Math 1272 Course Outline

Winter 2023

Instructor: A. J. Dean email: andrew.j.dean@lakeheadu.ca

Office Hours: By zoom appointment. Special office hours will be scheduled for the return of tests.

References:

Bloch, Ethan D. *Proofs and fundamentals. A first course in abstract mathematics.* Second edition. Undergraduate Texts in Mathematics. Springer, New York, 2011. xxiv+360 pp. ISBN: 978-1-4419-7126-5

Chartrand, Polimeni, and Zhang. *Mathematical proofs: A transition to advanced mathematics.* Fourth edition. Pearson Education, Boston, 2017. xv+512 pp. ISBN: 978-0134746753

Gerstein, Larry J. *Introduction to mathematical structures and proofs.* Second edition. Undergraduate Texts in Mathematics. Springer, New York, 2012. xiv+401 pp. ISBN: 978-1-4614-4264-6

Learner Outcomes:
Successful students of this course will be able to: Use the propositional calculus to construct and determine the truth values of compound propositions; understand how logical equivalences from the propositional calculus lead to the techniques of direct proof, proof by contrapositive, and proof by contradiction of implications, and construct such proofs; understand and construct arguments involving universal and existential quantifiers; understand terminology of set theory and perform basic operations with sets including taking unions, intersections, and relative compliments, and construct double inclusion arguments; construct inductive arguments using the principles of simple and strong induction, and the well ordering property of the natural numbers; understand the properties of reflexivity, symmetry, anti-symmetry, and transitivity of relations, and determine when a relation has these properties; recognize and construct partial orders and equivalence relations on sets and identify equivalence classes; appreciate the shortcomings of naive set theory, and understand why the axiomatic approach to mathematics is used; understand the distinction between constructive and non-constructive proofs, and the preferability of the former; understand the distinction between finite, countably infinite, and uncountable sets, and use cardinality arguments for existence proofs.

Schedule

Week 1. (January 9) Introduction and basic set theory.

Week 2. (January 16) Logical connectives, truth tables, and quantifiers.

Week 3. (January 23) Direct proofs and proofs by contrapositive.

Week 4. (January 30) Further examples of direct proofs and proofs by contrapositive.

Test # 1 on Thursday February 2

Week 5. (February 6) Existence proofs and proofs by contradiction.

Week 6. (February 13) Mathematical induction.

Study Week February 18-26

Week 7. (February 27) More on induction.

Test # 2 on Thursday March 2

Week 8. (March 6) Relations.

Week 9. (March 13) Functions.

Week 10. (March 20) Cardinality.

Test # 3 on Thursday March 23

Week 11. (March 27) More on set theory.

Week 12. (April 3) More on set theory and examples.

Grading Scheme: There will be three term tests worth 15% each. The homework will count for 15%, and the final exam will be worth 40%.

Homework: Each week, a homework assignment will be circulated by email and posted on the D2L site. They will be due at 10pm Thunder Bay time on Friday evenings, unless otherwise announced. Solutions to the homework assignments are to be submitted via D2L. Late assignments will not be accepted. Solutions to the problems will be distributed by email and posted on the D2L site.

Term Tests and Final Exam: The three term tests will be written during the lab hour in the lab room. The dates are on the schedule. The material the tests will cover will be announced in class and by email as the dates draw near. The final exam will cover the whole course, and is scheduled by the registrar's office. All tests and the exam will be **closed book, with no books, notes, calculators, cell phones, or other aids allowed.**

Marking Disputes: If you feel you have been treated unfairly in the marking of a test **put your complaint in writing on the paper and return it to the instructor**. In the case of an assignment, **put your complaint in writing in an email to the instructor**. Do not resubmit it to the D2L site.

Drop Date: The final date to withdraw from this course without academic penalty is Friday March 10.

Special Exams: Students who fail this course but attain a mark of 40% may be entitled to write a special exam. See the calendar for details.

Academic Dishonesty: All cases of academic dishonesty will be dealt with according to the university's Academic Integrity Code.

Accommodations: Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please visit: http://studentaccessibility.lakeheadu.ca