

Name: Eamonn Keogh

You can use the back of this page as scratch

Recall our containment universe, in a sense, it is a little like the map domain. Every capital city is in a country, every country is in a single continent, countries may border other countries.

We could have predicates such as:

$\text{isCapitalCity}(\text{Paris}), \quad \text{isCountry}(\text{France}), \quad \text{isContinent}(\text{Asia}), \quad \text{equals}(\text{Paris}, \text{CapitalCityOf}(\text{France}))$)
 $\text{isCapitalCityof}(\text{Paris}, \text{France})$ // i.e. It is the case that paris is the capital of france
 $\text{isBordering}(\text{US}, \text{Canada})$ // i.e. It is the case that the US borders Canada

We could have functions such as:

$\text{CapitalCityOf}(\text{France})$ // returns *Paris* $\text{hostContinentOf}(\text{Hong-Kong})$ // returns *Asia*

Assume for the moment that someone has TELLED the KB all the relevant facts about the world.

How would we ASK if Madrid is the capital of Spain?	$\text{isCapitalCityof}(\text{Madrid}, \text{Spain})$
How would we ASK if either Ankara or Istanbul is the capital of Turkey	$\text{isCapitalCityof}(\text{Ankara}, \text{Turkey}) \vee \text{isCapitalCityof}(\text{Istanbul}, \text{Turkey})$
How would we ASK if there are at least two counties that border Spain?	$\exists X, Y \text{ isBordering}(X, \text{Spain}) \wedge \text{isCountry}(X) \wedge \text{isBordering}(Y, \text{Spain}) \wedge \text{isCountry}(Y) \wedge \neg \text{equals}(X, Y)$
How would we ASK if there is country with two capital cities?	$\exists X, Y, Z \text{ isCountry}(X) \wedge \text{isCapitalCityof}(Y, X) \wedge \text{isCapitalCityof}(Z, X) \wedge \neg \text{equals}(Z, Y)$

The following questions are independent of the four questions above.

Assume that it is your job to TELL the KB all the relevant facts about the world.

How would you TELL the KB that Portugal borders Spain?	$\text{isBordering}(\text{Portugal}, \text{Spain})$
How would you TELL the KB that "borders" is symmetric?	$\forall X \forall Y \text{ isBordering}(X, Y) \rightarrow \text{isBordering}(Y, X)$
How would you TELL the KB that no county borders Australia?	$\neg \exists X \text{ isCountry}(X) \wedge \text{isBordering}(X, \text{Australia})$
How would you TELL the KB that there is a country that is also a continent?	$\exists X \text{ isCountry}(X) \wedge \text{isContinent}(X)$

Note: The above are my solutions, in most cases, there are other ways to get these 100% correct