AI tutorial 5

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Question 1

Assume that $P=\neg(p1 \vee \neg p2)$. Write down the truth table for P. Give the list of interpretations I under which P is true. How many different interpretations are there that make P true?

p1	**p2**	**$(p1 \vee \neg p2)$**	**$\neg(p1 \vee \neg p2)$**	**P**
1	1	1	0	0
1	0	1	0	0
0	1	0	1	1
0	0	1	0	0

Question 2

Assume thatP= $(((p1 \wedge \neg p2) \wedge p3) \Rightarrow p2)$. Write down the truth table for P. How many different interpretations make P true. Give the list of interpretations I under which P false.

p1	**p2**	**p3**	**$(p1 \wedge \neg p2)$**	**$(p1 \wedge \neg p2) \wedge p3$**	**$(((p1 \wedge \neg p2) \wedge p3) \Rightarrow p2)$**	**p**
1	1	1	0	0	1	1
1	1	0	0	0	1	1

1	0	1	1	1	0	0
0	1	1	0	0	0	0
0	0	1	0	0	1	1
0	1	0	0	0	0	0
1	0	1	1	1	0	0
1	0	0	1	0	0	0
0	0	0	0	0	1	1

This is wrong. Correcting the correct ones

Logical implication truth table

p1	**p2**	**p1 => p2**
1	1	1
1	0	0
0	1	1
0	0	1

Logical implication is ONLY false when 1 0 = 0

p1	**p2**	**p3**	**(p1∧¬p2)**	**(p1∧¬p2)∧p3**	**(((p1∧¬p2)∧p3)⇒p2)**	**p**
0	1	1	0	0	0	1

Question 3

A formula P is calledsatisfiableif there exists an interpretation I such that I§ = 1. Which of the following formulas are satisfiable? Check using truth tables

- (¬p1∧p2)

p1	**p2**	**~p1**	**~p1^p2**
1	1	0	0
1	0	0	0
0	1	1	1
0	0	1	0

Thus this is satisfiable for p1 a= 0 and p2 = 1

- (p1⇒¬p1)

p1	**~p1**	**p1=>~p1**
1	0	0
0	1	1

Thus this is sastisfiable for p1 = 0.

- (p1⇔¬p1)

p1	**~p1**	**p1 <=> ~p1**

1	0	0
0	1	0

Not satisfiable.

- $(p1 \land (\neg p2 \lor \neg p1))$

p1	**p2**	**~p1**	**~p1**	**(~p2 V ~p1)**	**$(p1 \land (\neg p2 \lor \neg p1))$**
1	1	0	0	0	0
1	0	0	1	1	1
0	1	1	0	1	0
0	0	1	1	1	0

Question 4

Consider a formula P with n atomic propositions. How many rows does the truth table for P have?

2^n rows. Because a proposition is either true or false (2).

Question 5

Consider P= $(((((\neg p1 \land p2) \lor p3) \land p4) \lor p5) \Rightarrow p1)$. Show without using truth tables that P is satisfiable.

Let p1 = 1.

Then

p1	anything	anything -> p1
1	1	1
0	1	1

Therefore as long as p1 is 1, anything on the left hand side will always be satisfiable as it either results in a 0 or a 1.

Question 6

Consider P= $(((((\neg p1 \wedge p2) \vee p3) \wedge p4) \vee p5) \wedge (p6 \wedge \neg p6))$. Show withoutus ing truth tables that P is not satisfiable

(p6^~p6) is never satisfiable. Therefore the left hand side is never satisfiable because its an and statement.

Question 7