Problem assignment 6

Due: Wednesday, October 16, 2019

Problem 1

Part a.

(i). It is syntactically invalid and therefore meaningless.

(ii). It correctly expresses the English sentence.

(iii). It is syntactically valid but does not express the meaning of the English sentence.

Part b.

(i). It correctly expresses the English sentence.

(ii). It is syntactically valid but does not express the meaning of the English sentence.

(iii). It is syntactically invalid and therefore meaningless.

(iv). It is syntactically invalid and therefore meaningless.

Part c.

(i). It correctly expresses the English sentence.

(ii). It correctly expresses the English sentence.

(iii). It is syntactically valid but does not express the meaning of the English sentence.

(iv) It is syntactically valid but does not express the meaning of the English sentence.

Part d.

(i). It correctly expresses the English sentence.

(ii). It correctly expresses the English sentence.

(iii). It is syntactically valid but does not express the meaning of the English sentence.

(iv). It is syntactically invalid and therefore meaningless.

Part e.

(i). It correctly expresses the English sentence.

(ii). It is syntactically valid but does not express the meaning of the English sentence.

(iii). It is syntactically valid but does not express the meaning of the English sentence.

(iv). It is syntactically invalid and therefore meaningless.

Problem 2

Part a.

$\text{Occupation(Emily, Surgeon)} \vee \text{Occupation(Emily, Lawyer)}$

Part b.

$\exists o\ (o \neq \text{Actor}) \wedge \text{Occupation(Joe, Actor)} \wedge \text{Occupation(Joe, o)}$

Part c.

$\forall p\ \text{Occupation(p, Surgeon)} \Rightarrow \text{Occupation(p, Doctor)}$

Part d.

$\neg \exists p\ \text{Occupation(p, Lawyer)} \wedge \text{Customer(Joe, p)}$

Part e.

$\exists p\ \text{Boss(p, Emily)} \wedge \text{Occupation(p, Lawyer)}$

Part f.

$\exists p1\ \text{Occupation(p1, Lawyer)} \wedge \forall p2\ \text{Customer(p2, p1)} \Rightarrow \text{Occupation(p2, Doctor)}$

Part g.

$\forall p1\ Occupation(p1, Surgeon) \Rightarrow \exists p2\ Occupation(p2, Lawyer) \wedge Customer(p1, p2)$

Problem 3

Part a.

First, assign symbols for the paragraph:

BelongTo(p,c): Predicate. Person p belongs to Club c.
Like(p,w): Predicate. Person p likes Weather w.
Skier(p): Function. Person p is Skier.
MountainClimber(p): Function Person p is mountain climber.
Tony, Mike, John: Constant denoting people.
Alpine Club: Constant denoting club.
Rain, Snow: Constant denoting weather.

Tony, Mike and John belong to the Alpine Club.
$BelongTo(Tony, Alpine\ Club) \wedge BelongTo(Mike, Alpine\ Club) \wedge BelongTo(John, Alpine\ Club)$ ---①

Every member of the Alpine Club is either a skier or a mountain climber or both.

$\forall m\ BelongTo(m, Alpine\ Club) \Rightarrow Skier(m) \vee MountainClimber(m)$ ---②

No mountain climber likes rain.

$\neg \exists p\ MountainClimber(p) \wedge Like(p, rain)$ ---③

all skiers like snow.

$\forall p\ Skier(p) \Rightarrow Like(p, snow)$ ---④

Mike dislikes whatever Tony likes and likes whatever Tony dislikes.

$[\forall w\ Like(Tony,w) \Rightarrow \neg Like(Mike, w)] \wedge [\forall w\ \neg Like(Tony,w) \Rightarrow Like(Mike, w)]$ ---⑤

Tony likes rain and snow.
$Like(Tony, Rain) \wedge Like(Tony, Snow)$ ---⑥

Part b.

First, use FOL express the statement:
There exists a member of the Alpine Club who is a mountain climber but not a skier.

$\exists p\ BelongTo(p, Alpine\ Club) \wedge MountainClimber(p) \wedge \neg Skier(p)$

Then for the knowledge base, from ①, we get:

BelongTo(Mike, Alpine Club) --- ⑦

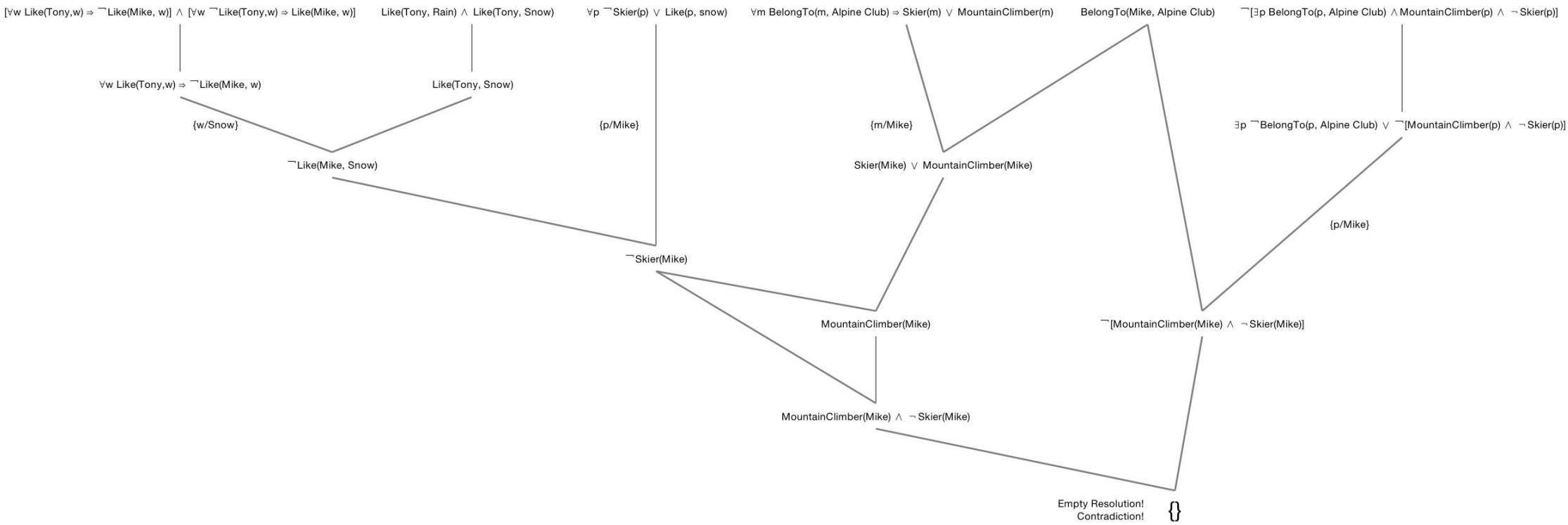
Knowledge rule ③ can be expressed in universal quantifier:

$\forall p\ MountainClimber(p) \Rightarrow \neg Like(p, Rain)$ --- ⑧

For knowledge rule ④, eliminate the ⇒:

$\forall p \ \neg Skier(p) \vee Like(p, snow)$ --- ⑨

Let's do the resolution refutation:



According to the resolution refutation, we got the contradiction at KB $\wedge \ \neg \alpha$, so the knowledge form the paragraph entails the statement.