Mathematics 490: Senior Seminar – p-adic Numbers
Spring 2013

Instructor: Elizabeth S. Allman

Office: 308B Chapman, 474-2479

E-mail: e.allman@alaska.edu

Office Hours: M, W 2-3, and by appointment

Web page: http://www.dms.uaf.edu/~eallman/classes/490-s2013/490-2013.html

Prerequisites: (Math 401 or 405) and (Comm 131 or 141)

Credit Hours: 2.0

Texts: p-adic Analysis Compared with Real, by Svetlana Katok, Student Mathematical Library, American Mathematical Society. Supplementary readings will be made available for additional topics.

Class Meetings: T, Th, in Gruening 401, 2:00 – 3:30 pm

Final Exam: Thursday, May 9, 1:00-3:00

Course overview and learning outcomes:

The primary purposes of the Senior Seminar is for you to learn to communicate to your peers about advanced mathematics, through both formal oral presentations and informal discussion, and to direct your own mathematical learning. Over the course of the semester, you will lecture to your fellow students, question and discuss with classmates when they present lectures, and in general help each other to learn about a new topic. The instructor will provide guidance throughout the course, and lay out a course structure, but will not be teaching you in the typical lecture format used for most mathematics courses.

The topic for this offering, the p-adic numbers, is one that blends ideas from analysis and algebra, and hence builds on ideas from the prerequisite courses. While not a part of the standard undergraduate curriculum, it is a good topic to help you relate different parts of your major and see how ideas you've been exposed to in other courses can lead to entirely new topics. The ability to deal with abstract mathematical concepts that you have developed in upper-level mathematics courses will also be put to use.

While there is a minimal amount of material that the course will definitely cover, the pace will be in part be determined by the students. When learning new mathematical material in a seminar format, it is easy to go too slowly, in an effort to make sure you understand every detail. Usually, however, it is better to forge ahead, recognizing that later material will help you get a deeper understanding of earlier topics. This can be dangerous however, if you allow yourself to slide over difficult issues without working hard to understand them. The instructor's roles will include monitoring the pace of the class, probing to make sure all students are engaging with the material, and offering perspectives that may not emerge from class discussions.

Mechanics of the course:

Class meetings will be divided into two parts, of lengths one half hour and one hour respectively. For the first half-hour, two (possibly three) students will present homework solutions at the board and take questions from the students about the homework due that day. The format of the homework review can be flexible (evolving in time if needed), but the general parameters are that two (or three) students will be assigned particular problems to present, and should be able to answer questions on other homework problems too.

The second hour of class will be for formal lecture. Each week these lectures will be lead by a pair of students (or, later in the course, perhaps a single student), who are assigned this responsibility in advance. All students should come to class having read the relevant section of the text, but the leaders should have already spent significant effort to master the material.

The class leaders should be prepared (with notes) to give a 30-40 minute lecture outlining the main points of the section, giving important definitions, proofs, and examples. The presentation need not include everything in the text, but rather emphasize whatever is most important. The two leaders will obviously need to meet in advance to decide how to present things, and both must contribute. Leaders may meet with the instructor ahead of time for advice or help, but this is not required. Other students should ask questions and contribute comments in class, asking for clarifications or additional examples as appropriate.

Teams of class leaders and homework solution presenters will rotate, so that you are paired with different classmates over the course of the semester.

Each class meeting, the instructor will assign a few homework problems for all students to complete by the next class. Students may work on these problems with classmates, but the work turned in must be written individually. Grades on homework will be based on both correctness and quality of presentation using good mathematical style.

Assignments are due in class, and will not be accepted late except in serious extenuating circumstances. I encourage you to work with others on the homework, but you must *write up solutions independently*. You will learn nothing from simply copying someone's solution. The best approach is 1) make a first attempt at all problems alone, 2) meet with a classmate to work out difficult issues, 3) write up complete solutions alone.

Class attendance and participation is required, and forms a significant part of your grade. If you must miss class for unavoidable reasons, you should inform the instructor of the reason in advance, if possible.

There will be one **midterm** and a **final examination** on the course material which will be part of your grade.

In addition, the department requires that seniors take a standardized **Mathematics Field Test** to gain data on the effectiveness of our major. Taking this test is required to pass the course, but your performance on it will not affect your grade in the seminar. This exam will be scheduled later in the semester, outside of scheduled class meetings.

Grades:

You must take the Mathematics Field Test to pass this course, but your score on that test will not affect your course grade.

You must achieve a passing grade on the final examination to pass the course. If you do pass the final, then your grade will be based on 20% homework, 35% class presentations and leadership, 10% other class participation, 10% midterm, 25% final examination. Your grades on class presentations will be based on organization and choice of material to present, clarity of

oral expression and blackboard use, and your success in engaging and being responsive to the audience. Your homework grade includes correctness of solutions and clarity of presentation.

Course grades will be determined according to the following cutoffs:

$$A \geq 90\%,$$
$$B \geq 80\%,$$
$$C \geq 70\%,$$
$$D \geq 60\%.$$

Plus and minus grades are assigned in the usual way.

Note that you are not in competition with your peers – everyone in the class may get an A, or everyone may get an F.

University and Department Policies:

Your work in this course is governed by the UAF Honor Code. The Department of Mathematics and Statistics has specific policies on incompletes, late withdrawals, and early final exams which can be found at

`http://www.dms.uaf.edu/dms/Policies.html`.

Disabilities:

If you have any disabilities that I should know about, you should bring them to my attention soon so that we can work with the Office of Disability Services to set up any necessary accommodations.

Speaking Center:

The UAF Speaking Center offers coaching and practice to prepare for oral presentations. It is located at 507 Gruening, with spring semester hours posted online. Call 474-5470 to schedule an appointment, or e-mail `fyspeak@gmail.com`. You can also simply walk in and ask for help.