MATH-2660 Principles of Mathematics
Spring 2016

Course Information.

Course name: Principles of mathematics
Course Number: MATH-2660
Course section: MO-1
Meeting times: To be agreed between the student and the instructor. 75 minute-long weekly meetings.
Semester: Spring 2016
Credit hours: 3
Prerequisite(s):   A grade of C- or better in MATH-142

Instructor Information

Name: Alba Segurado
Office hours: MW 11:00-12:15.
               Also by appointment.
               Math Office: Padre Arrupe Hall, 1st fl.
Contact: seguradoa@slu.edu
Biography: Terminal Degree: Ph.D. Mathematics (Universidad Complutense de Madrid)

Course Objectives

(1) Develop proficiency at writing mathematical proofs.
(2) Learn some important parts of theoretical math at a deep level.

Course overview

This course is about the logic of mathematics as a whole, rather than the content of some particular mathematical theory. It is also about the process of problem solving. Instead of calculating complicated integrals, we will consider problems where logic plays a more central role.

Learning outcomes

On successful completion of the course the student will have the following abilities:

- Translate a mathematical statement into logical form and discuss its negation and its implications.
- Translate a simple argument into logical form and detect logical validity and flaws.
- Read, write, listen and speak using standard mathematical terminology and reasoning.
- Use the basic language of mathematics (logic, sets, relations, functions).
- Outline, write and criticize mathematical proofs about numbers, sets, and functions.

Textbook:

Required reading: *Mathematical Proofs: A transition to Advanced Mathematics* (3rd. Edition) by Chartrand, Polimeni and Zhang.

Required work

Class work, two in-class exams and one comprehensive final exam will be given. They will emphasize the material presented in class but will also cover the reading assignments. Homework will be assigned for every topic covered.

Late work

Make up exams are not given. If an exam is missed due to an excused absence (see paragraph below), a make up exam will be given *the same day of the final exam*. Exams that are missed illegitimately result in a score of 0 in the final grade. Missing more than one exam results in an F grade for the entire course.

Excused Absences:

Legitimate conflicts and excuses require written documentation and are limited to death or near death instances in the immediate family, a student's illness that requires immediate doctor's care (with the corresponding doctor's note), a University sponsored event (not club sports) and regularly scheduled religious obligations. The documentation must be presented on the day the student returns to the university. Excuses that will NOT be considered include personal travel arrangements, non-University sponsored events, a conflicting appointment, or an illness that does not prevent you from coming to the exam.

Attendance and punctuality

Although not mandatory, I strongly urge you to attend all classes. On the other hand, you will be responsible for any announcements, information, problems or course changes that are made in all lectures. Students are expected to arrive on time to the lectures. Repeated lateness will not be tolerated. So, please come to class on time and do not leave early. **Anything else is rude and disruptive.**

Grading system

The final grade will be obtained as follows:
- o 40% class work.
- o 30% in-class exams.
- o 30% final exam

Evaluation:

- Class work consists of homework exercises and the oral presentation of some of them.
- In-class exams: 60-75 minutes exams consisting of some problems related to the material covered in class.
- Final exam: The final exam is cumulative. It will cover the **entire semester's material**, will be a two or three hour exam, and will be similar in form to the in-class exams.

Participation:

Active participation during the lectures by asking interesting questions will have a positive impact on the final grade, bringing up borderline grades.

Course calendar: http://www.slu.edu/madrid/academics/registrar/academic-calendar/spring-2016

- **January**:
  - o 13 Wed: First day of classes.
  - o 26 Tue: Last day to DROP a class without a grade of "W" and/or add a class. Last day to choose audit (AU), or Pass/No Pass (P/NP) Options.
  - o 29 Fri: No classes.
- **February:**
  - o 17 Wed: First in-class exam.
  - o 17 Wed: Registration for Summer 2016 sessions begins.
  - o 25-26 Th-Fri: Winter break (no classes).
- **March:**
  - o 11 Fri: Last day to drop a class a receive a grade of "W".
  - o 15 Tue: Last day to Submit Transfer application for Fall semester.
  - o 21-25 Mon-Fri: *Semana Santa* (University closed).

- **April:**
  - 6 Wed: Second in-class exam.
  - 6 Wed: Registration for Fall semester begins.
- **May:**
  - 2 Mon: Holiday (University closed).
  - 3 Tue: Final day of classes.
  - 4 Wed: Final Exam (12:00-15:00)

Academic Honesty Policy Statement:

The University is a community of learning, whose effectiveness requires an environment of mutual trust and integrity, such as would be expected at a Jesuit, Catholic institution. As members of this community, students, faculty, and staff members share the responsibility to maintain this environment. Academic dishonesty violates it. Although not all forms of academic dishonesty can be listed here, it can be said in general that soliciting, receiving, or providing any unauthorized assistance in the completion of any work submitted toward academic credit is dishonest. It not only violates the mutual trust necessary between faculty and students but also undermines the validity of the University's evaluation of students and takes unfair advantage of fellow students. Further, it is the responsibility of any student who observes such dishonest conduct to call it to the attention of a faculty member or administrator.

Examples of academic dishonesty would be copying from another student, copying from a book or class notes during a closed-book exam, submitting materials authored by or editorially revised by another person but presented as the student's own work, copying a passage or text directly from a published source without appropriately citing or recognizing that source, taking a test or doing an assignment or other academic work for another student, tampering with another student's work, securing or supplying in advance a copy of an examination without the knowledge or consent of the instructor, and colluding with another student or students to engage in an act of academic dishonesty.

Where there is clear indication of such dishonesty, a faculty member or administrator has the responsibility to apply appropriate sanctions. Investigations of violations will be conducted in accord with standards and procedures of the school or college through which the course or research is offered. Recommendations of sanctions to be imposed will be made to the dean of the school or college in which the student is enrolled. Possible sanctions for a violation of academic integrity include, but are not limited to, disciplinary probation, suspension, and dismissal from the University. The complete SLU Academic Honesty Policy can be found at the following link:
http://spain.slu.edu/academics/academic_advising/docs/Academic_integrity.pdf

Only **non-graphic** scientific calculators may be used in tests or in the final examination. Other calculators and devices will be taken from students during the exam and students may have to start the exam again. Not following this regulation constitutes cheating.

Accommodation statement

In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. Students who think they might benefit from these resources can find out more about:
- Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
- University-level support (e.g., tutoring/writing services, Disability Services) by visiting the Academic Dean's Office (San Ignacio Hall) or by going to
http://www.slu.edu/Documents/Madrid/academics/InformationStudents.pdf

Students who believe that, due to a disability, they could benefit from academic accommodations are encouraged to contact Disability Services at +34 915 54 58 58, ext. 204, send an e-mail to counselingcenter-madrid@slu.edu, or to visit the Counseling Office. Confidentiality will be observed in all inquiries. Course instructors support student accommodation requests when an approved letter from Disability Services has been received and when students discuss these accommodations with the instructor after receipt of the approved letter.

Collection of student work for assessment

Saint Louis University - Madrid Campus is committed to excellent and innovative educational practices. In order to maintain quality academic offerings and to conform to relevant accreditation requirements, we regularly assess our teaching, services, and programs for evidence of student learning outcomes achievement. For this purpose we keep on file "anonymized" representative examples of student work from all courses and programs such as: assignments, papers, exams, portfolios, and results from student surveys, focus groups, and reflective exercises. Thus, copies of your work for this course, including any exams, oral presentations, assignments, submitted papers and/or portfolios may be kept on file for institutional research, assessment and accreditation purposes. If you prefer that Saint Louis University-Madrid Campus does not keep your work on file, you will need to communicate your decision in writing to your professor.

Title IX

Saint Louis University and its faculty are committed to supporting our students and seeking an environment that is free of bias, discrimination, and harassment. If you have encountered any form of sexual misconduct (e.g. sexual assault, sexual harassment, stalking, domestic or dating violence), we encourage you to report this to the University. If you speak with a faculty member about an incident of misconduct, that faculty member must notify SLU's Title IX deputy coordinator, Marta Maruri, whose office is located on the ground floor of Padre Rubio Hall, Avenida del Valle, 28 (mmaruri@slu.edu; 915-54-5858 ext. 213) and share the basic fact of your experience with her. The Title IX deputy coordinator will then be available to assist you in understanding all of your options and in connecting you with all possible resources on and off campus.

If you wish to speak with a confidential source, you may contact the counselors at the SLU-Madrid's Counseling Services on the third floor of San Ignacio Hall (counselingcenter-madrid@slu.edu; 915-54-5858 ext. 230) or Sinews Multipletherapy Institute, the off-campus provider of counseling services for SLU-Madrid (www.sinews.es; 91-700-1979) To view SLU-Madrid's sexual misconduct policy and for resources, please visit the following web address:
http://www.slu.edu/Documents/Madrid/campus-life/SLUMadridSexualMisconductPolicy.pdf

Course outline (subject to truncation)

Communicating Mathematics
Mathematical writing; using symbols; writing mathematical expressions; common words and phrases in mathematics.

Sets
Describing a set; special sets; subsets; set operations; indexed collection of sets; partitions of sets; Cartesian products of sets.

Logic
Mathematical statements; the negation of a statement; the disjunction and conjunction of a statement; the implication; the biconditional; tautologies and contradictions; logical equivalence and its fundamental properties; characterizations of statements; quantified statements and their negations.

Direct Proof and Proof by Contrapositive
Trivial and vacuous proofs; direct proofs; proof by contrapositive; proof by cases; proof evaluations; proofs involving divisibility of integers; proofs involving congruence of integers; proofs involving real numbers; proofs involving sets; fundamental properties of set
Operations; proofs involving Cartesian products of sets.

Proof by Contradiction
Conjecture in mathematics; existence proofs; counterexamples; disproving statements; testing statements.

Equivalence Relations

Reflexive, symmetric, and transitive relations; equivalence relations; properties of equivalence classes; congruence modulo n; integers modulo n.

Functions
The definition of a function; the set of all functions from A to B; one-to-one and onto functions; bijective functions; inverse functions; permutations.

Mathematical Induction
The well-ordering principle; the principle of mathematical induction; mathematical induction and sums of numbers; mathematical induction and inequalities; mathematical induction and
Divisibility; other examples of induction proofs; proof by minimum counterexample; the strong form of induction.

Cardinalities of Sets
Numerically Equivalent Sets; denumerable Sets; uncountable Sets; comparing Cardinalities of Sets.

Proofs in Number Theory
Divisibility properties of integers; the division algorithm; greatest common divisors; the Euclidean algorithm; relatively prime integers; the fundamental theorem of arithmetic; concepts involving sums of divisors.

Proofs in Calculus
Limits of sequences; infinite series; limits of functions; fundamental properties of limits of functions; continuity; differentiability.