

1.5, 1.6 Ontology Analysis Project

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1. Axioms

The two ontologies in my project are:

1. https://github.com/gruninger/colore/blob/master/ontologies/tripartite_incidence/nonisolated_plane.clif
2. https://github.com/gruninger/colore/blob/master/ontologies/tripartite_incidence/strong_nonisolated_line.clif

The Prover9 translations of the ontologies are in the files *nonisolated_plane.in* and *strong_nonisolated_line.in*. The generic ontology given is found in the *cardworld.in* file.

2. Entailment

The first ontology (*nonisolated_plane*) does not entail the second (*strong_nonisolated_line*) as we can construct a model of the first that falsifies the other ontology.

nonentail1.model is a model of *nonisolated_plane.in* that falsifies the axiom:

```
(all l (line(l) -> exists p exists q (plane(q) & point(p) &
in(p, q) & in(p, l) & in(l, q)))).
```

in *strong_nonisolated_line.in*.

Both files share 8 axioms and have 1 distinct axiom each. The second ontology (*strong_nonisolated_line*) entails the additional distinct axiom in the first ontology (*nonisolated_plane*):

```
(all q all p (plane(q) & point(p) & (in(p, q))) -> exists l
(line(l) & in(p, l) & in(l, q))).
```

The proof of this is found in *entails1.proof*.

3. Mapping

The mapping from the tripartite incidence hierarchy ontologies to the generic ontology is described below:

```
(all x (point(x) <-> vertex(x))).
(all x (line(x) <-> edge(x))).
(all x (plane(x) <-> surface(x))).
(all x all y (in(x, y) <-> part(x, y))).
```

4. Interpretability

The two tripartite incidence ontologies each interpret some (but not all) axioms from the generic ontology, as described below:

nonisolated_plane.in interprets the following axioms from *cardworld.in*:

- *tlaxiom1.proof* proves the interpretability of axiom 1 of *cardworld.in* from *nonisolated_plane.in*:
$$(\text{all } x \text{ (point}(x) \rightarrow (\neg \text{edge}(x) \ \& \ \neg \text{surface}(x)))) .$$
- *tlaxiom2.proof* proves the interpretability of axiom 2 of *cardworld.in* from *nonisolated_plane.in*:
$$(\text{all } x \text{ (edge}(x) \rightarrow \neg \text{surface}(x))) .$$
- *tlaxiom3.proof* proves the interpretability of axiom 3 of *cardworld.in* from *nonisolated_plane.in*:
$$(\text{all } x \text{ all } y \text{ (part}(x,y) \rightarrow \text{part}(y,x))) .$$
- *tlaxiom6.proof* proves the interpretability of axiom 6 of *cardworld.in* from *nonisolated_plane.in*:
$$(\text{all } x \text{ all } y \text{ ((part}(x,y) \ \& \ \text{point}(x) \ \& \ \text{point}(y)) \rightarrow (x=y))) .$$
- *tlaxiom7.proof* proves the interpretability of axiom 7 of *cardworld.in* from *nonisolated_plane.in*:
$$(\text{all } x \text{ all } y \text{ ((part}(x,y) \ \& \ \text{edge}(x) \ \& \ \text{edge}(y)) \rightarrow (x=y))) .$$
- *tlaxiom8.proof* proves the interpretability of axiom 8 of *cardworld.in* from *nonisolated_plane.in*:
$$(\text{all } x \text{ all } y \text{ ((part}(x,y) \ \& \ \text{surface}(x) \ \& \ \text{surface}(y)) \rightarrow (x=y))) .$$

The rest of the axioms not mentioned above are not interpretable by *nonisolated_plane.in*. They are found in the *tlaxiom*<number>.model files. As a result, *cardworld.in* (T3) is not interpretable from *nonisolated_plane.in* (T1).

strong_nonisolated_line.in interprets the following axioms from *cardworld.in*:

- *t2axiom1.proof* proves the interpretability of axiom 1 of *cardworld.in* from *strong_nonisolated_line.in*:
$$(\text{all } x \text{ (point}(x) \rightarrow (\neg \text{edge}(x) \ \& \ \neg \text{surface}(x)))) .$$
- *t2axiom2.proof* proves the interpretability of axiom 2 of *cardworld.in* from *strong_nonisolated_line.in*:
$$(\text{all } x \text{ (edge}(x) \rightarrow \neg \text{surface}(x))) .$$
- *t2axiom3.proof* proves the interpretability of axiom 3 of *cardworld.in* from *strong_nonisolated_line.in*:
$$(\text{all } x \text{ all } y \text{ (part}(x,y) \rightarrow \text{part}(y,x))) .$$
- *t2axiom6.proof* proves the interpretability of axiom 6 of *cardworld.in* from *strong_nonisolated_line.in*:
$$(\text{all } x \text{ all } y \text{ ((part}(x,y) \ \& \ \text{point}(x) \ \& \ \text{point}(y)) \rightarrow (x=y))) .$$
- *t2axiom7.proof* proves the interpretability of axiom 7 of *cardworld.in* from *strong_nonisolated_line.in*:
$$(\text{all } x \text{ all } y \text{ ((part}(x,y) \ \& \ \text{edge}(x) \ \& \ \text{edge}(y)) \rightarrow (x=y))) .$$

- *t2axiom8.proof* proves the interpretability of axiom 8 of *cardworld.in* from *strong_nonisolated_line.in*:

$$(all\ x\ all\ y\ ((part(x,y) \ \&\ surface(x) \ \&\ surface(y)) \rightarrow (x=y))) .$$
- *t2axiom13.proof* proves the interpretability of axiom 13 of *cardworld.in* from *strong_nonisolated_line.in*:

$$(all\ e\ all\ v1\ all\ v2\ all\ v3 \\
\quad ((edge(e) \\
\quad \ \&\ vertex(v1) \\
\quad \ \&\ vertex(v2) \\
\quad \ \&\ vertex(v3) \\
\quad \ \&\ part(v1,e) \\
\quad \ \&\ part(v2,e) \\
\quad \ \&\ part(v3,e)) \\
\rightarrow \\
\quad ((v1 = v2) \ | \ (v1 = v3) \ | \ (v2 = v3)))) .$$

The rest of the axioms not mentioned above are not interpretable by *strong_nonisolated_line.in*. They are found in the *t2axiom<number>.model* files. As a result, *cardworld.in* (T3) is not interpretable from *strong_nonisolated_line.in* (T2).

3. Complete Listing of Files

1. *nonisolated_plane.in*
2. *strong_nonisolated_line.in*
3. *cardworld.in*
4. *nonentail1.model*
5. *entails1.proof*
6. *tlaxiom1.proof*
7. *tlaxiom2.proof*
8. *tlaxiom3.proof*
9. *tlaxiom4.model*
10. *tlaxiom5.model*
11. *tlaxiom6.proof*
12. *tlaxiom7.proof*
13. *tlaxiom8.proof*
14. *tlaxiom9.model*
15. *tlaxiom10.model*
16. *tlaxiom11.model*
17. *tlaxiom12.model*
18. *tlaxiom13.model*
19. *tlaxiom14.model*
20. *tlaxiom15.model*
21. *tlaxiom16.model*
22. *tlaxiom17.model*
23. *tlaxiom18.model*

24. tlaxiom19.model
25. tlaxiom20.model
26. tlaxiom21.model
27. tlaxiom22.model
28. tlaxiom23.model
29. tlaxiom24.model
30. tlaxiom25.model
31. t2axiom1.proof
32. t2axiom2.proof
33. t2axiom3.proof
34. t2axiom4.model
35. t2axiom5.model
36. t2axiom6.proof
37. t2axiom7.proof
38. t2axiom8.proof
39. t2axiom9.model
40. t2axiom10.model
41. t2axiom11.model
42. t2axiom12.model
43. t2axiom13.proof
44. t2axiom14.model
45. t2axiom15.model
46. t2axiom16.model
47. t2axiom17.model
48. t2axiom18.model
49. t2axiom19.model
50. t2axiom20.model
51. t2axiom21.model
52. t2axiom22.model
53. t2axiom23.model
54. t2axiom24.model
55. t2axiom25.model