Math 454/504: Mathematical Logic, Fall 2010

Instructor: Guram Bezhanishvili

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Prerequisites: C or better in Math 279 or Math 331 or Math 332 or consent of instructor.


Meetings: MWF 2:30–3:20 in SH 111.


Office: SH 245

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**Course Objectives:** The main objective of Math 454/504 is to give a detailed account of first-order logic, its syntax and semantics. The central topic of the course will be the completeness theorem of first-order logic. It states that a formula is provable in first-order logic iff it is satisfiable, thus showing that syntax and semantics of first-order logic go hand in hand. The theorem was originally proved by Kurt Gödel (1906—1978) in 1929. In 1949 Leon Henkin (1921—2006) designed a new method for proving the theorem, which became a standard tool in proving completeness results for different logical systems. We will learn about the Henkin method by studying Henkin’s original historical source. We will also see how powerful the Henkin method is by showing that it yields such fundamental theorems about first-order logic as the Löwenheim-Skolem and compactness theorems. Time permitting, we will also learn the first-order theory of arithmetic from the original historical source by Giuseppe Peano (1858–1932).

**Material:** We will cover portions of Part A of the textbook, which consists of the first eight chapters of the text. In addition, we will study Henkin’s original historical source. Time permitting, we will also study Peano’s original historical source.

**Grades:**

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<tr>
<th>Component</th>
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<tbody>
<tr>
<td>Homework</td>
<td>20 %</td>
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<tr>
<td>Midterm</td>
<td>25 %</td>
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<tr>
<td>Project</td>
<td>25 %</td>
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<tr>
<td>Cumulative Final Exam</td>
<td>30 %</td>
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**Homework:** Homework will be assigned routinely and a sample of exercises will be collected periodically for grading. To succeed in this course, daily work on practice problems is required. A student who can complete all homework problems will have a good grasp of the course material, and many of the questions on the exams will be of a similar nature to those assigned as homework. You are welcome to discuss the homework problems with other members of the class, but you are required to hand in your solutions separately.
Homework must be written up in a comprehensible way. I will not accept late assignments without a medical certificate or other university approved excuse within a reasonable time of the missed work.

**Midterm:** The midterm exam will roughly consist of 4 to 5 problems, and will cover material from the first half of the semester. It will be given sometime in early October.

**Project:** The central topic of the course will be the proof of completeness of first-order logic by Henkin’s method. We will study Henkin’s method from the original historical source by Leon Henkin. I plan to assign the project in early October, and expect to spend about a month on the project. As soon as we start the project, I will decrease the amount of homework considerably. Most work turned in during this time will be parts of the project. Again, you are welcome to discuss the project with other members of the class, but you are required to hand in your solutions separately. Time permitting, we will also study the first-order theory of arithmetic from Peano’s original source.

**Cumulative Final Exam:** The final exam for Math 454/504 will roughly consist of 6 to 8 problems, and will be cumulative. It will be given on Wednesday, December 8th, 1:00 – 3:00 in SH 111.

**Missed Test Policy:** Students must notify the instructor before an exam is missed in order to qualify for a make-up exam. Failure to do so will result in a “0” for any missed exam. The only valid excuses for missing an exam are documented illness, death in the family, or required participation in any university related function. Supporting documentation is required.

**Withdrawals and Incompletes:** You have the primary responsibility for withdrawing from the course. The last date to drop with a “W” is Tuesday, October 12th. Under University policy, an I grade is allowed only if a student has passed the first half of the course, and is precluded from completion of the second half of the course by a documented illness or family crisis.

**Policies:** Students are expected to attend every class and show up on time. I also expect students to write clear prose and show some mathematical maturity in the work they turn in.

**Important Notes:**

- At the end of the final examination, the course is over, and there are no more opportunities to submit additional work.
- I will not compose extra credit assignments for students who want to try to compensate for poor results in another component of the course.
- Feel free to ask questions in class.

**Disabilities and Discrimination:** Feel free to call Diana Quintana, Coordinator of Services for Students with Disabilities, at 575-646-6840 with any questions you may have on student issues related to the Americans with Disabilities Act (ADA) and/or Section 504 of the Rehabilitation Act of 1973. All medical information will be treated confidentially.

Feel free to call Jerry Nevarez, Director of Institutional Equity, at 575-646-3635 with any questions you may have about NMSU’s Non-Discrimination Policy and complaints of discrimination, including sexual harassment.