21-127 - Concepts of Mathematics, Spring 2013

Lecture 1 : MWF 1:30-2:20, GHC 4401.
Lecture 2 : MWF 3:30-4:20, PH 100.

Instructor: Mike Picollelli
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Email: mpicolle@andrew.cmu.edu
Office Hours: M 4:45-6:00, W 6:00-7:00, and by appointment.

TAs: See **Recitations** below.

Course text: *Mathematical Thinking: Problem-Solving and Proofs, Second Edition*, by D'Angelo and West.

Course Website: http://www.math.cmu.edu/∼mpicolle/concepts/

Course Overview: From the course catalog description of 21-127: *"This course introduces the basic concepts, ideas and tools involved in doing mathematics. As such, its main focus is on presenting informal logic, and the methods of mathematical proof. These subjects are closely related to the application of mathematics in many areas, particularly computer science. Topics discussed include a basic introduction to elementary number theory, induction, the algebra of sets, relations, equivalence relations, congruences, partitions, and functions, including injections, surjections, and bijections."*

This is a mathematics course about mathematics itself, and at the heart of mathematics is a notion of truth unencumbered by the physical world. When a result in mathematics is said to be true, it means something very precise: that a logical argument has been found that shows the result is an inescapable consequence of a handful of common assumptions. These arguments, these *proofs*, are the main subject of this course, and a central goal will be to develop your ability to appreciate, understand, verify and, most importantly, *write* proofs, as well as to identify and show when results are false. Simply put, we are no longer just interested what the answer is to a question, but in why it is the answer. (The "why" is almost always the more interesting part.)

We will develop your comfort and skills with proofs by focusing attention on a variety of results and proof methods, many of which are ubiquitous in modern mathematics. Specific topics will include elementary set theory and logic, mathematical induction, functions and cardinality, elementary number theory, probability theory, combinatorics and graph theory. Sections of the textbook covering this material (in loose order) can be found in Chapters 1-7 and 9-11. Doing so will also serve a secondary aim of this course: to lay a solid foundation for future studies in mathematics.

Prerequisites: There are no listed prerequisites, but you should prepare yourself for a semester of remembering properties of numbers and algebra. Both will show up frequently.

Recitations: Recitations meet twice weekly, on Tuesdays and Thursdays, and will be led by the TAs. Your recitation is determined by the section you registered for, and you will be responsible for knowing *both* which section you are in, and who your TA is:

Lecture Time	Section	TA (andrew id)	Recitation Time and Location
MWF 1:30	A	Thomas Prag (tprag)	TR 12:30-1:30, Porter A18A
MWF 1:30	B	Emily Allen (eaallen)	TR 1:30-2:20, Doherty 2105
MWF 1:30	C	Zilin Jiang (zilinj)	TR 2:30-3:20 Doherty 2302
MWF 1:30	D	Zilin Jiang (zilinj)	TR 3:30-4:20, Porter 126A
MWF 1:30	E	Travis Nell (tnell)	TR 4:30-5:20, Porter A18C
MWF 3:30	F	Sebastien Vasey (svasey)	TR 10:30-11:20, Scaife 222
MWF 3:30	G	Emily Allen (eaallen)	TR 12:30-1:20, Doherty 1211
MWF 3:30	I	Shiladitya Sinha (shiladit)	TR 3:30-4:20, Porter A18C
MWF 3:30	J	Dylan Quintana (dquintan)	TR 4:30-5:20, Gates-Hillman 4211

Recitations will both supplement and complement the lectures, and you are *strongly* encouraged to attend these. This is partly because homework assignments (discussed below) will be collected at the beginning of recitation, but it is mostly because

your TA is the *best* resource you have available for learning this material.

Your TA will also hold weekly office hours, which will be posted to the course website.

Assessment: Your grade in this course will be determined by scores on three mid-term tests, homework assignments, and a cumulative final exam as follows.

- **Mid-Term Tests:** (50% Total) There will be three 60-minute mid-term tests, given *outside* of class in the McConomy Auditorium in the University Center. The tentative schedule is:

  Test 1 - Wednesday, February 13th, at **7:20 AM** (in the morning)
  Test 2 - Monday, March 25th, at **8:00 PM** (in the evening)
  Test 3 - Wednesday, April 24th, at **8:00 PM** (in the evening)

  Your highest two test scores will contribute 20% each to your grade, and your lowest will contribute 10%. Make-up exams will be given in accordance with University policy, details given below. There will be no lectures scheduled for the dates of the exams.

- **Homework:** (20%) There will tentatively be 11 homework assignments, with your lowest homework score dropped. These assignments will be announced in class and

posted on the course website, and will be collected at the start of recitation. Solutions to assignments will typically be posted to the course website the day after they are due. Assignments which are turned in *after* the start of recitation on the due date, but *before* solutions are posted will receive half credit. No assignments will be accepted after solutions are posted. If you cannot attend recitation, you may submit assignments (late or early) to your TA's mailbox in Wean 6113, *provided you contact your TA beforehand to inform them.*

On the first page of each submitted assignment you must include **your name, section letter, andrew id, and a list of other students with whom you collaborated, if any.** Failure to include these may result in points deducted from your score. A focus of this course is on your ability to express your thoughts clearly, which should be reflected not only in the solutions you find but the presentation of those solutions. This means that handwritten assignments should be clearly legible, and the physical sheets of paper you turn in should contain little to no extraneous material (like half a page scribbled over), nor should it look as though you just ripped them out of a notebook. Points will be deducted on assignments that seriously fail this criteria.

Collaborating with other students on homework assignments is both allowed and encouraged. That is, you are allowed to discuss specific problems with other students, including strategies and even determine a solution, *provided that you maintain no record, written or photographic, of this work and that you list the students with whom you collaborated on your assignment.* You are required to write up solutions entirely on your own, and you are **not** allowed to see the assignment another student is submitting, nor are you allowed to show another student the assignment you are submitting.

- **Final Exam:** (30%) There will be a cumulative final exam, scheduled by the University, sometime between May 6th and 14th. Please wait to plan your end-of-semester travel until after this date is announced.

The *highest* grade cutoffs will be as follows: 90% for an A, 80% for a B, 70% for a C, 60% for a D. These cutoffs *might* be lowered but will not be raised.

Other Policies

Contacting Me: The single best way to get in touch with me to discuss anything at all is to email me, because doing so provides me a clear record of our communication. You are welcome, of course, to speak with me before or after class, or even to flag me down if you see me walking around campus. But if our discussion requires action on my part (like scheduling a meeting), I will ask you to send a follow-up email reminding me of what we spoke about. This will ensure that anything we discuss is, in fact, dealt with, and done so in a timely manner.

Class Attendance: My policy regarding attendance and absenteeism is rather simple: you are (likely) adults, and can decide for yourselves whether or not to attend lectures or recitations. However, if you miss a class or recitation, it is your responsibility to obtain

relevant notes on any material you miss from your classmates; neither the TAs nor myself will be giving "repeat" lectures.

Furthermore, I expect your attention when you do attend, which means cell phones should be set to silent, or a very quiet vibrate, and if you do need to answer the phone I ask that you step outside before doing so. Laptops are permitted for taking notes, provided doing so does not distract or bother the students around you.

Makeup Tests: Makeup tests will be administered for full credit for absences covered by University policy, which includes documented illness, religious observation, family emergency, and participation in a University event. As our tests lie outside the normal class time, "University event" includes class meetings for another course you may be taking. If you will require a makeup test for non-emergent reasons (i.e., if you know ahead of time), you must contact me *as soon as possible.*

Grading Issues: All graded assignments and exams will be returned to you via the TAs. In the event the recorded scores are summed improperly, and this is the *only* problem with your score, let myself or your TA know and this will be adjusted promptly. But if you take issue with how an assignment or exam problem was graded, I will be happy to look it over and, if warranted, adjust your score. Your TA may be willing to do so as well, but they reserve the right to tell you to speak with me. And if you do wish to discuss such an issue, you must first look over the solutions to the assignment/exam problem and be able to explain to me both the correct answer and why you feel your score should be adjusted.

Furthermore, the deadline for raising such issues is one week (7 days) from the first recitation in which your TA has your graded assignment available for return. After this week passes, no adjustments to your score will be made. (Exceptions to this deadline may be granted in extraordinary and documented cases, such as an illness.)

Academic Honesty: Academic honesty is of the highest importance, and any acts of academic dishonesty, such as cheating, will be dealt with according to University policy: see `http://www.cmu.edu/policies/documents/Cheating.html`. Examples of violations in this course include copying portions of another student's assignment, showing another student the assignment you are turning in, and searching the internet for solutions to homework problems. Please speak with me if you have any questions about this.

Special Accommodations: Some students qualify for special accommodations such as extra time on tests. Any student with documentation supporting such a request must contact me within the first two weeks of class so that appropriate arrangements can be made.