Syllabus for Math 488: Senior Mathematics Capstone

Dr. Bruce Dearden
Fall 2019 (1901)

Math 488.01 (#7173)
Senior Capstone (3cr)
Witmer 309, 2:00 – 2:50 MWF
Last Day to Drop: November 10, 2013
Arts & Sciences Showcase: Thu. Dec. 12
Capstone Paper due: Wed. Dec. 18, by 3:15pm

Instructor:
Bruce Dearden, Professor
Department of Mathematics, Witmer 332
E-mail: bruce.dearden@und.edu
Phone: (701-77)7-4604
Office Hours: 3:00 – 3:50 MWF; and by Appt.

Important Dates:
09/02: Labor Day Holiday (no classes)
09/04: Last day to add/drop(no record), audit(to-from)
10/20: Mid-Term Grades
11/11: Veteran's Day Holiday (no classes)
11/15: Last day to drop, withdraw, to-from S/U grading
11/15: Last day to request Final accommodation.
11/27 – 11/29: Thanksgiving Holiday (no classes)
12/12: *Arts & Sciences Undergraduate Showcase*
12/13: Reading and Review Day
12/18: Capstone Project Paper is due as "Final Exam"

Course Books:
WRITING MATH RESEARCH PAPERS: A Guide for Students and Instructors, by Robert Gerver, IAP, 3rd ed 2013.

Cracking the GRE Mathematics Subject Test, by Princeton Review, Random House, 4th ed. 2010

Catalog Description: (From 2019—2020 Catalog.)
MATH 488. Senior Capstone. 3 Credits.
This course is designed to help students transition into working mathematicians. Thus the course will address 1) written and oral expression of mathematical material and concepts, 2) research and problem solving in mathematics, and 3) technology in mathematics, and its appropriate use. Material will build on the core areas of calculus, linear algebra, and differential equations. Prerequisites: Senior standing with a major in mathematics. F.

Course Description:
This course helps students to become working mathematicians. In particular, we will work on methods and techniques of mathematical communication, and proofs, expository writing and oral presentation skills and problem-solving methods and explanations or proofs.

Learning Outcomes:
Upon successful completion of the course, students will be able to:

1. Use contemporary software to typeset and present mathematical content.
2. Communicate mathematical ideas and material clearly and succinctly in writing.
3. Articulate complex mathematical ideas to an audience.
4. Demonstrate breadth of knowledge within mathematics.
5. Demonstrate mastery of the following departmental goals:
   - Be proficient in the computational techniques taught in Pre-Calculus, Calculus, Linear Algebra and Differential Equations..
   - Develop an appreciation for the importance of proof in mathematics, knowledge of what constitutes a mathematical proof, and the ability to understand and construct elementary proofs.
   - Develop an appreciation for the central role that examples play in mathematics.
   - Develop an awareness of the broad applicability of mathematics and be exposed to some areas of mathematics that are obviously applicable.
   - Develop an appreciation for the beauty of mathematics as an independent discipline and be exposed to some areas of mathematics that are not obviously applicable.
   - Develop and appreciation for the complexity and subtlety of mathematics.

Essential Studies:
In addition to being the capstone course for the B.S. in Mathematics, this course is an Essential Studies capstone course, and as such serves as a culmination of a significant part of your undergraduate educational experience. Part of what makes it an Essential Studies capstone is the way it thoughtfully and intentionally integrates multiple ES Program learning goals into the course content and activities. In this course you should strive to produce advanced-level work in the intellectual skills represented by the ES learning goals on which the course is focused. Those goals are *Critical Inquiry & Analysis* and *Advanced Communication* as used by professional mathematicians. Which means, among other things, that your grade will largely be determined by your writing and speaking skills.

Learning Goal Descriptions:
 Critical Inquiry & Analysis:
This course addresses the Essential Studies learning goal of Critical Inquiry & Analysis. This means it will focus on collecting and analyzing information to reach conclusions based on the evidence.

More specifically, inquiry should be thought of as a systematic process of exploring issues, objects, or works through the collection and analysis of evidence that results in informed conclusions or judgments. Analysis is the process of breaking complex topics or issues into parts to gain a better understanding. You should expect to focus on these intellectual skills as part of this course.

 Written Communication:
This course addresses the Essential Studies learning goal of Written Communication. This means it is about developing and expressing ideas in writing or with a mix of words, data, and images. You can expect to work in different genres and styles of writing as you develop your written communication skills in this course.

 Oral Communication:
This course addresses the Essential Studies learning goal of Oral Communication. This means it is about presenting information (formally or informally) in various settings and to various audience sizes to achieve some purpose, such as to increase the listeners' knowledge, to foster their understanding of a topic, or to promote a change in their attitudes, values, beliefs, or behaviors. You can expect to work on these skills in this course

 Advanced Communication:
This course is an Essential Studies Special Emphasis course in Advanced Communication, which means it places a strong emphasis on practice and process in communication. You will receive regular feedback on your speaking and/or writing, and you will be required to produce multiple spoken presentations and/or written texts. In addition to assignments which require you to work with content, they will also demand that you are aware of rhetorical strategies and styles of delivery.

As an Advanced Communication course, at least 1/3 of your assignments will emphasize writing and/or speaking skills, and you should expect these assignments to build on skills developed in earlier courses – such as awareness of audience and purpose, argumentation and rhetorical effectiveness, or the communication conventions associated with particular civic, academic, and professional contexts.

You should also expect to receive feedback on the quality of your communication in writing and/or oral presentation assignments, and have the time necessary to use that feedback to improve your writing and/or oral communication skills.

Topic of Paper and Presentations:
The large majority of your work will be centered on learning about, understanding, and advancing an argument about a topic (primarily) of your choosing. This topic must relate to one of the core areas of the mathematics curriculum – calculus, differential equations, linear algebra, discrete mathematics, statistics, applied mathematics, and set theory and logic. It must be substantial enough to warrant the attention of the paper and presentation described below. It should be something your find intrinsically interesting; something that will likely hold your interest throughout the semester.

You are encouraged to choose a topic of your own, although it must be something that can be classified as "using substantial mathematics". No two students may choose the same, or substantially the same, topics. If this occurs, I will require at least one of the students to choose a different topic.

Assessment and Grading

This course uses a points-free, competency-based assessment system that differs from traditional points-based systems in some very important ways. It is designed to provide you with control over the grading process, transparency as to your progress toward a course grade that truly reflects your actual mastery of course concepts.

Evaluated Types of Items:

1. GRE Problems (submitted to Bb)
2. GRE Problem Presentations (in class)
3. Project Proposal (submitted to Bb)
4. Paper Draft (submitted to Bb)
5. Poster & Presentation (Bb, A&S Showcase)
6. Project Slide Presentation (in class)
7. Final Project Paper (submitted to Bb)

Assessment of mastery: Each evaluated item will be evaluated at one of three levels:

Master[1], Apprentice[0.5], or Initiate[0].

Each type of item will have an associated specification of mastery.

Attempts at Mastery and Tokens:
Except for the Final Paper, you will have two attempts to master each item. After two, you will need to "buy" an additional attempt with a token. You will start the course with two tokens in your account. You may earn additional tokens by mastering additional GRE Problems or additional GRE Problem Presentations. You will only get **one** attempt to demonstrate mastery to earn an additional token.

Course Grade:
Your course grade will be earned according to your overall mastery levels of the seven types above. A separate Grade Specifications Table will be provided detailing how each course grade is earned. As an example, to earn a course grade of "A" you must achieve **all** of the following numbers of mastered characteristics:

1. Nine out of ten GRE Problem solutions.
2. Two GRE Problem Presentations.
3. Nine out of ten characteristics of an excellent Project Proposal.
4. Nine out of ten characteristics of an excellent Paper Draft.
5. Nine out of ten characteristics of an excellent Poster, with A&S Showcase Presentation.
6. Nine out of ten characteristics of an excellent Presentation of your Project
7. Nine out of ten characteristics of an excellent Final Project Paper.

All documents (GRE Problem Solutions, GRE Problem Presentations, Project Proposal, Paper Draft, Project Poster Project Slideshow, and Final Project Paper), must be submitted as a pdf document typeset using LaTeX. That is, you will typeset your homework assignments using LaTeX. We will discuss using the on-line ***Overleaf*** Latex web engine during the first two weeks of class.

Remember, all documents are required to be electronically submitted to Bb as PDF files that have been typeset using LaTeX.

Additional Information

Attendance:

Regular attendance is expected and is vital to success in this course. This means you must be alert and paying attentions to what is being said during class. Whenever you have a question, you should ask it.

Class Etiquette:

Students are expected to treat each other with respect. Students are also expected to promote a healthy learning environment, as well as minimize distracting behaviors. In particular, you should be supportive of other students while they are making presentations. Moreover, every attempt should be made to arrive to class on time. If you must arrive late or leave early, please do not disrupt class.

Please turn off the ringer on your cell phone. I do not have a strict policy on the use of laptops, tablets, and cell phones. You are expected to be paying attention and engaging in class discussions. If your cell phone, etc. is interfering with your ability (or that of another student) to do this, then put it away, or I will ask you to put it away.

Getting Help:

There are many resources available to get help. First, I recommend that you work on homework in groups as much as possible, and to come see me whenever necessary. Also, you are strongly encouraged to ask questions of your class mates. I am always happy to help you, although I may just ask you questions rather than directly answer you, similar to how Socrates taught. If my office hours don't work for you, then we can probably find another time to meet. It is your responsibility to be aware of how well you understand the material. Don't wait until it is too late if you need help. *Ask questions*! Lastly, you can always email me.

Notes:

The UND Policy on Final Examinations is strictly enforced. The final exam schedule cannot be altered. For example, **no rescheduling of the final exam will be permitted to accommodate travel arrangements, job schedules, or social gatherings.** Your final paper is due at the scheduled time for the Final Exam day and time as listed for our course.

Instructor Concerns:
If your are dissatisfied or have a concern with my teaching or with the behavior of other students, please come come to my office, or make an appointment, to discuss your concerns with me.

Accommodations: (See Disability Support Services: http://www.und.edu/dept/dss/)
If you have emergency medical information to share with me, if you need special arrangements in case the building must be evacuated, or if you need accommodations in this course because of a disability, please make an appointment with me. My office is Witmer 332, and my office hours are listed above. If you plan to request disability accommodations, you are expected to register with the Disability Support Services (DSS) office (190 McCannel Hall, 777-3425 v/tty). If you have a letter from DSS stating specific testing accommodations to which your are entitled, please submit a copy of your letter to me at least one week before a test, quiz, or exam. Even if you do not anticipate using any accommodations, it is a good idea to submit the letter as soon as possible.

Academic Honesty: (See Code of Student Life: http://sos.und.edu/csl/3-3.php)
Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, and collusion. I will handle any instance of scholastic dishonesty as an academic matter **and** report it to the Dean of Students.
