Student ID:	Duration: 20 mins	;	Date: 26/07/2023
Student name:			Score:/_
factoring when possible.	Following propositional logic sentence to Conjur $(P  o (Q  o R))  o (P  o (R  o Q))$		
Question 2 (2pts) Consider the check whether KB entails F.	following propositional knowledge base. Please	e <b>1</b> .	
[0.5pt] Convert each sentence in 1.	the knowledge base to its CNF form.  5.		$B \wedge E \to G$
2		4.	$E \rightarrow C$
<ol> <li>4.</li> </ol>	7		D
		6.	E
		7.	$A \wedge G \to F$
	olying <b>Resolution Refutation</b> . Note that, for every strom. You don't need to exhaustively conside	-	•

8	From required conclusion
9.	From
10	
11.	
12	
13	
14	From

5.  $B \wedge D \rightarrow F$ 

6.  $F \rightarrow G$ 

7.  $A \wedge E \rightarrow H$ 8.  $A \wedge C \rightarrow E$ 

### IN-CLASS EXERCISE (13)

2.

3.

Student ID:	Duration: 20 min	ns Date: 26/07/2023
Student name:		Score:/ <u>3</u>
factoring when possible.	ving propositional logic sentence to Conj $ ightarrow (P  ightarrow R))  ightarrow (Q  ightarrow (R  ightarrow P))$	untive Normal Form. Apply
	wing propositional knowledge base. Plea	
1	5	4. $A \wedge B \rightarrow D$

[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.

6.

7.

9	From required conclusion
10.	From
11	From
12.	
13	From
14	From
15	From

Student ID:		Duration: 20 mins	Date: 26/07/2023
Student name:			Score:/
factoring when possible.	$(R \rightarrow (P \rightarrow Q)) \rightarrow$	logic sentence to Conjuntive $(R  o (Q  o P))$	
Question 2 (2pts) Consider		al knowledge base. Please 1	. A
check whether <b>KB entails H</b> .		2	. В
[0.5pt] Convert each sentenc	e in the knowledge base to	its CNF form.	. C
1	5.	4	$A \wedge B \to D$
2	6	5	$. B \wedge D \to F$
3	7	6	
			$F \to G$
4	8		$F \to G$ $A \land E \to H$
4	8	7	$A \wedge E \to H$
[1.5pt] Perform inference by	applying <b>Resolution Refu</b>	7	A $\wedge$ E $\rightarrow$ H A $\wedge$ C $\rightarrow$ E ep, state clearly which
[1.5pt] Perform inference by sentences your inference co more lines if necessary.	applying <b>Resolution Refu</b> omes from. You don't need		A $\wedge$ E $\rightarrow$ H A $\wedge$ C $\rightarrow$ E ep, state clearly which pairs of clauses. Add

 11.
 From

 12.
 From

 13.
 From

 14.
 From

 15.
 From

Date: 26/07/2023

Score: /3

Duration: 20 mins

# IN-CLASS EXERCISE (13)

Student name:

Student ID:

<b>Question 1 (1pt)</b> Conve factoring when possible.	rt the following propositional logic	sentence to Conju	ntive N	ormal Form. Apply
<b>3</b>	$P \to ((P \to Q) \land \neg (\neg$	$Q \lor \neg P))$		
· · · · ·	der the following propositional kno	wledge base. Pleas	e 1.	$A \rightarrow E$
check whether <b>KB entail</b>		NE forms	2.	$B \wedge F \rightarrow G$
[0.5pt] Convert each sent	ence in the knowledge base to its C		3.	$C \wedge E \rightarrow F$
1			4.	A
2			5.	В
3			6.	_
4	8		7.	
[4 E .] D		N l C		
	e by applying <b>Resolution Refutatio</b> e comes from. You don't need to ex			•
more lines if necessary.	e comes from. For don't need to e.	anaustively conside	er an pa	all's of clauses. Add
•		From requ	iired co	nclusion
	From			
	From			

## **SOLUTION**

Student ID:	Duration: 20 mins	Date: 26/07/2023
Student name:		Score: / 3

**Question 1 (1pt)** Convert the following propositional logic sentence to Conjunctive Normal Form. Apply factoring when possible.

$$(P \rightarrow (Q \rightarrow R)) \rightarrow (P \rightarrow (R \rightarrow Q))$$

<u>-P∨Q∨-R</u>

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

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

- 1. ¬B∨¬C∨A
- 2.  $\neg D \lor \neg E \lor B$
- 3.  $\neg B \lor \neg E \lor G$
- 4. ¬E∨C
- 5. <u>D</u>
- 6. <u>E</u>
- 7. ¬**A** ∨ ¬**G** ∨ **F**

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

[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>¬F</u>	From required conclusion
9.	<u>B</u>	From 2, 5, and 6
10.	C	From 4 and 6
11.	<u>A</u>	From 1, 9, and 10
12.	G	From 3, 6, and 9
13.	<u>F.</u>	From 7, 11, and 12
14.	•	From 8 and 14

Thus, KB entails F.

Student ID:	Duration: 20 mins	Date: 26/07/2023
Student name:		Score: / 3

**Question 1 (1pt)** Convert the following propositional logic sentence to Conjunctive Normal Form. Apply factoring when possible.

$$(Q \rightarrow (P \rightarrow R)) \rightarrow (Q \rightarrow (R \rightarrow P))$$

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	5. ¬B∨¬D∨F
2. <u>B</u>	6. ¬F∨G
3. <u>C</u>	7. ¬A∨¬E∨H
4. ¬A∨¬B∨D	8 — A V — C V F

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

[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.  $\neg A \lor \neg C \lor E$ 

9. <u>¬G</u>	From required conclusion
10. <u>¬</u> F	
11. <u>¬B∨¬D</u>	From 5 and 10
12. <u>¬D</u>	From 2 and 11
13. ¬A∨¬B	From 4 and 12
14. <u>A</u>	From 2 and 13
15. •	

Thus, KB entails G.

Student ID:	Duration: 20 mins	Date: 26/07/2023
Student name:		Score: <u>/ 3</u>

**Question 1 (1pt)** Convert the following propositional logic sentence to Conjunctive Normal Form. Apply factoring when possible.

$$(R \rightarrow (P \rightarrow Q)) \rightarrow (R \rightarrow (Q \rightarrow P))$$

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

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

16. <u>A</u>	20. ¬B∨¬D∨F
17. <u>B</u>	21. ¬F ∨ G
18. <u>C</u>	22. ¬A∨¬E∨H
19. <u>¬A∨¬B∨D</u>	23. ¬A∨¬C∨E

- 2. B
- 4. A ∧ B → D
   5. B ∧ D → F
   6. F → G
   7. A ∧ E → H

[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.

24. <u>H</u>	From required conclusion
25. <u>¬A ∨ ¬E</u>	From 7 and 9
26. <u>-</u> E	From 1 and 10
27. <del>¬A ∨ ¬C</del>	From 8 and 11
28. <u>¬A</u>	From 3 and 12
29. •	From 1 and 13

Thus, KB entails H.

Student ID:	Duration: 20 mins	Date: 26/07/2023
Student name:		Score: <u>/ 3</u>

**Question 1 (1pt)** Convert the following propositional logic sentence to Conjunctive Normal Form. Apply factoring when possible.

$$P \to ((P \to Q) \land \neg (\neg \, Q \lor \neg \, P))$$

-P∨Q

**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∨E
- 2.  $\neg B \lor \neg F \lor G$
- 3.  $\neg C \lor \neg E \lor F$
- 4. A

- 5. <u>B</u>
- 6. C
- 7. <u>D</u>

- 1.  $A \rightarrow E$
- 2.  $B \wedge F \rightarrow G$
- 3.  $C \wedge E \rightarrow F$
- 4. A
- 5. *B*
- 6. *C*
- 7. *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>⊸G</u>	From required conclusion
9.	<u>E</u>	From 1 and 4
	$\neg E \lor F$	From 3 and 6
11.	<u>F</u>	From 9 and 10
	$\neg B \lor \neg F$	From 2 and 8
13.	¬B	From <u>11 and 12</u>
14.		From 5 and 13

Thus, KB entails G.