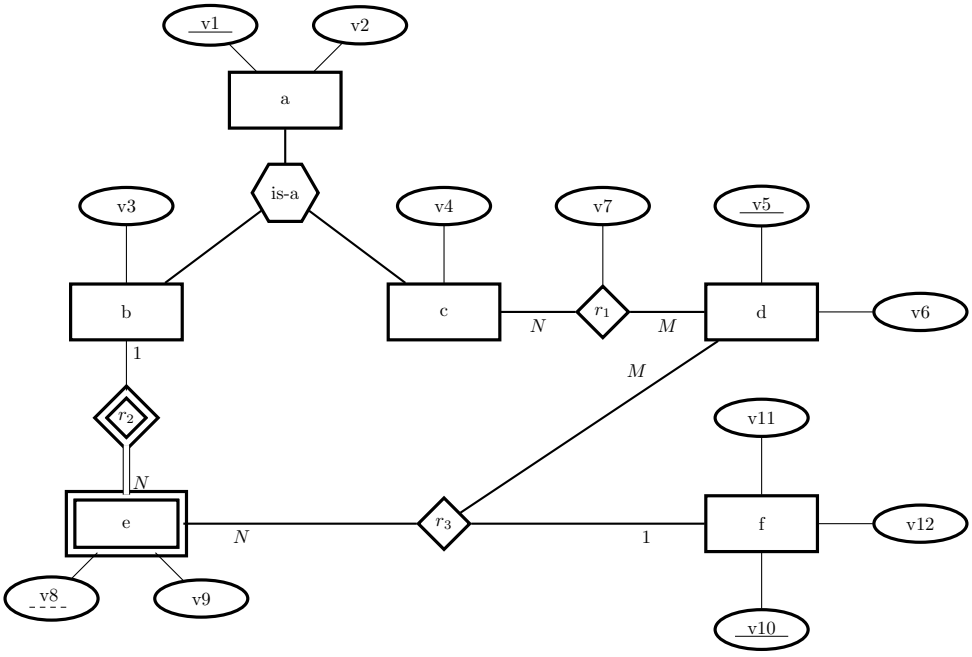
1 Converting an ER Model

Map the following ER model, including primary and foreign keys, to a corresponding relational database schema. Follow the receipt given in the lecture slides and avoid NULL values as much as possible. Whenever you find a foreign key, describe it using the following description:

FOREIGN KEY (a1) REFERENCES a(a1)

Where a1 is the foreign key and a the entity whose attribute a1 belongs to.



2 Relational Algebra and Domain Relational Calculus

Describe in natural language the output of the following relational algebra queries performed on the *Mondial database*.

1. $\pi_{Name,Country}(city) \setminus \pi_{Name,Country}(\rho_{Name \leftarrow City}(located))$
2. $\pi_{Name,Population}(\sigma_{Area>500}(\rho_{Desert \leftarrow Name}(desert) \bowtie geoDesert \bowtie \rho_{Country \leftarrow Code}(\pi_{Code,Name,Population}(country))))$
3. $\pi_{Name,Agriculture,Service,Industry}(\sigma_{GDP<100}(country \bowtie_{Code=Country} economy))$

Describe in natural language the output of the following domain relational calculus queries performed on the *Mondial database*.

1. $\{< n > | \exists c_1, p, po, c, i, d(< c_1, n, p, po, c > \in country \wedge < c_1, i, d, \text{`}Democracy\text{''} > \in politics)\}$

2. $\{< c_1 > |(\exists l, c_2((< c_1, c_2, l > \in borders \vee < c_2, c_1, l > \in borders) \wedge \neg \exists c_3((< c_1, c_3, l > \in borders \vee < c_3, c_1, l > \in borders) \wedge c_2 \neq c_3)))\}$
3. $\{< n_1, a_1 > |\exists i_1, h_1, c_1(< n_1, i_1, a_1, h_1, \text{“}Volcanic\text{”}, c_1 > \in island \wedge \forall n_2, i_2, a_2, h_2, c_2(< n_2, i_2, a_2, h_2, \text{“}Volcanic\text{”}, c_2 > \in island \implies a_1 \geq a_2))\}$

Transform to both relational algebra and domain relational calculus the following queries performed on the *Mondial database*.

1. Return the Names of all the deserts.
2. Return the Area of the Madagascar Island.
3. Return the Names of all countries together with the languages that are spoken there.
4. Return the Names of all the mountains that are located in countries not adjacent to a sea.
5. Return the Country Code of the country with the lowest GDP.
6. Return the Names of the countries that have ALL ethnic groups.