

**SGBI 103: Gaming the System:  
Alternatives in Math and Logic**

Fall 2023

MWF, 12:00-1:05pm

Goldspohn 35

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Office: 5 S. Loomis St., Office 11 (in attic)

Office Hours: MWF, 1:15-2:30pm, or by appointment

**Course Description**

We see into the philosophical foundations of math and logic by comparing both to games and puzzles, taking a playful approach to seeking deeper truths about how we acquire “exact” knowledge. We see how classical math and logic (Euclidean geometry and Aristotelian syllogisms) develop into modern variations (Cartesian and Imaginary Geometry and propositional logic) through innovative thinking toward problem solving. We practice visual representation of quantitative knowledge in both classical and modern variations and students practice solving real world problems with new mathematical and logical tools.

This course satisfies the iCon “Innovating the World” by looking specifically into how math and science have developed over time, and how they affect our lives on a day-to-day level.

Understanding what we mean by “knowing” something, how our knowledge can change and the complex historical relationships between science and society will help us read modern thinkers such as Lobachevsky and Gödel in a fruitful manner, examining the astounding innovations of the last one hundred and fifty years and asking what they mean for this world and our own lives.

**Required Texts**

Euclid, *Elements, Book One with Questions for Discussion*, ed. Dana Denstore, trans. Thomas L. Heath (Santa Fe: Green Lion, 2015). ISBN: 978-188800946-0.

Ernest Nagel and James R. Newman, *Gödel’s Proof*, ed. Douglas R. Hofstadter (New York: NYU Press, 2001). ISBN: 978-0-8147-5837-3.

All other course texts will be provided as print-outs by the professor and made available on the course page on Blackboard.

**Learning Outcomes**

- Argue effectively about the plausibility/reasonableness of axioms, definitions, postulates, and theorems in an axiomatic system.
- Join in-class discussions and activities spontaneously with evident attention to both classmates and course materials.
- Demonstrate a comprehension of mathematical models.
- Generate or explain quantitative information using visual and other representations such as graphs, tables, and formulas.
- Apply quantitative skills with appropriate technology to an examination of real-world problems.

## Assignments and Grading

Courses in the Shimer Great Books Program are heavily discussion-based and student-driven. Accordingly, class participation counts for a much higher proportion of student grades than in most courses: 50%. A series of written assignments will make up the other 50%.

**Class participation** presupposes careful and thorough preparation and serious intellectual involvement in class discussion. Students should come to class not only having read the text through, but having underlined, taken notes, and scanned over the marked text at least one additional time after the initial reading. On the basis of such preparation, students should be prepared for an intensive discussion focused on the texts or artworks assigned for that day.

You must also come prepared to class, and that means having the course text in front of you, along with annotations or notes. Hard copies are strongly preferred, especially for assigned books available from the college bookstore, but if electronic copies are used, you should plan to mark them and/or take notes as you read.

My expectation for class participation is that every member of class will be able to contribute with remarks and citations that are on-topic and reflect solid preparation for class. A student who meets that baseline will receive a grade in the **B range** for their participation portion. Students whose contribution is notably lacking—for instance, those who speak very little, who give no evidence of having done the reading carefully, who consistently change the topic in a disruptive way, or whose primary contributions are jokes or personal anecdotes—will receive a participation grade in the **C or D range**. Students who distinguish themselves through some particular service—such as consistently contributing new topics that shape the discussion, serving as a resource for navigating the text, or making a special effort to draw in quieter classmates—will qualify themselves for a participation grade in the **A range**.

Your participation grades will be posted on Blackboard roughly every two weeks. Normal day-to-day participation for each class session is worth approximately 1% of your final grade. In addition, there will be a midterm and final **discussion exams** on the session following the written exam, each of which will be worth 5% of your total grade. These discussions will center around a short reading to be distributed after the written exam and will be completely student-led—the professor will play a strictly observational and assessing role for these sessions. Students will be graded not on whether they arrive at the “correct” interpretation of the class, but on their discussion skills. In case a student absolutely must be absent, we will devise a way to make up the discussion exam—but please make every effort to attend.

All students will be required to have a one-on-one meeting with the professor around the middle of the semester. The purpose of this conference will be an open-ended discussion of the student’s performance and any ways that their experience in class can be improved. This meeting will be worth 3% of the final grade, awarded on an all-or-nothing basis.

The baseline condition for class participation is of course physical presence in class. Absences not only affect the individual student, but the entire group, and the same is true of habitual lateness. Punctual attendance should be regarded as mandatory. Lateness will count against a student’s participation for that session, and in extreme cases will be treated as the equivalent of

an absence. An increasing number of absences carries with it increasing consequences, which are as follows:

1-2 absences No grade penalty, in recognition of our shared human frailties. (If students miss fewer than two classes, however, then in cases where a student is at the threshold between two grades, the professor will go with the higher one.)

3-5 absences A half letter grade is deducted from the student's final grade for each absence; this penalty may be lifted by doing an absence make-up for each missed class.

6-8 absences For each absence, the student *must* complete an absence make-up (described below) to avoid failing the course, and a half letter grade penalty is imposed on the student's final grade which *cannot* be made up.

9 absences Automatic failure of the course.

In order to make up for an absence, students must write a paper summarizing and reflecting on the day's reading (at least one *full* page, double spaced) or schedule a meeting of at least 10 minutes to discuss the reading with the professor. Absence make-ups must be completed **within two weeks** of the absence being made up, though I strongly urge you to do so earlier.

Students requiring *additional accommodations* are urged to discuss this matter with the professor as early as possible in the semester and to devise a formal written plan in consultation with the relevant institutional offices. In line with the Shimer School's policies on attendance, accommodations will be made with the aim of allowing a student to attend at least 80% of class sessions synchronously and without placing undue burdens on either the accommodated student or the faculty member.

**Written work** will consist of a midterm and final exam, each worth 15% of the final grade, and a reading journal worth 20%. Details of the exams will be provided closer to the time they occur.

The *reading journal* will take the form of a notebook devoted to this class. There will be a variety of exercises you will work on in relation to our readings, which will include puzzles and games; logic and geometry problems and simple mathematical exercises; and some philosophical questions (distributed via the Blackboard page) on which you will want a place to work in a rough but ready and extended fashion. Note that you will need a compass and straight-edge (like from geometry class) for some problems.

I may ask to check your journals for work periodically, but will certainly take it briefly for grading at the middle and end of the semester following the mid-term and final exam, at which point I will provide a letter grade. Generally speaking, all of the written work of the course, including note taking and problem solving, should be done in or included otherwise (e.g. as scratch sheets in whatever form) in your journal. As a rough guide, your journal should include entries on every assigned reading and class discussion and you should "show (all) your work" (if you want credit for it)!

Note that reading journals will be graded on completeness, not correctness. The goal is not for you to come to class with all the right answers, but to begin working through the problems and

questions on your own to prepare for our collaborative effort. You should, however, correct your notebook as appropriate to reflect our class discussion.

### Note on Institutional Policies

Please note that the college-wide policy on plagiarism holds for this class. Plagiarism is a very serious academic and ethical offence that can lead to failure of the assignment or course—or, after multiple instances, expulsion from college. Please consult the Student Handbook for more details of the plagiarism policy. Note that the professor considers the use of AI text-generation software as a form of plagiarism. All other institutional policies apply equally, including those related to accommodations for students with learning disabilities or differences and Title IX protections. More details on those policies are available in the Student Handbook, and students are encouraged to approach the professor with any questions or concerns they may have.

### Class Schedule and Readings

*This calendar provides the schedule for assignments and readings for our time together this semester. Students should be aware that the schedule is approximate and may change. All students will be alerted as soon as possible via email and Blackboard announcement. **Failure to check email regularly is no excuse for missing these updates.** All problems or proofs in a given reading are to be prepared in your reading journal prior to class.*

Wednesday	August 23	Course introduction and syllabus “Bits and Bins”
Friday	August 25	“Bits and Bins” (cont.)
Monday	August 28	“A Little Reasoning about Reasoning and Logic”—read through entire text, do problems 1 through 3
Wednesday	August 30	“A Little Reasoning...,” do problems up through 11
Friday	September 1	“A Little Reasoning...,” do remaining problems
Monday	September 4	<b>NO CLASS—Labor Day</b>
Wednesday	September 6	Euclid, Book 1: Definitions, Postulates, and Common Notions, Proposition 1 (pp. 1-13)
Friday	September 8	Euclid, Book 1: Propositions 2-4 (pp. 14-18)
Monday	September 11	Euclid, Book 1: Propositions 13-16 (pp. 31-34)
Wednesday	September 13	Euclid, Book 1: Propositions 34-37 (pp. 59-65)
Friday	September 15	Euclid, Book 1: Propositions 41-42 (pp. 69-70)
Monday	September 18	Euclid, Book 1: Proposition 47 (pp. 78-79)
Wednesday	September 20	Euclid: review/catch-up day
Friday	September 22	Aristotle, <i>On Interpretation</i> (pp. 1-6)
Monday	September 25	Aristotle, <i>Prior Analytics</i> (pp. 7-10)
Wednesday	September 27	Aristotle, <i>Posterior Analytics</i> , Book 1, Parts 1-4 (pp. 11-16)
Friday	September 29	Aristotle, <i>Posterior Analytics</i> , Book 1, Parts 5-13 (pp. 16-22)
Monday	October 2	<b>NO CLASS—Professor travelling for conference</b>

Wednesday	October 4	Aristotle, <i>Posterior Analytics</i> , Book 1, Part 14 through Book 2, Part 19 (pp. 22-27)
Friday	October 6	Aristotle, <i>On Sophistical Refutations</i> , Part 1 through first half of Part 5 (pp. 28-33)
Monday	October 9	Aristotle, <i>On Sophistical Refutations</i> , rest of Part 5 through Part 8 (pp. 34-39)
Wednesday	October 11	Aristotle: review/catch-up day
Friday	October 13	<b>NO CLASS—Professor attending Board of Trustees Meeting</b>
Monday	October 16	<b>NO CLASS—Fall Break</b>
Wednesday	October 18	“On the Stoics: Diogenes Laertius”
Friday	October 20	“The Stoics and the Sorites”
Monday	October 23	Review Day for Midterm <b>Deadline for individual meeting with professor</b>
Wednesday	October 25	<b>MIDTERM WRITTEN EXAM</b>
Friday	October 27	<b>MIDTERM DISCUSSION EXAM</b>
Monday	October 30	Descartes, <i>Discourse on Method</i> , Parts 1 and 2
Wednesday	November 1	Descartes, <i>Discourse on Method</i> , Parts 3 and 4
Friday	November 3	Leibniz, “Arguments from <i>Theodicy</i> ”
Monday	November 6	“On Paradox”
Wednesday	November 8	“Introduction to Non-Euclidean Geometry”
Friday	November 10	“Introduction to Non-Euclidean Geometry” (cont.)
Monday	November 13	Nagel & Newman, <i>Gödel’s Proof</i> , chs. 1-2 (pp. 1-24)
Wednesday	November 15	Nagel & Newman, <i>Gödel’s Proof</i> , chs. 3-4 (pp. 25-44)
Friday	November 17	Nagel & Newman, <i>Gödel’s Proof</i> , chs. 5-6 (pp. 45-67)
Monday	November 20	<b>NO CLASS—Professor travelling for conference</b>
Wednesday	November 22	<b>NO CLASS—Thanksgiving break</b>
Friday	November 24	<b>NO CLASS—Thanksgiving break</b>
Monday	November 27	Nagel & Newman, <i>Gödel’s Proof</i> , ch. 7A (pp. 68-80)
Wednesday	November 29	Nagel & Newman, <i>Gödel’s Proof</i> , ch. 7B (pp. 80-91)
Friday	December 1	Nagel & Newman, <i>Gödel’s Proof</i> , ch. 7C (pp. 92-108)
Monday	December 4	Nagel & Newman, <i>Gödel’s Proof</i> , ch. 8 (pp. 109-113); section on computers from forward (pp. xv-xx)
Wednesday	December 6	Review Day for Final Exam
Friday	December 8	<b>FINAL WRITTEN EXAM</b>
Wednesday	December 13	<b>FINAL DISCUSSION EXAM—10:30am-12:30pm</b>