Knowledge Representation

April 2nd, 2020

Exercises from AIMA book, 3rd edition, chapter 8

For each of the exercises, indicate the best logical representation and explain why the others can not be solutions or are not suitable.

8.9a) Paris and Marseilles are both in France:

(i) $In(Paris \wedge Marseilles, France)$

(ii) $In(Paris, France) \wedge In(Marseilles, France)$

(iii) $In(Paris, France) \vee In(Marseilles, France)$

Exercises from AIMA book chapter 8

8.9b) There is a country that borders both Iraq and Pakistan:

(i) $\exists c\ Country(c) \land Border(c, Iraq) \land Border(c, Pakistan)$
(ii) $\exists c\ Country(c) \rightarrow [Border(c, Iraq) \land Border(c, Pakistan)]$
(iii) $[\exists c\ Country(c)] \rightarrow [Border(c, Iraq) \land Border(c, Pakistan)]$
(iv) $\exists c\ Border(Country(c), Iraq \land Pakistan)$

Exercises from AIMA book chapter 8

8.9c) All countries that border Ecuador are in South America:

(i) $\forall c\ Country(c) \wedge Border(c, Ecuador) \rightarrow In(c, SouthAmerica)$
(ii) $\forall c\ Country(c) \rightarrow [Border(c, Ecuador) \rightarrow In(c, SouthAmerica)]$
(iii) $\forall c\ [Country(c) \rightarrow Border(c, Ecuador)] \rightarrow In(c, SouthAmerica)$
(iv) $\forall c\ Country(c) \wedge Border(c, Ecuador) \wedge In(c, SouthAmerica)$

Exercises from AIMA book chapter 8

8.9d) No region in South America borders any region in Europe:

(i) $\neg[\exists c, d\ In(c, SouthAmerica) \wedge In(d, Europe) \wedge Borders(c, d)]$
(ii) $\forall c, d\ [In(c, SouthAmerica) \wedge In(d, Europe)] \rightarrow \neg Borders(c, d)$
(iii) $\neg\forall c\ In(c, SouthAmerica) \rightarrow \exists d\ In(d, Europe) \wedge \neg Borders(c, d)$
(iv) $\forall c\ In(c, SouthAmerica) \rightarrow \forall d\ In(d, Europe) \rightarrow \neg Borders(c, d)$

Exercises from AIMA book chapter 8

8.9e) No two adjacent countries have the same map color:

(i) $\forall x, y\ \neg Country(x) \vee \neg Country(y) \vee \neg Borders(x, y) \vee \neg(MapColor(x) = MapColor(y))$
(ii) $\forall x, y\ (Country(x) \wedge Country(y) \wedge Borders(x, y) \wedge \neg(x = y)) \rightarrow \neg(MapColor(x) = MapColor(y))$
(iii) $\forall x, y\ Country(x) \wedge Country(y) \wedge Borders(x, y) \wedge \neg(MapColor(x) = MapColor(y))$
(iv) $\forall x, y\ (Country(x) \wedge Country(y) \wedge Borders(x, y)) \rightarrow MapColor(x \neq y)$

Exercises from AIMA book chapter 8

For the next exercises, write a suitable logical representation.

8.10a) Emily is either a surgeon or a lawyer.

Exercises from AIMA book chapter 8

8.10a) Joe is an actor, but he also holds another job.

Exercises from AIMA book chapter 8

8.10c) All surgeons are doctors.

Exercises from AIMA book chapter 8

8.10d) Joe does not have a lawyer (i.e., is not a customer of any lawyer).

Exercises from AIMA book chapter 8

8.10e) Emily has a boss who is a lawyer.

Exercises from AIMA book chapter 8

8.10f) There exists a lawyer all of whose customers are doctors.

Exercises from AIMA book chapter 8

8.10g) Every surgeon has a lawyer.

Exercises from AIMA book chapter 8

8.19a) Joan has a daughter (possibly more than one, and possibly sons as well).

Exercises from AIMA book chapter 8

8.19b) Joan has exactly one daughter (but may have sons as well).

Exercises from AIMA book chapter 8

8.19c) Joan has exactly one child, a daughter.

Exercises from AIMA book chapter 8

8.19d) Joan and Kevin have exactly one child together.

Exercises from AIMA book chapter 8

8.19e) Joan has at least one child with Kevin, and no children with anyone else.

Exercises from AIMA book chapter 8

8.23a) No two people have the same social security number.