# Logic, Language and Philosophy

Exam 2

December 26, 2022

***Read this first:***

- All questions count for 10 points each.
- You need to answer questions 1–7 ('Logic') and 8–10 ('Philosophy').
- You can pick *one* of the questions 11–13 ('Extra questions'), but only after you have finished answering questions 1–10; the extra question counts for 10 points.
- You are allowed to write either in Chinese or in English, but be clear.
- For each of the questions 8–10 ('Philosophy'), you are required to write between 300 and 400 words.
- You are allowed to bring the philosophical papers, but the use of the textbook, the slides, your homework and notes, is *not* allowed.

## 1 Logic

**Question 1** Translate the following sentences in the language of predicate logic. Specify domain and translation key:

a. Students who study hard, pass
b. If all students pass, then all students study hard
c. If only one student passes, not all students study hard

**Question 2** Consider the following model for a predicate logical language with a 1-place predicate letter $A$ and a 2-place predicate letter $R$:

$$D = \{1, 2, 3, 4\}$$
$$I(A) = \{1, 2, 3\}$$
$$I(R) = \{\langle 1, 2\rangle, \langle 1, 3\rangle, \langle 3, 1\rangle, \langle 4, 4\rangle\}$$

a. Draw a diagram of the model
b. Which of the following formulas are true in the model? Motivate your answer.

i. $\forall x(Ax \rightarrow \exists y(x \neq y \wedge Ryx))$
ii. $\forall x \forall y(((Ax \wedge Ay) \wedge Rxy) \rightarrow Ryx)$

**Question 3** Show that the following formulas are valid:

a. $Aa \rightarrow \exists x Ax$
b. $\exists y \forall x \phi \rightarrow \forall x \exists y \phi$

**Question 4** Show that the following argumentation schemes are not valid by specifying a counter-model:

a. $\forall x \exists y Rxy, \forall x \forall y \forall z((Rxy \wedge Ryz) \rightarrow Rxz) \,/\, \forall x \forall y(Rxy \vee Ryx)$
b. $\exists x_1 \exists x_2 \exists x_3 \exists x_4((x_1 \neq x_2 \wedge x_1 \neq x_3 \wedge x_1 \neq x_4 \wedge x_2 \neq x_3 \wedge x_2 \neq x_4 \wedge x_3 \neq x_4) \wedge \forall y(y = x_1 \vee y = x_2 \vee y = x_3 \vee y = x_4)) \,/\, \exists x \exists y(x \neq y \wedge (Ax \leftrightarrow Ay) \wedge (Bx \leftrightarrow By))$

**Question 5**

a. Show that anti-symmetry does not entail irreflexivity
b. In order for *x is n years old* to be a well-defined property over the relation *x is as old as y* what interpretation should be given to that relation?

**Question 6** Make derivations for the following argument schemes:

i. $\exists x \forall y Rxy / \forall y \exists x Rxy$
ii. $\neg \exists x(Ax \wedge Bx) / \forall x(Ax \rightarrow \neg Bx)$

**Question 7** Show that the modal principle $\Box\phi \rightarrow \Box\Box\phi$ corresponds with transitivity of the accessibility relation $R$.

## 2 Philosophy

**Question 8** In the opening pages of 'On What There Is' Quine refers to an argument called *Plato's Beard*. What is that argument, and how is it related to the main topic of the paper? How does Quine's dictum 'To be is to be the value of a bound variable' address this argument?

**Question 9** Explain how the analysis of definite descriptions that Russell gives in 'On Denoting' saves the validity of the principle of bi-valence. Is that principle still valid in Strawson's approach? Why (not)?

**Question 10** According to Tarski, what is the distinction between object language and metalanguage? What requirements should be met by a metalanguage for it to allow for the formulation of a truth definition for an object language?

## 3 Extra questions

**Question 11** A relation is called *(right) Euclidean* if the following holds:

$$\forall x \forall y \forall z((Rxy \wedge Rxz) \rightarrow Ryz)$$

Show that if a relation $R$ is right Euclidean and reflexive, it is symmetric.

**Question 12** Show that:

a. If $\Gamma$ is consistent, at least one of $\Gamma \cup \{\phi\}$, $\Gamma \cup \{\neg\phi\}$ is consistent
b. If $\Gamma$ is maximally consistent, then $\Gamma$ is deductively closed and syntactically complete

**Question 13** What is a 'conservative extension' of a logic? And why is it not intrinsically a proof-theoretic concept according to Engel? And what use does Engel make of that?

**Question 14** Kripke regards proper names as rigid designators. Explain what he means by that and compare his view with that of Frege. What are the consequences for Kripke's and Frege's views on the cognitive status of identity statements?