Southern New Hampshire University

Undergraduate Course Syllabus

MAT 299: Mathematical Proof and Problem Solving

Center: Online

Course Prerequisites

MAT 225, MAT 230, or MAT 239

Course Description

This course introduces students to the language and methods used to create and write mathematical proofs and solve problems. Methods of proof will include: direct, contrapositive, contradiction, and induction. Methods of problem solving will be based on Polya's four steps for problem solving. Students will learn about and utilize the many functions of proof including: verification, explanation, communication, discovery, justification, and inquiry. The course will also explore the relationship between problem solving and the process of proving. Students will explore fundamental abstract concepts in mathematics including: functions and relations, set theory, number theory, and logic.

Minimum Grade Requirements

Students who plan to take MAT 415 Abstract Algebra and/or MAT 470 Real Analysis must earn a C or higher in this course. If you are unsure if MAT 415 or MAT 470 is required in your program of study, please consult your academic advisor.

Course Outcomes

- Develop and evaluate conjectures
- Analyze abstract definitions and construct examples
- Apply a variety of strategies for constructing a proof (*Integration, Application, and Reflection*)
- Recognize a rigorous proof, identify weak spot(s) in a less rigorous argument (their own or someone else's), and supply missing details in a sketchy proof
- Write mathematical proofs in a clear, concise manner using correct English and mathematical grammar (*Knowledge of Human Cultures and the Physical and Natural World*)
- Present and defend a proof or problem solution to a group of their peers, both orally and in writing (*Communication*)
- Demonstrate the capacity to articulate an understanding of how reasoning and proof are integral to the field of mathematics (and mathematics education)
- Demonstrate the capacity to articulate an understanding of fundamental abstract concepts including functions and relations, set theory, number theory, and logic

Required Materials

Using your learning resources is critical to your success in this course. Please purchase directly through the SNHU Online Bookstore rather than any other vendor. Purchasing directly from the bookstore ensures that you will obtain the correct materials and that the IT Service Desk, your advisor, and the instructor can provide you with support if you have problems.

How to Prove It: A Structured Approach
Daniel J. Velleman
Cambridge University Press
3rd Edition
2019
ISBN: 978-1-108-43953-4

This course requires Adobe Connect (free) and a computer with an internal or external microphone for the final presentation/oral defense of proof.

Diversity, Equity, and Inclusion

As indicated in our core values, SNHU is committed to "embrace diversity where we encourage and respect diverse identities, ideas, and perspectives by honoring difference, amplifying belonging, engaging civilly, and breaking down barriers to bring our mission to life."

This may or will be reflected in SNHU's curriculum as we embrace and practice diversity, equity, and inclusion (DEI) to provide the most transformative experience for our students, faculty, and staff. Because topics pertaining to DEI can be sensitive, please remember that embodying and practicing diversity, equity, and inclusion is one of our core values that you will encounter throughout the academic experience. In higher education, we are expected to think and engage critically. Use a growth mindset to embrace the diverse readings, course assignments, and experiences of your peers and faculty.

For more information about DEI at SNHU, please visit our website at the Office of Diversity and Inclusion.

Instructor Availability and Response Time

Your class interaction with the instructor and your classmates will take place on a regular, ongoing basis. Your instructor will be actively engaged within the course throughout the week. You will normally communicate with your instructor in the weekly discussions or the General Questions discussion topic so that your questions and the instructor's answers benefit the entire class. You should feel free, however, to communicate with your instructor via SNHU email at any time, particularly when you want to discuss something of a personal or sensitive nature. Your instructor will generally provide a response within 24 hours. Instructors will post grades and feedback (as applicable) within seven days of an assignment's due date, or within seven days of a late submission.

Grade Distribution

Assignment Category	Number of Graded Items	Point Value per Item	Total Points
Discussions	4	25	100
Homework	6	45	270
Quizzes	2	100	200
Module Eight Quiz	1	45	45
Final Project			
Oral Defense of Proof	1	285	285
Reflection Journal	1	100	100
			Total Course Points: 1,000

This course may also contain practice activities. The purpose of these non-graded activities is to assist you in mastering the learning outcomes in the graded activity items listed above.

University Grading System: Undergraduate

Grade	Numerical Equivalent	Points
A	93–100	4
A-	90–92	3.67
B+	87–89	3.33
B	83–86	3
B-	80–82	2.67
C+	77–79	2.33
C	73–76	2
C-	70–72	1.67
D+	67–69	1.33
D	60–66	1
F	0–59	0
I	Incomplete	
IF	Incomplete/Failure *	
IP	In Progress (past end of term)	
W	Withdrawn	

* Please refer to the policy page for information on the incomplete grade process.

Grading Guides

Specific activity directions, grading guides, posting requirements, and additional deadlines can be found in the Assignment Guidelines and Rubrics section of the course.

Weekly Assignment Schedule

All reading and assignment information can be found within each module of the course. Assignments and discussion posts during the first week of each term are due by 11:59 p.m. Eastern Time. Assignments and discussion posts for the remainder of the term are due by 11:59 p.m. of the student's local time zone.

In addition to the textbook readings that are listed, there may be additional required resources within each module.

Module	Topics and Assignments
1	Deductive Reasoning and Truth Tables Topic I: Deductive Reasoning Topic II: Logical Connectives Topic III: Truth Tables *How to Prove It: A Structured Approach:* Introduction, Sections 1.1 and 1.2 1-1 Discussion: Getting Started 1-2 Homework 1-3 Final Project Introduction
2	Set Theory and Sequential Logic Topic I: Variables and Sets Topic II: Operations on Sets Topic III: The Conditional and Biconditional Connectives *How to Prove It: A Structured Approach:* Introduction, Sections 1.3–1.5 2-1 Homework 2-2 Final Project: Choose Presentation Time
3	Quantificational Logic Topic I: Quantifiers Topic II: Equivalences Involving Quantifiers Topic III: More Operations on Sets *How to Prove It: A Structured Approach:* Sections 2.1–2.3 3-1 Discussion: Mock Presentations 3-2 Homework 3-3 Quiz
4	Proofs: Part I Topic I: Proof Strategies Topic II: Proofs Involving Negations and Conditionals Topic III: Proofs Involving Quantifiers *How to Prove It: A Structured Approach:* Sections 3.1–3.3 and Summary of Proof Techniques (p. 453) 4-1 Discussion: Proofs and Problem Solving 4-2 Homework 4-3 Final Project: Problem Assigned

Module	Topics and Assignments
5	Proofs: Part II Topic I: Proof Involving Conjunctions and Biconditionals Topic II: Proofs Involving Disjunctions Topic III: Existence and Uniqueness Proofs Topic IV: More Examples of Proofs *How to Prove It: A Structured Approach:* Sections 3.4-3.7 5-1 Homework 5-2 Final Project: Practice Session 5-3 Final Project: Draft of Written Proof (Non-graded)
6	Relations Topic I: Ordered Pairs and Cartesian Productions Topic II: Relations Topic III: Ordering Relations Topic IV: Equivalence Relations *How to Prove It: A Structured Approach:* Sections Sections 4.1-4.5 6-1 Homework 6-2 Quiz 6-3 Final Project: Continue Work 6-4 Discussion: Course Wrap-Up
7	Functions Topic I: Functions Topic II: One-to-One and Onto Topic III: Inverses of Functions Topic IV: Images and Inverse Images *How to Prove It: A Structured Approach:* Sections 5.1–5.3, 5.5 7-1 Final Project: Written Proof and Oral Defense
8	Mathematical Induction Topic I: Proof by Mathematical Induction *How to Prove It: A Structured Approach:* Sections 6.1–6.2 8-1 Discussion: Questions About Proofs (Non-graded) 8-2 Module Eight Quiz 8-3 Final Project: Reflection

Course Participation

Course participation is required within the first week of the term for all online courses. *Participation* in this context is defined as completing one graded assignment during the first week of the course. Otherwise, students will be administratively removed for nonparticipation. Students who do not participate during the first week may forfeit their rights to be reinstated into the course. Students who stop attending a course after the first week and who do not officially withdraw will receive a grade calculated based on all submitted and missed graded assignments for the course. Missed assignments will earn a grade of zero. See the course withdrawal policy and the full attendance policy for further information.

Late Assignments

Students who need extra time may submit assignments (excluding discussion board postings) up to one week after the assignment due date. Discussion board submissions will not be accepted for credit after the deadline except in extenuating circumstances.

- A penalty of 10 percent of the total value of the assignment will be applied to the grade achieved on the late assignment regardless of the day of the week on which the work is submitted.
- Students who submit assignments more than one week late will receive a grade of zero on the assignment unless they have made prior arrangements with the instructor.

Students must submit all assignments no later than 11:59 p.m. (in their own time zone) on the last day of the term. No assignments are accepted after the last day of the term unless an incomplete has been submitted. See the incomplete grades policy.

There may be times an instructor makes an exception to the late assignment policy. Instructors may accept late work, including discussion board posts, with or without prior arrangement.

- Exceptions to the late policy on these grounds are left to the instructor's discretion, including whether the late penalty is applied or waived. Students should not assume that they will be allowed to submit assignments after the due dates.
- If an instructor finds that they are unable to determine whether an exception to the late policy would be appropriate without documentation, the collection and review of student documentation should be handled through the Dispute Resolution team in order to protect the student's privacy. In these cases, students should file a Student Concern Dispute form to have the circumstances reviewed.

If a student is experiencing (or knows they will experience) a circumstance, including pregnancy, that is protected under the Americans with Disabilities Act or Title IX, they are encouraged to contact the Online Accessibility Center (OAC) as soon as possible to explore what academic accommodations might be offered. Instructors must honor all deadlines established through the OAC.

Student Handbook

Review the student handbook.

ADA/504 Compliance Statement

Southern New Hampshire University (SNHU) is dedicated to providing equal access to individuals with disabilities in accordance with Section 504 of the Rehabilitation Act of 1973 and with Title III of the Americans with Disabilities Act (ADA) of 1990, as amended by the Americans with Disabilities Act Amendments Act (ADAAA) of 2008.

SNHU prohibits unlawful discrimination on the basis of disability and takes action to prevent such discrimination by providing reasonable accommodations to eligible individuals with disabilities. The university has adopted the ADA/504 Grievances Policy (version 1.2 effective October 16, 2017), providing for prompt and equitable resolution of complaints regarding any action prohibited by Section 504 or the ADA.

For further information on accessibility support and services, visit the Disability and Accessibility Services webpage.

Academic Integrity Policy

Southern New Hampshire University requires all students to adhere to high standards of integrity in their academic work. Activities such as plagiarism and cheating are not condoned by the university. Review the full academic integrity policy.

Copyright Policy

Southern New Hampshire University abides by the provisions of United States Copyright Act (Title 17 of the United States Code). Any person who infringes the copyright law is liable. Review the full copyright policy.

Withdrawal Policy

Review the full withdrawal policy.

Southern New Hampshire University Policies

More information about SNHU policies can be found on the policy page.