Lab - 6

Propositional Logic

Implemention of truth-table enumeration algorithm for deciding propositional entailment.

i.e Create a knowledge base using propositi-onal logic & show that the given query entails the knowledge base @ not.

Truth table for connectives.

P	Q	$\sim P$ (¬)	$P \wedge Q$ (And)	$P \vee Q$ (or)	$P \Leftrightarrow Q$ (xor)
false	false	true	false	false	true
false	true	true	false	true	false
true	false	false	false	true	false
true	true.	false	true	true	true.

Q. Propositional Inference :- Enumeration Method.

Example:

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

Checking that $KB \models \alpha$ → entails → whenever KB is true, then α must also be true

A	B	C	$A \vee C$	$B \vee \neg C$	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
false	true	true	true	true	true	true
true	false	false	true	true	false	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

① List all variables
- Find all the symbols that appear in KB & α
- Ex:- A, B, C

② Try every possibility
- Each symbol can be True or False
- So we test all combinations

③ Check KB
For each combination, see if KB is true.

④ 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.

⑤ 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.

Q. Consider S & T as variables & following relation →

a : (S∨T)
b : (S∧T)
c : T ∨ ∼T

Write truth-table & show wheather if
① a entails b (a⊨b)
② a entails c

| | | | a | b | c |
S	T	~T	S∨T	S∧T	T∨~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

① $a \models b$ ⇒ not holds.   ✗

②. $a \models c$ ⇒ holds   ✓