

Guidelines:

There are **10 questions** in this assignment, and each is worth 0.5 points. Together they amount to 5 points. Type your answers in the designated place in Canvas, and then submit them. You can re-write your answers as many times as you like, but once you have submitted your answers, *you cannot change them anymore*. This assignment is worth **5% of the final grade**.

Please keep in mind:

1. You should *type* your answers in the designated place in Canvas.
2. You should type down your answers *directly* in Canvas.
3. Regarding the five connectives of TFL: All the symbols are available in Canvas. You should click on “show/hide advanced buttons”, and when you see all the buttons, you should click on “insert character”. You can find all the characters you need over there. Again: Do not copy-paste symbols from another document.
4. Do not forget to submit your assignment after you are done with typing down your answers. If you do not submit your assignment, it remains as a draft. Drafts are not marked.
5. Please number your answers so we can recognize which answer belongs to which question.

Questions 1, 2, 3, 4 are about validity of arguments and semantics in general. You are asked to select the correct answer. You might want to use Truth Tables, although it is not required by this exercise that you attach them to the answer.

Questions 5, 6, 7, 8, 9, 10 concern rules citations and are distributed over 3 proofs, all of which are complete and correct proofs in the natural deduction system for TFL. In the proofs, 6 citations (justifications) are erased and replaced with a question mark. You should answer what that citation must be. Please number your answers.

Here is an example:

1.	P	
2.	Q	
3.	R \vee Q	? (Example 1)
4.	(R \vee Q) \wedge P	? (Example 2)

Answer:

Example 1: The citation must be $\vee I$ 2

Example 2: The citation must be $\wedge I$ 3, 1

Questions:**Question 1**

- Suppose $\neg A$ is True. What can you say about the following sentence? **(0.5 points)**

$$(A \rightarrow (C \rightarrow B)) \rightarrow ((A \rightarrow B) \rightarrow (\neg A \rightarrow (C \rightarrow A)))$$

- A. It is True
- B. The truth value of the sentence depends on the assignment values for B and C
- C. It is False
- D. It can't be determined

Question 2

- Suppose A is a Tautology and B is a Contradiction. Note that A, B, C are **metavariables** (an atomic sentence can't be a Tautology or a Contradiction). What can you say about the following sentence? **(0.5 points)**

$$(\neg A \wedge C) \rightarrow \neg (\neg B \vee C)$$

- A. It can't be determined
- B. It is a Tautology
- C. It is a Contradiction
- D. It is a contingent sentence (can be either T or F)

Question 3

- Suppose C is True, and H is False. What is the truth value of the following sentence? **(0.5 points)**

$$\neg (C \vee \neg E) \rightarrow (G \wedge \neg H)$$

- A. It can't be determined
- B. It is True
- C. It depends on the truth value of E
- D. It is False

Question 4

- The following argument is **invalid**:

$$P \rightarrow Q, \neg R \rightarrow \neg Q, R \rightarrow S \therefore \neg P$$

We want to **add** another **premise** to the existing premises of the argument to make it **valid**. Which one of the following choices works? That is, which one of the following choices, if added to the argument as another premise, would make the argument valid? Help yourself with the use of the Truth Tables (it is **not required** that you write down the Truth Table in your answer!). **(0.5 points)**

- A. Q
- B. R
- C. $\neg S$
- D. $Q \vee S$

Proof1

1.	$C \wedge D$	
2.	$(D \vee E) \rightarrow G$	
3.	$(G \wedge C) \rightarrow \neg L$	
4.	$\neg N \rightarrow L$	
5.	D	$\wedge E 1$
6.	$D \vee E$? (Question 5)
7.	G	$\rightarrow E 2, 6$
8.	C	$\wedge E 1$
9.	$G \wedge C$	$\wedge I 7, 8$
10.	$\neg L$	$\rightarrow E 3, 9$
11.	$\neg N$	
12.	L	$\rightarrow E 4, 11$
13.	\perp	$\neg E 10, 12$
14.	N	? (Question 6)

Proof 2

1.	$P \vee Q$	
2.	$\neg C \wedge R$	
3.	$\neg S \rightarrow \neg P$	
4.	$Q \rightarrow (S \wedge R)$	
5.	P	
6.	$\neg S$	
7.	$\neg P$? (Question 7)
8.	\perp	$\neg E$ 7, 5
9.	S	IP 6 – 8
10.	Q	11.
11.	$S \wedge R$	$\rightarrow E$ 4, 10
12.	S	$\wedge E$ 11
13.	S	$\vee E$ 1, 5-9, 10-12
14.	R	? (Question 8)
15.	$S \wedge R$	$\wedge I$ 13, 14

Proof 3

1.	$M \rightarrow \neg\neg R$	
2.	$G \rightarrow D$	
3.	$\neg M \rightarrow \neg\neg D$	
4.	$\neg D$	
5.	G	
6.	D	$\rightarrow E\ 2, 5$
7.	\perp	$\neg E\ 4, 6$
8.	$\neg G$	$\neg I\ 5-7$
9.	$\neg R$	
10.	$\neg M$	
11.	$\neg\neg D$	$\rightarrow E\ 3, 10$
12.	\perp	$\neg E\ 11, 4$
13.	M	IP 10 – 12
14.	$\neg\neg R$	$\rightarrow E\ 1, 13$
15.	\perp	? (Question 9)
16.	R	IP 9-15
17.	$\neg G \wedge R$	$\wedge I\ 8, 16$
18.	$\neg D \rightarrow (\neg G \wedge R)$? (Question 10)

End of Assignment 2