

Lab Propositional logic

Implementation of truth-table enumeration algo for deciding propositional entailment
i.e. create a knowledge base using propositional logic & show that the given query entails the knowledge base or not.

Truth table for Connectives:

P	Q	$\neg P$	$P \wedge Q$	$P \vee Q$	$P \Rightarrow Q$
false	false	true	false	false	true
false	true	true	false	true	false
true	false	false	false	true	false
true	true	false	true	true	true

a. Propositional inference: Enumeration method

Example: Knowledge base

$$\alpha = A \vee B \quad KB = (A \vee C) \wedge (B \vee C)$$

checking that $KB \models \alpha$

A	B	C	$A \vee C$	$B \vee C$	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 $\models \alpha$ holds (KB entails α)

Algorithm

→ List all variables

* Find the symbols that appear in KB & 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 \rightarrow KB entails α

* if in any case KB is true but α is false \rightarrow KB does not entail α

a. Consider $S \in T$ as variables & following relations \rightarrow

$$a: S \vee T$$

$$b: (S \wedge T)$$

$$c: T \vee \neg T$$

Write truth table & show whether

(i) a entails b

(ii) a entails c

			or	And	
S	T	$\neg T$	$S \vee T$	$S \wedge T$	$T \vee \neg T$
0	0	1	0	0	1
0	1	0	1	0	1
1	0	1	1	0	1
1	1	0	1	1	1

Answer: a entails $b \Rightarrow$ not holds
 a entails $c \Rightarrow$ holds.

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Enter alpha (example: $A \mid B$): $(A \mid B)$
Enter KB (example: $(A \mid C) \& (B \mid \sim C)$): $(A \mid C) \& (B \mid \sim C)$

Truth Table for $\alpha = (A \mid B)$, $KB = (A \mid C) \& (B \mid \sim C)$

A	B	C	α	KB
False	False	False	False	False
False	False	True	False	False
False	True	False	True	False
False	True	True	True	True
True	False	False	True	True
True	False	True	True	False
True	True	False	True	True
True	True	True	True	True

$KB \models \alpha$ holds (KB entails α)

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