Philosophy 395S: Space and Time
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Midterm Exam

You must do four essay questions in all: one from each part of the exam and then one more. Each essay should be 1-2 pages double-spaced. Be sure to answer all parts of the questions you choose. You may use the readings to review the topics of the essays, but be sure to put the answers in your own words so that I know that you understand them. Exams should be e-mailed to me before our next class, Tuesday at 4:00. (This deadline is different than what I said in an earlier e-mail.)

Part 1. *Zeno's paradoxes*. Answer *at least one* of the following questions:

1. Present Zeno's paradox of Achilles and the Tortoise. Explain the concept of the sum of an infinite series and use it to resolve the paradox. (Assume space and time are continuous.)

2. Present Zeno's Arrow paradox. Explain the concept of instantaneous velocity, and use it to resolve the paradox. (Assume space and time are continuous.)

3. Present and criticize Black's argument that it is logically impossible to complete an infinite number of distinct tasks in a finite amount of time. Illustrate with respect to the "infinity machine" of your choice.

Part 2. *The Epistemology of Geometry*. Do *at least one* of the following questions:

4. Discuss the geometry of the surface of an egg. Where is the curvature positive, negative, or flat? Is it variable or constant? What are the geodesics? How would measurements of the sum of the angles of a triangle differ on different parts of the surface? Could the two-dimensional inhabitants of the egg's surface determine that their space is non-Euclidean? Could they determine that their space was not spherical? Discuss.

5. According to Reichenbach, whether or not two objects separated in space have the same length is not a matter of fact, but a matter of definition. Give his argument for this, making use of the notions of a universal force and a coordinative definition.

6. Present the reductionist and anti-reductionist (realist) positions with respect to the geometry of physical space. Give at least one argument that supports the reductionist view and one argument that supports and anti-reductionist view.

Part 3. *Conceptions of Spacetime; Absolute Space and Time.* Do *at least one* of the following questions:

7. What is spacetime?   What is a persisting object from the spacetime perspective? Conceptions of spacetime can be distinguished by which questions make sense relative to the conception. With this in mind, discuss how Aristotelian spacetime differs from Galilean spacetime. Give a reason why science might prefer Galilean spacetime to Aristotelian spacetime.

8. Carefully present Leibniz's "metaphysical" argument against absolute space. (You will need to present and explain the principle of the Identity of Qualitatively Indiscernible Worlds.) Present a reason why you might accept this principle and also a reason why you might reject it.

9. Present Newton's argument that we can infer the existence of absolute space from the effects of circular motion. Make use of Newton's two thought experiments: the rotating bucket and the two globes connected by a string. How might a reductionist (positivist) such as Mach respond to Newton's argument, and the two thought experiments?