CS 270 - Logic and Deduction Homework
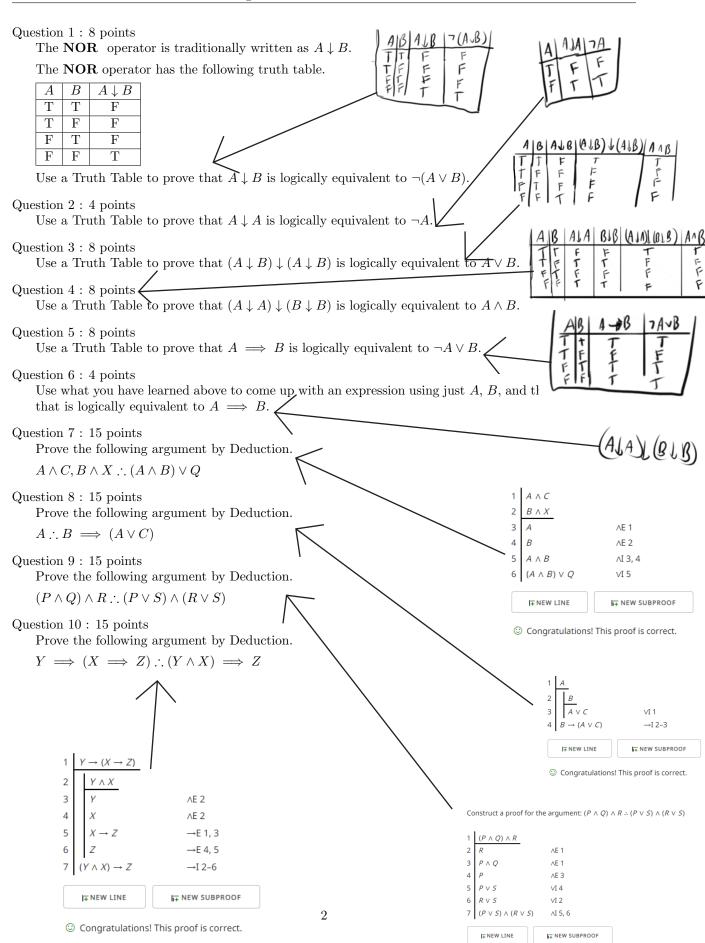
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This homework is worth 100 points.

For deductive proofs, complete each proofs using **Natural Deduction Proof Editor** from the Open Logic Project.

`http://proofs.openlogicproject.org`

To submit the assignment

1. Create a word document *drexeluserid*`_hw1.doc`.

2. Use tables to draw the Truth Tables in MS Word.

3. Complete each deduction proof using the website and take a screenshot of the proof. You may only use the Basic Rules of Deduction.

4. Copy-Paste each screenshot into the Word Document. Make sure your screenshot includes the part that says either **Congratulations! This proof is correct** or **Sorry there were errors**. If you cannot get your answer to work, partial credit will be given. You **must** include all errors generated by the checker to earn partial credit.

5. Export the Word document as a *single* PDF and submit *drexeluserid*`_hw1.pdf` to GradeScope.

Question 1 : 8 points

The **NOR** operator is traditionally written as $A \downarrow B$.

The **NOR** operator has the following truth table.

A	B	$A \downarrow B$
T	T	F
T	F	F
F	T	F
F	F	T

Use a Truth Table to prove that $A \downarrow B$ is logically equivalent to $\neg(A \lor B)$.

Question 2 : 4 points

Use a Truth Table to prove that $A \downarrow A$ is logically equivalent to $\neg A$.

Question 3 : 8 points

Use a Truth Table to prove that $(A \downarrow B) \downarrow (A \downarrow B)$ is logically equivalent to $A \lor B$.

Question 4 : 8 points

Use a Truth Table to prove that $(A \downarrow A) \downarrow (B \downarrow B)$ is logically equivalent to $A \land B$.

Question 5 : 8 points

Use a Truth Table to prove that $A \implies B$ is logically equivalent to $\neg A \lor B$.

Question 6 : 4 points

Use what you have learned above to come up with an expression using just A, B, and th
that is logically equivalent to $A \implies B$.

Question 7 : 15 points

Prove the following argument by Deduction.

$A \land C, B \land X \therefore (A \land B) \lor Q$

Question 8 : 15 points

Prove the following argument by Deduction.

$A \therefore B \implies (A \lor C)$

Question 9 : 15 points

Prove the following argument by Deduction.

$(P \land Q) \land R \therefore (P \lor S) \land (R \lor S)$

Question 10 : 15 points

Prove the following argument by Deduction.

$Y \implies (X \implies Z) \therefore (Y \land X) \implies Z$

$(A \downarrow A) \downarrow (B \downarrow B)$

Proof for Question 7:

1	$A \land C$	
2	$B \land X$	
3	A	∧E 1
4	B	∧E 2
5	$A \land B$	∧I 3, 4
6	$(A \land B) \lor Q$	∨I 5

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☺ Congratulations! This proof is correct.

Proof for Question 8:

1	A	
2		B	
3		$A \lor C$	∨I 1
4	$B \to (A \lor C)$	→I 2–3

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☺ Congratulations! This proof is correct.

Construct a proof for the argument: $(P \land Q) \land R \therefore (P \lor S) \land (R \lor S)$

1	$(P \land Q) \land R$	
2	R	∧E 1
3	$P \land Q$	∧E 1
4	P	∧E 3
5	$P \lor S$	∨I 4
6	$R \lor S$	∨I 2
7	$(P \lor S) \land (R \lor S)$	∧I 5, 6

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☺ Congratulations! This proof is correct.

Proof for Question 10:

1	$Y \to (X \to Z)$	
2		$Y \land X$	
3		Y	∧E 2
4		X	∧E 2
5		$X \to Z$	→E 1, 3
6		Z	→E 4, 5
7	$(Y \land X) \to Z$	→I 2–6

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☺ Congratulations! This proof is correct.