Special Topics: Mathematical Writing through Theory of Relations
MATH 3500

INSTRUCTOR: ANDRZEJ ROSLANOWSKI

Office: DSC 235
Phone: 554-3105 (office)
Email: roslanow@member.ams.org
URL: http://www.unomaha.edu/logic

Schedule:

	MON	TUE	WED	THU	FRI
10:00–11:15		MATH3500 (DSC 109)		MATH3500 (DSC 109)	
11:15–12:00		OFFICE (DSC 235)		OFFICE (DSC 235)	
3:00–4:00	OFFICE (DSC 235)		OFFICE (DSC 235)		
4:00–5:15	MATH4240 (DSC 256)		MATH4240 (DSC 256)		
5:30–6:45	MATH4760 (DSC 109)		MATH4760 (DSC 109)		

Office hours by appointment also possible.

COURSE OBJECTIVE:
The primary objective of this course is to develop the student's ability to communicate mathematics: to write proofs, articles, theses. The student should obtain critical thinking and writing skills which will prepare her/him for future employment and/or graduate study.
The students will acquire an appreciation for how important it is to communicate mathematics well. They will learn *how* any mathematical (short or long) text should be written and presented, they will learn *the art of mathematical writing*.
After completing the course students shall be able to do the following:

- demonstrate further development of the writing skills learned in foundational composition courses;
- engage in the mathematics' research practices, using the databases, bibliographies, and documentation conventions;
- use the writing strategies and genres expected in the mathematical community;
- demonstrate command of the mathematics' discourse practices, vocabulary, and style.

TEXTBOOK:
The course is based solely on the materials available on internet (links provided on Instructor's Web Page) and lecture notes developed during 2010-2011 academic year (pdf file available on Instructor's Web Page).

ATTENDANCE:
Attendance is mandatory, and you are responsible for all assignments, activities and material covered every day.

CHEATING:
Any student caught cheating will receive an F for the course, and referral to the Dean of the College and/or Vice-Chancellor of Student Services for inclusion of the incident in your permanent records. This is regarded as a **very** serious matter.

PAPERS AND GRADING:
To successfully complete the course students will have to

- demonstrate the ability to express mathematical ideas in the English language,
- demonstrate basic knowledge of LaTeX,
- write 4 intermediate papers on topics/problems discussed in class,
- write an expanded paper on a topic selected individually. (A project presented to KMGP may be substituted for the final paper.)

The first two papers/assignments will be worth 50 points each and they will actually constitute two steps of one bigger assignment. The next two papers will be worth 100 points each, and the final paper will be woth 200 points. Thus there are 500 points available to you during the semester.
Letter grades will be assigned on the following basis:

A: $> 95\%$	A-: 90–95%	B+: 85–90%
B: 80–85%	B-: 75–80%	C+: 70–75%
C: 63–70%	C-: 55–63%	D+: 50–55%
D: 45–50%	D-: 40–45%	F: below 40%

Accommodations are provided for students with verified disabilities. For more information contact Services for Students with disAbilities in `EAB 117` *or* `554-2872`*,* `TTY 554-3799`*.*

Content of the course

Mathematical writing starts with your homework problems (2 weeks)

1. Basic structure of any solution.
2. How to mix symbols and words.
3. Logic of mathematics and logic of your sentences.
4. Examples of solutions to problems from MATH1950 and MATH1960.

Mathematical articles - types, forms and structures (1 week)
Thesis: reading mathematical papers should be pleasurable, so mathematical articles should be written with humans in mind. However, at the same time they should convince the reader that they could have been written so that a machine could follow them.

1. Types of mathematical articles/papers
2. Basic structure of any mathematical article:
   front matter: title, author information, abstract, keywords, MSC,
   the body of the paper: sections, introduction(s), definitions, theorems, lemmas etc,
   references,
   impact of search engines.

LaTeX Document Preparation System (1 week)
Thesis: The right tools help us to achieve the desired structure of our article.

Language and logic (3 weeks)
Thesis: The common logic and mathematical logic are not that different.

1. Formulas, quantifiers and elements of the first order logic.
2. Typically, a mathematical proof is a first order logic proof written in common language.
3. Writing arguments (proofs) with alternating quatifiers in common language
4. Sets, ordered pairs, Cartesian products.

Binary relations (3 weeks)
Thesis: Relations are more common than you think. As a matter of fact, a large portion of mathematics can be formalized as relational systems.

1. Binary relations, examples, basic properties.
2. Composition, inverse relations, images/preimages of sets by relations.
3. Functions as relations.

Equivalence relations (3 weeks)
Thesis: Every generalization involves creating equivalence relation and considering its equivalence classes as objects of interest.

1. Equivalence relation and corresponding equivalence classes. Partitions and equivalence relations
2. The use of representatives to define functions on equivalence classes.
3. Quotients in mathematics: definitions of rationals, reals (through classes of Cauchy sequences).

Partial orders (1 week)
Thesis: Even when all objects are equal, they are (partially) ordered.

1. Partial orders, the largest/smallest elements, successors/predecessors, intervals, examples.
2. Linear (total) orders, dense orders.
3. Supremum and infimum, completeness.

Induction (1 week)

1. Inductive definitions and proofs. Characterization of the rationals as the only linear countable dense order.
2. Well ordered sets and transfinite-induction.