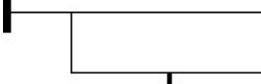
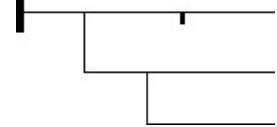
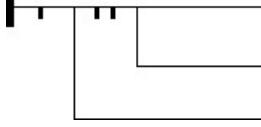
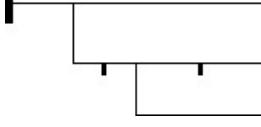
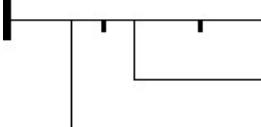


# (M) Colorless Green Concepts Scripting Furiously (1/3)

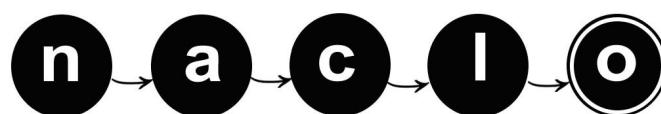
## [10 Points]

Modern logicians represent the logical relationships between statements with a straightforward notation. For example, if we represent the statement “Canada is beautiful” with  $p$ , then we can represent the statement “Canada isn’t beautiful” with  $\neg p$  (read as “not  $p$ ”). If we have two statements represented by  $p$  and  $q$ , then we can represent “if  $p$ , then  $q$ ” as  $p \rightarrow q$ , and similarly we can represent “ $p$  and  $q$ ” and “ $p$  or  $q$ ” as  $p \wedge q$  and  $p \vee q$ , respectively. Pretty easy, right?

But things weren’t always this clear! In 1879, German logician Gottlob Frege published a seminal work on logic called *Begriffsschrift*, which literally translates to “concept script”. The notation he used, also called *Begriffsschrift*, confused many readers with its two-dimensional format and use of few symbols. That being said, the *Begriffsschrift* notation is a carefully thought-out system that adheres to formal rules. Here are some examples of *Begriffsschrift* formulas, with their translations into modern logical notation.

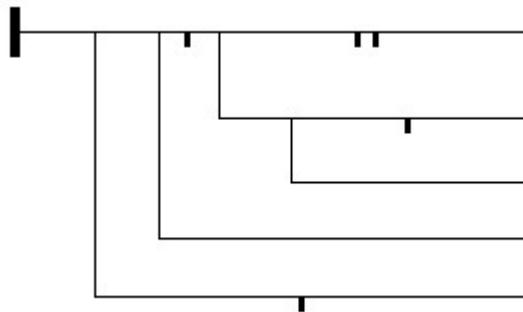
<i>Begriffsschrift</i>	Modern notation
	$B \vee A$
	$(C \rightarrow B) \rightarrow \neg A$
	$C \wedge \neg(B \rightarrow A)$
	$(C \rightarrow \neg B) \vee A$
	$(D \vee C) \vee (B \wedge A)$

© Daniel Lovsted, North American Computational Linguistics Olympiad, 2019 Round 2



# (M) Colorless Green Concepts Scripting Furiously (2/3)

M1. Translate from *Begriffsschrift* into modern notation:

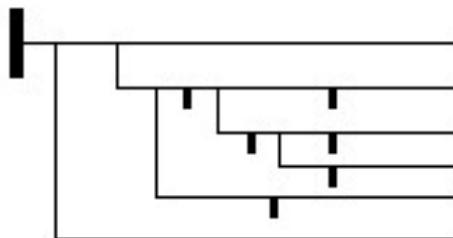


Begriffsschrift ain't just pretty to look at! It's also a meaningful logical language. As an example, consider the following facts which you may not have known about astrophysics:

All quaxors are galactions. Most of those pulsoids with a sateotrope are galactions, too. A pulsoid with a sateotrope is only not a galaction when it is dingly. (Of course, all this only holds true if the polyverse is Groop-normal.)

M2. Match these sentences to letters A to F to correctly complete the *Begriffsschrift* formula below (note that there are two possible correct answers) in your answer sheets:

- i.  $x$  is a galaction
- ii. the polyverse is Groop-normal
- iii.  $x$  is dingly
- iv.  $x$  has a sateotrope
- v.  $x$  is a quaxor
- vi.  $x$  is a pulsoid



M3: Explain how the *Begriffsschrift* notation works in your answer sheets



# (M) Colorless Green Concepts Scripting Furiously (3/3)

(M) Colorless Green Concepts Scripting Furiously

1.

2. i.  ii.  iii.  iv.  v.  vi.

3.

