Propositional Logic

Implementation of truth table enumeration algorithm for deciding propositional entailment.

i.e, create a knowledge base using propositional logic and show that the given query entails the knowledge base or not.

: semantics

→ Truth tables for connectives

P	Q	¬P	P∧Q	P∨Q	P⟺Q
false	false	true	false	false	true
false	true	true	false	true	false
true	false	false	false	true	false
true	true	false	false	true	false

↗ and   ⟹ output

Example i)   ¬or
$\alpha = A \vee B$ KB = (A∨C) ∧ (B∨¬C)

checking that KB ⊨ α

A	B	C	A∨C	B∨¬C	KB	α
false	false	false	false	true	false	false
false	false	true	true	false	false	false
false	true	false	false	true	false	true
false	true	true	true	true	true	true
true	false	false	true	true	true	true
true	false	true	true	false	false	true
true	true	false	true	true	true	true
true	true	true	true	true	true	true

KB ⊨ α holds (KB entails α)

Algorithm

→ List all variables
- Find all the symbols that appear in KB and α
- Example A, B, C

→ Try every possibility
- Each symbol can be True or False
- so we test all combinations (like filling a truth table)

→ check KB
- For each combination, see if KB is true

→ check α
- if KB is true, then α must also be true
- if KB is false, we don't care about α in that row

→ Final decision
- if in all cases where KB is true, α is also true
  → KB entails α
- if in any case KB is true but α is false →
  KB does not entail α

2. consider $S \in T$ as variables and follow relation
$$a : \neg(S \vee T)$$
$$b : (S \wedge T)$$
$$c : T \vee \neg T$$
write truth table and show whether
   i) a entails b
   ii) a entails c

S	T	¬T	S∨T (a)	S∧T (b)	T∨¬T (c)
0	0	1	0	0	1
0	1	0	1	0	1
1	0	1	1	0	1
1	1	0	1	1	1

"1" = True

"0" = False

Answer: a entails b ⟹ not holds

a entails c ⟹ holds

8 ig
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