Student ID:	Duration: 20 mins	S Date: 24/07/2023	
Student name:		Score: / 3	
Question 1 (1pt) (A \wedge B) entails (A &	→B). Explain why the given statement is TF	RUE (or FALSE).	
Question 2 (2pts) Consider the follo check whether KB entails Y . [0.5pt] Convert each sentence in the l	owing propositional knowledge base. Pleasok knowledge base to its CNF form.	e 1. $C \wedge D \longrightarrow Y$ 2. $R \wedge Z \longrightarrow C$	
1	56	3. $B \rightarrow D$ 4. $D \wedge R \rightarrow Z$	
2	7	5. B	
4		6. $R \leftrightarrow D$	
	g Resolution Refutation . Note that, for ever m. You don't need to exhaustively conside		
-	From requ	ired conclusion	
	From		
10	From		
11.	From		

12. From

13. From

14. From

Student ID:	Duration: 20 mins		Date: 24/07/2023
Student name:			Score: / 3
Question 1 (1pt) $(A \leftrightarrow B)$ entails $(A \nearrow B)$	\sim B). Explain why the given statement is TRI	JE (or	FALSE).
	ving propositional knowledge base. Please	1.	$A \wedge B \rightarrow E$
check whether KB entails G . [0.5pt] Convert each sentence in the k	nowledge base to its CNF form.	2.	$A \wedge D \to C$
1	5	3.	$E \rightarrow F$
2	6	4.	$B \wedge E \to D$
3	7	5.	$C \rightarrow F$
4	8	6.	$D \wedge F \rightarrow G$
		7.	Α
		8.	В
	Resolution Refutation . Note that, for every	_	
more lines if necessary.	n. You don't need to exhaustively consider	all pa	airs of clauses. Add
	From requi	ed co	nclusion
10	•		
11			
12.			
13.			
14			

15. <u>From</u>

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forward chaining or backward chaining.	check whether a propositional knowledge b Explain why the given statement is TRUE	(or FALSE).	
	ng propositional knowledge base. Please owledge base to its rule form.		
1	5	3. $\neg B \lor D$	
2	6	4. $\neg D \lor \neg R \lor Z$	
3	7	5. <i>B</i>	
4		6. $R \leftrightarrow D$	
sentences your inference comes from. If process them from top to bottom.	Forward Chaining. Note that, for every so there are multiple rules that are ready to	o be triggered at a time,	

positional knowledge base o UE (or FALSE).	Score:/ <u>3</u> entails a query using
UE (or FALSE).	entails a query using
owledge base. Please 1.	$\neg C \lor \neg D \lor Y$ $\neg R \lor \neg Z \lor C$
4.	
	owledge base. Please 1. 2. 3. 4. 5. 6. Note that, for every step, rules that are ready to be

SOLUTION

Student ID:	Duration: 20 mins	Date: 24/07/2023
Student name:		Score:/_3
Question 1 (1pt) $(A \wedge B)$ <i>entails</i> $(A \leftrightarrow B)$. Explain why	the given statement is TRUE ((or FALSE).
TRUE. $(A \leftrightarrow B) \equiv (A \land B) \lor (\neg A \land \neg B)$. Every model making	g (A \wedge B) true also makes (A \leftrightarrow	B) true.
		•••••

Question 2 (2pts) Consider the following propositional knowledge base. Please check whether **KB entails Y**.

[0.5pt] Convert each sentence in the knowledge base to its CNF form.

- 1. $\neg C \lor \neg D \lor Y$
- 2. ¬R∨¬Z∨C
- 3. ¬B∨D
- 4. $\neg D \lor \neg R \lor Z$
- 5. B
- 6. ¬R∨D
- 7. ¬D∨R

- 1. $C \wedge D \longrightarrow Y$
- 2. $R \wedge Z \rightarrow C$
- 3. $B \rightarrow D$
- 4. $D \wedge R \longrightarrow Z$
- 5. *B*
- 6. $R \leftrightarrow D$

[1.5pt] Perform inference by applying **Resolution Refutation**. Note that, for every step, state clearly which sentences your inference comes from. You don't need to exhaustively consider all pairs of clauses. Add more lines if necessary.

8.	<u>¬Y</u>	From required conclusion
	$\neg C \lor \neg D$	From 1 and 8
	<u>D</u>	From 3 and 5
	<u>¬C</u>	From 9 and 10
	R.	From 7 and 10
	<u>Z</u>	From 4, 10, and 12
	<u>C</u>	From 2, 12, and 13
	•	From 11 and 14

Thus, KB entails Y.

Student ID:	Duration: 20 mins	Date: 24/07/2023
Student name:		Score: <u>/ 3</u>

Question 1 (1pt) $(A \leftrightarrow B)$ *entails* $(A \land B)$. Explain why the given statement is TRUE (or FALSE).

FALSE. $(A \leftrightarrow B) \equiv (A \land B) \lor (\neg A \land \neg B)$. When A = B = false, $(A \leftrightarrow B)$ is true, yet $(A \land B)$ is false. Thus, not every model making $(A \leftrightarrow B)$ true also makes $(A \land B)$ true.

Question 2 (2pts) Consider the following propositional knowledge base. Please check whether **KB entails G**.

[0.5pt] Convert each sentence in the knowledge base to its CNF form.

- 1. ¬A∨¬B∨E
- 2. ¬A∨¬D∨C
- 3. ¬E∨F
- 4. ¬B∨¬E∨D

- 5. ¬C∨F
- 6. $\neg D \lor \neg F \lor G$
- 7. A
- 8. B

- 1. $A \wedge B \rightarrow E$
- 2. $A \wedge D \rightarrow C$
- 3. $E \rightarrow F$
- 4. $B \wedge E \rightarrow D$
- 5. $C \rightarrow F$
- 6. $D \wedge F \rightarrow G$
- 7. A
- 8. B

[1.5pt] Perform inference by applying **Resolution Refutation**. Note that, for every step, state clearly which sentences your inference comes from. You don't need to exhaustively consider all pairs of clauses. Add more lines if necessary.

10. E From 1, 7, and 8 11. F From 3 and 10 12. D From 4, 8, and 10 13. G From 6, 11, and 12	9.	<u>_G</u>	From	required conclusion
12. D From 4, 8, and 10 13. G From 6, 11, and 12		F.	From	1, 7, and 8
13. G From 6, 11, and 12	11.	F	From	3 and 10
14 - Enom 0 and 12	12.	D	From	4, 8, and 10
14 - Enom 0 and 12	13.	G	From	6. 11. and 12
17. • ITUIL / allu 1.)				

Thus, KB entails G.

Student ID:	Duration: 20 mins		Date: 24/07/2023
Student name:			Score: / 3
Question 1 (1pt) It is always possible to che forward chaining or backward chaining. Exp			
FALSE. Forward chaining and backward chai	ning can answer any question of enta	ilment	t only when the KB
contains all propositional definite clauses.			
Question 2 (2pts) Consider the following periods whether KB entails Y. [0.5pt] Convert each sentence in the knowledge.		1.	$\neg C \lor \neg D \lor Y$ $\neg R \lor \neg Z \lor C$
1. <u>C∧D→Y</u>	5. <u>B</u>	3.	$\neg B \lor D$
2. $R \wedge Z \rightarrow C$	6. <u>R → D</u>	4.	$\neg D \vee \neg R \vee Z$
3. <u>B → D</u>	7. $\underline{D \rightarrow R}$	5.	В
4. $D \wedge R \rightarrow Z$		6.	$R \leftrightarrow D$
[1.5pt] Perform inference by applying For sentences your inference comes from. If th process them from top to bottom.		_	-
The initial fact is B.			
From (3) and (5), we have D (8)			
From (7) and (8), we have R (9)			
From (4), (8), and (9), we have Z (10)			
From (6) and (9), we have D again			
From (2), (9) and (10), we have C (11)			
From (1), (11), and (8), we have Y			
Thus, KB entails Y.			

Student ID:	Duration: 20	mins	Date: 24/07/2023
Student name:			Score: /3
Question 1 (1pt) It is always possible to che resolution refutation. Explain why the given TRUE. Resolution refutation can work on a normalized to CNF clauses.	statement is TRUE (or FALSE). ny KB of CNF clauses, and any	propos	itional sentence can be
Question 2 (2pts) Consider the following polycheck whether KB entails Y . [0.5pt] Convert each sentence in the knowledge.	-	Please	 ¬C ∨ ¬D ∨ Y ¬R ∨ ¬Z ∨ C
1. $C \wedge D \rightarrow Y$	5. <u>B</u>		3. $\neg B \lor D$
2. <u>R∧Z→C</u>	6. <u>R → D</u>		4. $\neg D \lor \neg R \lor Z$
3. <u>B</u> → D	7. $D \rightarrow R$		5. <i>B</i>
4. $D \wedge R \rightarrow Z$			6. $R \leftrightarrow D$
[1.5pt] Perform inference by applying Bacl sentences your inference comes from. If th process them from top to bottom.	•	-	tep, state clearly which
The goal Y requires C and D from (1)			
Subgoal C requires R and Z from (2)			
Subgoal R requires D from (6) (*)			
Subgoal D requires B from (3) (**)			
B is given in (5)			
Subgoal Z requires D and R from (4)			
Both subgoals are satisfied from the	bove steps, (*) and (**)		
Subgoal D is satisfied from the above steps	(**)		
Thus, KB entails Y.			