Math 444, Spring 2021, Section D13

Instructor Information

Course Information

Course Overview

Real analysis, which is the study of the real number system and of functions and sequences of real numbers, lays the theoretical foundation for calculus. It is interesting and perhaps surprising that most of the calculations and techniques that you learn in Calculus were developed by the 17th century (see History of Calculus), but the theoretical underpinnings, in particular precise definitions of *limit*, *derivative*, and *integral*, did not appear until over a hundred years later (see History of Mathematical Analysis). So why do we need to study real analysis when we can use calculus very well without it? The first reason is the simple intellectual appeal of a rigorous foundation for the powerful techniques of calculus and for the intriguing ideas of the "infinitely small." The second reason is that real analysis includes powerful concepts that can be applied in other fields and generalized to many contexts. Ideas of real analysis play a big role in differential equations, dynamical systems, probability, statistics, economics, physics, financial mathematics and many other areas.

Topics covered by Math 444 include the real number system, limits, continuity, derivatives, the Riemann integral, and sequences of functions.

This course has significant overlap with Math 447, but Math 447 is more general in that it covers analysis on metric spaces in general, whereas Math 444 covers analysis only on the real line. The Math Department recommends that students who plan to pursue graduate work in mathematics should take Math 447 if possible.

Course Goals

Students will gain a rigorous understanding of the fundamental concepts of real analysis and will improve their ability at reading and writing mathematical arguments.

Academic Calendar

This is a **3 credit hour** course that can count for either undergraduate or graduate credit. The course is **15 weeks long (not counting finals week) and consists of 14 weekly units and one review week**. You should dedicate **at least 8 hours per week or more**. Actual time commitments will vary depending on your input, needs, and personal study habits. Please log on to the course website and check your e-mail frequently for updates, news and announcements.

Required Text

Required: Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, 4th edition, Wiley .

Hardcopy and ebook versions of the textbook are available. The University of Illinois library has paper and electronic copies.

There will be readings from the textbook assigned each week and the course will follow the textbook closely.

Course Components

This course will consist of the following components:

Weekly Units

Each weekly unit begins with an overview and the learning goals you are expected to achieve. These goals should guide your study through the unit. Every unit consists of a homework assignment, a definitions/theorems exercise, lectures, quizzes, readings and additional exercises to support these goals.

Homework Assignments

Each week contains a homework assignment consisting of several exercises. After clicking the assignment you will see assignment instructions and a link to a PDF file containing these exercises. View the PDF file and complete the exercises. When you are finished, scan or take a picture of your work and submit the file via the assignment link in Moodle. Please submit it as a single pdf file. **Assignments are due by 5:00pm Central Time on the due date,** normally every Monday. You will get feedback and a grade for your homework.

Definition/Theorem Worksheets

Each week, you will also submit a definition/theorem worksheet for the week's material. These are also **due by 5:00pm Central Time on the due date,** normally every Monday. You will get feedback and a grade on your worksheets.

Lectures

Each unit contains a list of recorded lectures. There is also a pdf with notes for each lecture, which you may use as a supplement or a substitute if bandwidth prevents you from accessing the recorded lecture.

There is a quiz after most lectures to help you stay motivated and to check your understanding. The quizzes are graded and you have several attempts for each quiz. When you have difficulty with a quiz question, review the lecture, the lecture notes, the reading, and/or ask for help from your instructor.

Readings and Exercises

Each unit contains assigned readings and additional exercises. You are responsible to complete these items. Lectures cover major topics from the readings but do not necessarily include all important information from the readings. The additional exercises are not submitted for a grade, but you will do best to write them out as if they were to be graded.

Discussion Forums and Office Hours

Each week has a discussion forum. This forum can be used if you have a question about the assignment, quiz, or content of the unit. Posting questions here allows everyone to benefit from the answer. Most likely, other students also have the same question.

By default, you will receive an e-mail each time a new post is created. To unsubscribe from the forum, go to the forum and click the blue gear symbol in the upper right. By unsubscribing, you won't receive the emails, but you can still use the forum.

There will be several Zoom help sessions each week, where you can discuss course material, exercises, and homework problems with the instructor and with other students.

Because of the importance of staying engaged in an online course, 5% of your grade will be based on your participation in office hours and discussion forums.

Exams

This course includes 4 midterm exams and an optional final exam. See the **Exam** tab for details.

Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students should contact both the instructor and the Disability Resources and Educational Services (DRES) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, (217) 333-1970, or via e-mail at disability@illinois.edu.

Grading

Grading Distribution

	#	Percentages	Points	Total Points
Homework Assignments	**14**	35%	25 points each homework	350
Definition/Theorem Sheets	**14**	9.8%	7 points each sheet	98

Office Hours/Forums		5.1%	3 points for each substantive participation, up to 51 maximum (also max 9 per week)	51
Quizzes	**101**	10.2%	1 point each quiz	101
Midterm Exams	**4**	Each 10%	100 points each exam	400
Optional Final Exam	**1**	Replace one midterm exam grade		
Course Total		100.1%		1000

*No "dropped" grades in this course.

Points	Course grade
970-1000	A+
930-969	A
900-929	A-
870-899	B+
830-869	B
800-829	B-
770-799	C+
730-769	C
700-729	C-
670-699	D+
630-669	D
600-629	D-
0-599	F

Policies

Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students should contact both the instructor and the Disability Resources and Educational Services (DRES) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, (217) 333-1970, or via e-mail at disability@illinois.edu. Students are encouraged to use all accommodations to which they are entitled.

Assignments

Assignments are due by 5:00PM Central time on the dates specified in the weekly overviews unless otherwise noted.

If you need an extension on an assignment because of medical reasons or personal emergencies, you must contact the course instructor before the assignment is due. Such accommodations will be made on a case-by-case basis and documentation may be required.

Grades

See Course Information page.

Communications

Routine Contact

Your routine contact should be via the discussion forums and via e-mail. The instructor will post all couse information on Moodle and will post a weekly overview (normally each Sunday) on the forum for that week.

Course Questions

Questions pertaining to the course may be posted in the discussion forums. Posting questions here allows everyone to benefit from the answers. If you have a question, someone else is probably wondering the same thing. Participants should not hesitate to answer questions posed by peers if they know the answers and the instructor has not yet responded. This not only expedites the process but also encourages peer interaction and support. You are also welcome to contact the instructor by email at any time: kmortens@illinois.edu

Personal and Grade-related Questions

Questions should first be sent to the instructor's e-mail address: **kmortens@illinois.edu**

Course Announcements

The **Announcements** forum serves as a way for your instructor and University of Illinois administrators to make announcements within the virtual learning environment. Announcements posted here will also be sent to your Illinois e-mail address, so be sure to check your e-mail or the Announcements forum frequently to see whether any new announcements have been made.

Office Hours/Help Sessions

There will be several opportunities for discussion by Zoom with the instructor and with fellow students each week. Please take advantage of them! A schedule will be set after the instructor surveys the class to determine times that work well for everyone.

Email

Instructor Email: kmortens@illinois.edu

Netiquette

In any social interaction, certain rules of etiquette are expected and contribute to more enjoyable and productive communication. The following are tips for interacting online via e-mail or discussion board messages, adapted from guidelines originally compiled by Chuq Von Rospach and Gene Spafford (1995):

- Remember that the person receiving your message is someone like you, deserving and appreciating courtesy and respect.
- Remember that no one is born knowing real analysis; we are all learning. Be brave enough to ask questions; be patient and helpful when you respond to others' questions.
- Be brief; succinct, thoughtful messages have the greatest effect.

- Your messages reflect on you personally; take time to make sure that you are proud of their form and content.
- Use descriptive subject headings.
- Think about your audience and the relevance of your messages.
- Be careful when you use humor and sarcasm; absent the voice inflections and body language that aid face-to-face communication, messages are easy to misinterpret.
- When making follow-up comments, summarize the parts of the message to which you are responding.
- Cite appropriate references whenever using someone else's ideas, thoughts, or words.

Emergencies

If you have an emergency or other situation that will keep you from participating in the course, please contact your instructor promptly at kmortens@illinois.edu.

Academic Integrity

Expectations

Academic dishonesty will not be tolerated. Examples of academic dishonesty include the following:

- Cheating
- Fabrication
- Facilitating infractions of academic integrity
- Plagiarism
- Bribes, favors, and threats
- Academic interference
- Examination by proxy (letting someone else take an exam for you)
- Grade tampering
- Non-original work

Guidelines

Should an incident arise in which a student is thought to have violated academic integrity, the incident will be processed under the disciplinary policy set forth in the Illinois Academic Integrity Policy in the Student Code. Significant penalties will be imposed for cheating or other violations. This is not a hollow threat; I will take the time to follow through on each and every violation, and I will not show partiality to any student. You will find me flexible and understanding about difficulties you have related to this course, and you will find me firm and inflexible about cheating.

If you do not understand relevant definitions of academic infractions, contact the instructor for an explanation within the first week of class.

Copyright

Student Content

Participants in University of Illinois courses retain copyright of all assignments and posts they complete; however, all materials may be used for educational purposes within the given course. In group projects, only the portion of the work completed by a particular individual is copyrighted by that individual. The University of Illinois may request that students' materials be shared with future courses, but such sharing will only be done with the students' consent. The information that students submit during a course may, however, be used for the purposes of administrative data collection and research. No personal information is retained without the students' consent.

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Course Schedule

Assignment and Exam Dates (times are in Illinois)

	Date
Homework 1 & Definitions/Theorems 1	Monday, Feb. 1, 5pm
Homework 2 & Definitions/Theorems 2	Monday, Feb. 8, 5pm
Homework 3 & Definitions/Theorems 3	Monday, Feb. 15, 5pm
Homework 4 & Definitions/Theorems 4	Monday, Feb. 22, 5pm
TEST 1	Wednesday, Feb. 24, 10:00-10:50am

Homework 5 & Definitions/Theorems 5	Monday, March 1, 5pm
Homework 6 & Definitions/Theorems 6	Monday, March 8, 5pm
Homework 7 & Definitions/Theorems 7	Monday, March 15, 5pm
TEST 2	Wednesday, March 17, 10:00-10:50am
Homework 8 & Definitions/Theorems 8	Monday, March 22, 5pm
Homework 9 & Definitions/Theorems 9	Monday, March 29, 5pm
Homework 10 & Definitions/Theorems 10	Monday, April 5, 5pm
TEST 3	Wednesday, April 7, 10:00-10:50am
Homework 11 & Definitions/Theorems 11	Monday, April 12, 5pm
Homework 12 & Definitions/Theorems 12	Monday, April 19, 5pm
Homework 13 & Definitions/Theorems 13	Monday, April 26, 5pm
TEST 4	Wednesday, April 28, 10:00-10:50am
Homework 14 & Definitions/Theorems 14	Monday, May 3, 5pm
Final Exam	**DATE and TIME** to be determined