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CSCI 4350

CSCI 4350/5350

Homework #5

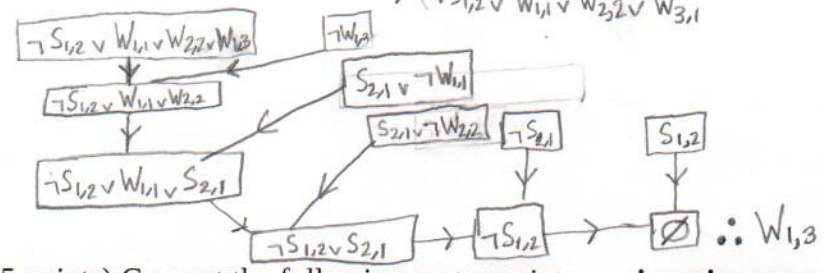
Due: Thu. Oct. 18 by 11:00pm

1. (5 points) Assuming that the KB contains following, apply **resolution** to show W1,3

KB:
$\neg S_{1,1}, \neg B_{1,1}, \neg S_{2,1}, B_{2,1}, S_{1,2}, \neg B_{1,2}$ (percepts)
$\neg S_{1,1} \Rightarrow \neg W_{1,2} \wedge \neg W_{2,1}$
$\neg S_{2,1} \Rightarrow \neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1}$
$S_{1,2} \Rightarrow W_{1,1} \vee W_{2,2} \vee W_{1,3}$

CNF:
$(S_{1,1} \vee \neg W_{1,2}) \wedge (S_{1,1} \vee \neg W_{2,1})$
$(S_{2,1} \vee \neg W_{1,1}) \wedge (S_{2,1} \vee \neg W_{2,2}) \wedge (S_{2,1} \vee \neg W_{3,1})$
$\neg S_{1,2} \vee W_{1,1} \vee W_{2,2} \vee W_{3,1}$

G:
$W_{1,3}$



W!			
S,Ok	Ok		
OK	B,Ok	P!	
1	2	3	4

2. (5 points) Convert the following sentence into **conjunctive normal form** (CNF):
1.) $\neg S_{2,1} \Leftrightarrow (\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1})$
2.) $(\neg S_{2,1} \Rightarrow (\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1})) \wedge ((\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1}) \Rightarrow \neg S_{2,1})$ by Equivalence Definition
3.) $(\neg\neg S_{2,1} \vee (\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1})) \wedge ((\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1}) \Rightarrow \neg S_{2,1})$ by Implication Definition
4.) $(S_{2,1} \vee (\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1})) \wedge ((\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1}) \Rightarrow \neg S_{2,1})$ by Double Negation
5.) $(S_{2,1} \vee (\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1})) \wedge (\neg(\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1}) \vee \neg S_{2,1})$ by Implication Definition Rule
6.) $(S_{2,1} \vee (\neg W_{1,1} \wedge \neg W_{2,2} \wedge \neg W_{3,1})) \wedge (W_{1,1} \vee W_{2,2} \vee W_{3,1} \vee \neg S_{2,1})$ by Distributivity, Double Negation x3
7.) $(S_{2,1} \vee \neg W_{1,1}) \wedge (S_{2,1} \vee \neg W_{2,2}) \wedge (S_{2,1} \vee \neg W_{3,1}) \wedge (W_{1,1} \vee W_{2,2} \vee W_{3,1} \vee \neg S_{2,1})$ by Distributivity

3. (5 points) Use **forward chaining** to determine all literals *inferred* by the KB below (show all work):

KB:
S_1: $A \wedge B \Rightarrow E$
S_2: $A \wedge C \Rightarrow F$
S_3: $C \wedge D \Rightarrow G$
S_4: $B \wedge D \Rightarrow H$
S_5: $E \wedge F \Rightarrow I$
S_6: $E \wedge F \Rightarrow J$
S_7: $F \wedge H \Rightarrow K$
S_8: $I \wedge K \Rightarrow L$
S_9: $J \wedge K \Rightarrow M$
S_{10}: A
S_{11}: B
S_{12}: C

Step / Clause	0	1	2	3	4	5	6	7
S_1	2	2	1	0				
S_2	2	1	1	0				
S_3	2	1	1	1	1	1	1	1
S_4	2	2	1	1	1	1	1	1
S_5	2	2	2	2	1	0		
S_6	2	2	2	2	1	0		
S_7	2	2	2	2	1	1	1	1
S_8	2	2	2	2	2	2	2	1
S_9	2	2	2	2	2	2	1	1
S_{10}	0							
S_{11}	0							
S_{12}	0							

Stack:							
	ⓒ						
	B	Ⓑ		Ⓕ		Ⓙ	
	A	A	Ⓐ	E	Ⓔ	I	Ⓘ

The literals inferred by the knowledge base are:
{A, B, C, E, F, I, J}