FORMAL LOGIC
ФОРМАЛЬНАЯ ЛОГИКА
School of Advanced Studies
Quarter 4, April 13 to June 11, 2020

Instructor: Giacomo Andreoletti g.andreoletti@utmn.ru

Available for consultation via pre-scheduled Zoom appointment

Contact Hours: 64

Type of Course: Elective

Meeting Times: Tuesday, 10:40-12:10; Thursday, 10:40-12:10; Saturday, 9:00-10:30

Related Minors

This course counts toward the minors in Information Technology, Life Sciences and Philosophy.

Course Description

Logic is about reasoning. We all reason, but logic helps us distinguish what is good reasoning from bad reasoning. The study of logic improves our natural capacity to reason, and it proves especially helpful when our reasoning faces abstract and challenging questions. Formal logic is the study of what follows from what, or what inferences are valid. It originated with the work of Aristotle and it has been developing ever since. Nowadays it is used in Philosophy, Artificial Intelligence, Linguistics, and other fields.

Logic studies reasoning by means of a regimented formal language that aims at clarifying our natural languages. In class we will cover the following topics: the nature of an inference, reasoning fallacies, validity and soundness, how to set up a formal language, logical connectives, quantifiers, truth tables, predicate calculus, and some basics of modal logic (the study of inferences on what is possible and impossible).

There are no prerequisites for this course. The study of formal logic improves critical thinking, as it teaches how to analyze the logical coherence of arguments in a precise fashion. Although the course is open to everyone, it could be of special interest for students intending to major in IT.

Course Structure

During the **distance learning mode**, each week features 1 synchronous class and 2 asynchronous classes. Weeks without a test (Weeks 1-2-4-6-7) will feature 1 on-line seminar (on Zoom), and 2 asynchronous classes consisting of videolectures plus quizzes. Weeks 3-5-8 will feature a synchronous test (see below for details) and 2 video lectures plus quizzes classes. The video lectures will be made available on Canvas before the week starts.

During seminars and videolectures, we will cover the nature of key logical concepts and techniques. You will also be assigned exercises through quizzes and homework during the week. The exercises will require you to apply logical concepts and techniques to specific examples and learn how they work in practice. Examples of exercises are: constructing a proof of a theorem, checking in what formal models a given formula is valid, building a refutation tree of an argument.

The course will follow the textbook *Schaums Outline of Theory and Problems of Logic* (see the course literature below). Each course week will roughly correspond to a book chapter. The textbook explains every concept in detail and contains plenty of exercises with their solutions.

Student Learning Goals

Students who successfully pass this course will be able to:

Learning goals	
Knowledge goal	understand the main principles of propositional and predicate logic;
Knowledge goal	understand the behavior of logical connectives and quantifiers;
Practical skill	construct formal proofs and refutation trees;
Practical skill	identify the logical coherence or incoherence of an argument.

Required Coursework and Evaluation Criteria

The final grade for this course will be calculated as follows:

Assignment or Task	Due date/s	Percent
Test #1	Week 3	20%
Test #2	Week 5	30%
Test #3	Week 8	30%
Homework	ongoing	10%
Participation	ongoing	10%

This course employs the 7-average (the average final grade for all students should fall between 6.50 and 7.49) Failing grades (0-3) are included in the calculation of the 7-rule.

All marks are provisional until the end of the course. The 7-rule WILL NOT be used in assessing individual assignments. It will only be applied to the final course marks, pending

overall student performance. If general performance is low, a lower overall median/average may apply – if performance is outstanding, a higher overall median may apply.

Tests (20%+30%+30%)

The tests are designed to assess: a) your knowledge of the main logical concepts covered in the course (see learning goals 1 and 2); b) your familiarity with the logical techniques to prove theorems and check validity (see learning goal 3); and c) your ability to apply logical laws to specific arguments (see learning goal 4).

The tests will comprise multiple answers questions and exercises. Here are some examples of questions and exercises that might appear in the tests:

1. Write down the refutation trees for the following argument forms and check whether they are valid.

   (a) $\forall x(Fx \vee Gx) \vDash \forall xFx \vee \forall xGx$
   (b) $\forall x \forall y(Lxy \rightarrow Lyx), \exists xLax \vDash \exists xLxa$

2. If the conclusion of an argument is a tautology, then the argument is certainly valid. Is the previous statement true or false?

3. In the following chain of inferences, (8) can't validly follow from (1). Find which step(s) is/are wrong. Your answer should look like: step from number x to y is invalid. There is at least one wrong step, but there might be more.

   (1) All logicians are vampires.
   (2) All non-vampires are non-logicians.
   (3) No non-vampires are logicians.
   (4) No logicians are non-vampires.
   (5) It is not the case that (some logicians are non-vampires).
   (6) No vampires are logicians
   (7) All vampires are non-logicians.
   (8) All logicians are non-vampires.

4. Construct a formal proof (derivation) of the following valid argument:

   $\sim P \rightarrow Q \vDash P \vee Q$

During the **distance learning** mode, the tests will be open-book (you will be allowed to use the textbook and other sources).

Participation (10%)

Participation in class discussion, especially during seminars, will be evaluated by your instructor. The grade will depend on the level of your contribution to class discussion (e.g., how much the contribution moves the discussion forward, how much it offers an original perspective, how much your contributions shows that you read the required material, etc.). Furthermore, your course copybook will be checked throughout the course and it will contribute to your participation grade (for instance, did you do any suggested extra exercise

on your copybook?). During the **distance learning** phase, the course will feature a board discussion on Canvas. The board will be the place to discuss the course material. Any kind of discussion is welcome and encouraged (from the implications of some of the logical concepts covered in the course to a more mundane "I don't understand how to do exercise 3.2, can anyone help me?"). Contributions to the discussion board (discussing a concept, asking a question, help your peer!) will boost your participation grade (and perhaps make us feel less isolated).

Moreover, you have the opportunity to do a short presentation (7-10 minutes) where you present some individual research related to the course topics. A list of possible topics for individual presentations will be provided during the first week of the course. Please note that doing a presentation is **not** mandatory. However, if you decide to do one and you do a good job, it will boost your participation grade.

The participation grade will be assigned during week 8 and it will be communicated on Canvas.

Homework (10%)

Weeks 1, 2, 4, 6 and 7 (the weeks without a test) will have homework to be completed and submitted on Canvas. The homework consists of exercises where you will have to apply the logical concepts and techniques covered during the week. The deadline for homework will always be Sunday 23:59. I will post the solutions on Monday morning, so that you can see whether you have done the exercises correctly.
Each weekly homework will be graded as completed or not completed, and the final homework grade will depend on how much homework you completed. You can work on the homework individually or with other students.

Canvas and Other Course Resources

This course has a website on Canvas (https://canvas.instructure.com/). You should have received an invitation to join the course on Canvas two weeks before the start of classes. If you did not, double check your SAS email and then follow up with the instructor. All course readings, this syllabus, and any other course materials are available on Canvas.

All written assignments completed outside of class must be submitted via Canvas.

Course Literature

Here is a bibliography of literature that will assist you in studying and writing assignments. See the course schedule below for specific reading assignments.

Nolt, John, Dennis Rohatyn, and Achille Varzi. *Schaums Outline of Theory and Problems of Logic.* 2nd Edition. New York: McGraw-Hill, 1998.

Priest, Graham. *Logic: a Very Short Introduction*. Oxford: Oxford University Press, 2017.

Course Policies and Expectations

In order to learn formal logic and successfully pass the class, students are expected to: pay attention in class, study the textbook and the class material, and do as many exercises as possible (the textbook contains many exercises together with their solutions).

You are required to use a copybook throughout the course. You will use the copybook during the group work sessions and to do any additional exercise. The teacher reserves the right to inspect your copybook to assess your participation grade and group work grade.

Moreover, bear in mind that each part of formal logic depends on previous parts. That is, it is *impossible* to understand material later on in the course without understanding previous material. It is thus of paramount importance to take action if you feel you are missing some important points or concepts. If that happens, don't hesitate to seek help, for instance by contacting your teacher or by asking a question in the Discussion Board..

Examination Format

The examination consists of a 90-minute test that includes the identification of ten quotations from required course readings and a written essay. For full details on the format and grading, see the SAS policies section below.

Course Schedule

Week	Date	Activity	Topics & Readings	Assignments
0	13.04-19.04	-	No classes	-
1	21.04 async	Recorded lecture+quiz	Topic: The notion of validity Reading: Nolt, John, Dennis Rohatyn, and Achille Varzi. *Schaums Outline of Theory and Problems of Logic, 2nd Edition*. New York: McGraw-Hill, 1998, **(henceforth: TB)** section 3.1 Priest, Graham. *Logic: a Very Short Introduction*. Oxford: Oxford University Press, 2017, chapter 1	Homework #1 (due Sunday 23:59)
	23.04 async	Recorded lecture+quiz	Topic: The notion of validity Reading: **TB** section 3.2	
	25.04 sync	On-line seminar	Topic: Semantics of logical operators Reading: **TB** sections 3.3 and 3.4	

2	28.04 async	Recorded lecture+quiz	Topic: Truth tables Reading: **TB** section 3.5	Homework #2 (due Sunday 23:59)
	30.04 async	Recorded lecture+quiz	Topic: Formalizing natural language Reading: **TB** section 3.6	
	2.05 sync	On-line seminar	Topic: Refutation trees for propositional logic Reading: **TB** section 3.7	
3	5.05 async	Recorded lecture+quiz	Topic: Propositional Calculus and non-hypothetical inference rules Reading: **TB** 4.1 and 4.2	Test #1
	7.05 async	Recorded lecture+quiz	Topic: Hypothetical inference rules Reading: **TB** 4.3	
	9.05 sync	test	Test #1 (90 minutes)	
4	12.05 async	Recorded lecture+quiz	Topic: Propositional Calculus (theorems) Reading: **TB** section 4.4	Homework #4 (due Sunday 23:59)
	14.05 async	Recorded lecture+quiz	Topic: Propositional Calculus (equivalences) Reading: **TB** section 4.5	
	16.05 sync	On-line seminar	Topic: Propositional Calculus (tips to construct proofs) Reading: **TB** section 4.6	
5	19.05 async	Recorded lecture+quiz	Topic: Propositional Logic Recap Reading: **TB** revise ch. 3	Test #2
	21.05 async	Recorded lecture+quiz	Topic: Propositional Logic Recap Reading: **TB** revise ch. 4	
	23.05 sync	Test	Test #2	
6	26.05 async	Recorded lecture+quiz	Topic: Categorical statements and Venn diagrams	Homework #6 (due Sunday 23:59)

			Reading: **TB** section 5.1	
	28.05 async	Recorded lecture+quiz	Topic: Immediate inferences Reading: **TB** section 5.2	
	30.05 sync	On-line Seminar	Topic: Categorical syllogisms Reading: **TB** sections 5.3 and 5.4	
7	2.06 async	Recorded lecture+quiz	Topic: Predicate Logic Reading: **TB** 6.1	Homework #7 (due Sunday 23:59)
	4.06 async	Recorded lecture+quiz	Topic: Existential Quantifiers Reading: **TB** 6.2	
	6.06 sync	On-line Seminar	Topic: Universal Quantifiers Reading: **TB** 6.3	
8	9.06 async	Recorded lecture+quizr	Topic: Refutation trees for predicate logic Reading: **TB** sections 6.4	Test #3
	11.06 async	Recorded lecture+quiz	Topic: The Identity Operator Reading: **TB** sections 6.5 and 6.6	
	13.06 sync	test	Test #3 (90 minutes)	

SAS Policies for Online Courses

Please note the addition and updating of policies to reflect the realities of online teaching in Q4.

Technical Requirements and Responsibilities for Online Education

Professors and students are responsible for ensuring they have access to a computer and a stable Internet connection during all scheduled class meetings. This is to ensure that students get the most out of the online education format. If you have problems with your Internet, smartphones may be used as a backup option (as a wifi hotspot or to participate in class).

Course materials and all assignments will be made available on Canvas; all synchronous class meetings will be conducted over Zoom. All communication about the course and assignments must happen over Canvas or official email. The use of any supplementary platforms (discussion boards etc.) is at the discretion of the instructor.

Professors are required to post all resources for online teaching via Canvas before the start of each week. This includes: Any nonsynchronous lesson material, the invitations for individual Zoom meetings, and any other materials required to complete the course.

All synchronous classes will be recorded and made available via Canvas on the same day for a minimum of one week. These recordings are only for teaching purposes and should not be shared.

Etiquette for Online Classes

Professors and students should join Zoom a few minutes before class in order to have time to solve any technical problems. When you join a class, your microphone will be muted. Individual professors will decide how to run class discussions and whether to enable such features as chat. As a general rule of thumb, you should mute your microphone when you are not speaking.

In seminars, students are required to make themselves visible. If you have concerns about what is visible, then either take the time to "curate" your environment or consider using the background option in Zoom. During lectures, you are welcome to turn off your video.

Students should feel free to contact the professor or Head of Education (d.kontowski@utmn.ru) to discuss any concerns that may arise concerning online delivery of the course (i.e., technical issues, course material availability, access to apps, communication challenges, and changes to syllabus or schedule). Don't wait until course evaluations to draw attention to your concerns!

Technical Emergencies Protocols

Students who have difficulty getting online to attend a synchronous class or complete an assignment, should contact the professor immediately according to the specific instructions provided in the syllabus (i.e., via telephone, SMS, or email). Follow the below instructions concerning making up classes missed due to technical problems.

If your professor is not online for the start of a class session, keep Zoom open and check your email. If the professor does not come on-line or send a message to clarify the situation within 10 minutes after the official starting time, class is cancelled. Both the professor and a designated student should alert the Head of Education about the situation. Missed classes will be rescheduled; update class times to be shared via Canvas and Modeus.

Attendance and Absences

Zoom has an attendance feature that will be used to record attendance. Attendance is required for all synchronous classes or required online activities (i.e., designated asynchronous tasks, timed assignments, group work meetings, etc.) and will be recorded on a grading sheet. Students can miss up to two classes without an excuse; every further absence will see the final mark lowered by 1 point for each class missed (i.e., a student who misses 6 class meetings without prior approval or a valid excuse cannot pass a course). Missing more than 15 minutes of scheduled online class is considered an absence, unless the student has received prior approval from the Head of Education.

If you plan to miss a class due to a legitimate conflict (i.e. attendance of a student conference), you must apply to the instructor for an approved absence at least seven days in advance and CC Head of Education. Without advanced approval, it will count as a missed class.

If you are sick, email all your instructors and Alyona Bunkova (a.bunkova@utmn.ru) as soon as possible to notify them that you will be missing class. They will follow up with you with any necessary arrangements related to your illness.

If you need to miss a class due to something that arises at short notice (i.e., bureaucracy that needs to be dealt with, an emergency at home), email the instructor as soon as possible to notify them about your absence. Should a student have repeated problems with attendance, the instructor will notify the Head of Education.

Making Up Classes Missed for Legitimate Reasons

Students who miss a synchronous class session to a legitimate conflict, an emergency that arises at short notice, or a technical problem will be required to watch the recording of the class and submit a written summary of the key points of the class, including any questions that you have about the content. This should be sent to the instructor via email within 48 hours of the ending of the class in order to receive credit. If a technical problem emergency situation persists beyond 48 hours, an extension may be granted. Students who are sick should watch the videos of missed classes in order to keep up on courses, but they are not required to submit written summaries.

Extensions for Assignments

All assignments must be submitted by their due dates. Extensions will be granted only when ill health, death of a loved one, or personal difficulties of a serious nature near the due date prevent completion of an assignment. As the due dates for assignments are stated in the syllabus, the pressure of other university work or extracurricular activities will not be accepted as a reason for an extension.

If you require an extension, you must write to your instructor at least three working days in advance. Clearly explain your situation and provide any necessary documentation (such as a medical certificate) to Alyona Bunkova. Your instructor should reply to you within one day; you will be notified by email about whether an extension has been granted.

Late Assignments

Late assignments will be penalized by a full grade deduction for each day of lateness. For example, an essay submitted three days late that received a mark of 7 would be reduced to 4. Late assignments will not be accepted once graded assignments are returned or after June 11. The acceptance of late assignments for minor assessments (worth 10 percent or less of the final mark, including minor tasks completed during class hours) is left up to the discretion of individual instructors.

Rescheduling of Classes or Substitution of Instructor

Should a course be unable to meet at its regular time, the instructor will liaise with Alyona Bunkova to approve the change and to find a different time that suits both the instructor and students. Should this occur, all involved will receive an email notification from Alyona Bunkova about the changed schedule and any schedule changes will appear in Modeus. If the instructor requires a substitute to replace them, students will be notified by email.

Grading

SAS uses a ten-point grading system. Grades from 0 to 3 are failing grades. Grades from 4 to 10 are passing grades. 10 and 9 are excellent grades given in exceptional circumstances.

In most courses, SAS faculty are obliged to follow the 7-rule. This may be calculated either as a “median” (the number of grades above 7 and the number of grades below 7 do not differ by more than 1) or an average (the average final grade for all students should fall between 6.50 and 7.49). The 7-rule may be applied to each assignment OR only to the final course marks. Exceptions to this rule are only granted by the Teaching Council.

Examinations

The examination will consist of a 90-minute written test that includes the identification of ten quotations from required course readings and a written essay. The use of any electronic devices is prohibited. The student must: 1) Attribute the given quotations; identify the sections of the texts (such as a chapter) where the quotations are taken from as well as their authors, titles, and year of publication. 2) Based on the given quotations, write an essay in English (1000–1500 words) analyzing semantic relationships between the texts where these quotations are taken from.

Assessment Criteria:

Satisfactory (C, or 3):	Good (B, or 4):	Excellent (A, or 5):
1) All quotations are attributed correctly;	1) all quotations are attributed correctly;	1) all quotations are attributed correctly;
2) The essay is written in English (no less than 1000 words) in accordance with the following requirements: a) in the essay, there is a sequential logic structure (introduction, body, and conclusion); b) the essay demonstrates satisfactory knowledge and understanding of all texts analyzed; c) the essay contains at least five exact quotations, different from the attributed quotations in assignment 1, illustrating the main ideas of the essay and formatted in accordance with the GOST 2008 (State Standard 2008).	2) the essay is written in English (no less than 1000 words) in accordance with the following requirements: a) in the essay, there is a sequential logic structure (introduction, body, and conclusion); b) the essay demonstrates good knowledge and understanding of all texts analyzed; c) the essay contains at least seven exact quotations, different from the attributed quotations in assignment 1, illustrating the main ideas of the essay and formatted in accordance with the GOST 2008 (State Standard 2008).	2) the essay is written in English (no less than 1000 words) in accordance with the following requirements: a) in the essay, there is a sequential logic structure (introduction, body, and conclusion); b) the essay demonstrates excellent knowledge and understanding of all texts analyzed; c) the essay contains at least nine exact quotations, different from the quotations in assignment 1, illustrating the main ideas of the essay and formatted in accordance with the GOST 2008 (State Standard 2008).

Course Evaluations

Toward the end of the quarter, students will be asked to complete an anonymous evaluation of the course. The results of the evaluations will be reviewed by the instructor, the Head of the Education Office, and the Teaching Council in order to improve education at SAS.

Academic Integrity

Students are expected to comply with the SAS Academic Integrity Document (see English version HERE or Russian version HERE). Cheating, plagiarism, and disrespectful behavior will not be tolerated and *must* be sanctioned by the instructor in accordance with the document. The use of any translation applications (Google Translate etc.) is highly discouraged. Students are required to cite any sources employed in written assignments using the citation style listed in the syllabus.

Online assignments will be “open book,” meaning that you can look at course reading materials and notes while answering the questions. However, the Academic Integrity still applies. That means: You must not communicate with anyone; your answers will be your own work; and you will not use Google Translate. You are discouraged from searching the Internet for answers, as you will run out of time, may risk violation of the Academic Integrity Policy, and will likely do worse than if you simply answer with the knowledge you already have.

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