UCSCIMAT23 Analysis and Algebra

Course Information

Instructor and Course Meeting Information

Instructor: Dr. Lola Thompson
Pronouns: She/Her or They/Them
E-mail: l.thompson@uu.nl
Class Meetings: Newton B1.06 G
M 9:00 - 10:45
W 11:00 - 12:45
Office Hours: By appointment. Please e-mail me at least 24 hours in advance.
Teaching Assistant: Balazs Nagyvaradi (b.nagyvaradi@uu.nl)

Learning Objectives

By the end of this course, you will be able to:

- read and write formal proofs in group theory.
- recognise and work with group-theoretic structures and concepts, such as subgroups, order, permutations, isomorphisms, direct products, and Lagrange's Theorem, in a variety of different contexts.
- justify and apply key results about analytic functions, complex differentiation and integration.
- use complex methods, such as path integrals in the complex plane, to solve problems from other areas such as real-valued calculus, physics, and engineering.

Textbook

In lieu of a textbook, we will be using worksheets and lecture notes prepared by the instructor, which will be posted on our course Blackboard page.

Prerequisites

You must complete UCSCIMAT11: Calculus and Linear Algebra prior to starting this course.

Grades

The grades in this course will be calculated as follows:

	number	percentage each	total percentage
Class Participation	–	–	10%
Assignments	6*	5%	30%
Midterm Exam	1	30%	30%
Final Exam	1	30%	30%

*There will be a total of 7 Assignments, but your lowest score will be dropped.

Exams and homework assignments will be graded on a scale of 100 points and then converted to letter grades according to the following table.

A+	96–100	B+	77–81	C+	64–67	D+	51–54		
A	88–95	B	72–76	C	59–63	D	46–50	F	0–35
A–	82–87	B–	68–71	C–	55–58	D–	36–45		

Course Structure

The course will be divided into two halves: group theory (before the Spring Break) and complex analysis (after the Spring Break). A typical class period will consist of a mixture of short lectures and group problem solving.

Class Participation

Attendance: Each student is granted three "unexcused" absences. After that, each additional absence will result in a 1 point deduction from your Class Participation grade. There is no need to e-mail me to explain an unexcused absence. If you have a prolonged illness or another conflict that will cause you to miss more than three classes, please contact me so that we can discuss appropriate accommodations. This class is very "vertical" (i.e., the topics build on one another). As a result, if you miss a class, you are strongly encouraged to make up the work that you missed prior to the start of the next class period. Otherwise, you may find it difficult to catch up.

Group work: Working groups will be assigned. They will normally consist of 3-4 students. Groups will be shuffled (approximately) every two weeks. That way, you will have the opportunity to work with most of your classmates by the end of the semester. If you are having a serious problem with someone in your assigned group, please contact me ASAP.

Students who do not have excessive absences (as defined above) and who participate regularly in the discussions with their group members will receive full credit for the Class Participation grade.

Homework Assignments

There will be seven written assignments that will be graded by your TA. Homework will be due on Mondays at 23:39. Late assignments will not be accepted. That said, your lowest score will be dropped at the end of the semester. That way, if something comes up and you are unable to turn in your homework at some point during the semester, you will not be penalized.

Exams

There will be two in-class exams: a midterm exam before the spring break, and a final exam at the end of the semester. The midterm exam will cover all of the Group Theory content. The final exam will cover all of the Complex Analysis content. The final exam will NOT be cumulative (i.e., Group Theory will not be tested on the final exam).

Blackboard

Copies of all course materials will be posted on our course Blackboard site. Go to `http://uu.blackboard.com` to access these materials.

LaTeX

You are strongly encouraged to write up your hand-in exercises using LaTeX. To help everyone improve their LaTeX skills, I will post a number of LaTeX resources on our course Blackboard page. I will also post the .tex files associated with some of our problems sets so that you will be able to figure out how to create group theory-specific symbols. If you do not have LaTeX installed on your computer, you can find a free web-based version at Overleaf: `https://www.overleaf.com`

Course Policies

Academic Honesty

Assignments
You are welcome to consult the course text, your class notes, and the instructor. I also encourage you to form (virtual) study groups with other students, provided that you abide by the following guideline: the work you hand in must be written in your own words, and it must reflect your own understanding. In case of direct copying, both students' work will be downgraded. Repeat offenders will be reported for academic dishonesty.

Exams
You are not allowed to consult any source *other than the instructional staff* during the exams. In particular, this means that you may not use any of the following to assist you with solving the exam questions: *calculators, smartphones, laptops, notes, textbooks, Chegg.com, ChatGPT, classmates, etc.* You MAY consult the instructor or TA to ask clarifying questions (e.g, "Should we assume that G is a group?").

Note: Information about academic regulations can be found at the following website: `https://students.uu.nl/en/university-college-utrecht/practical-information/rules-and-procedures/academic-rules-and-regulations`. Please familiarize yourself with its content. All students are responsible for maintaining the highest standards of honesty and integrity in every phase of their academic careers. The penalties for academic dishonesty are severe and ignorance is not an acceptable defense.

Disabilities

Students in this course with disabilities, including "invisible" disabilities such as chronic diseases and learning disabilities, and who may need disability-related classroom accommodations, are encouraged to make an appointment to speak with me as soon as possible. *Please note that I cannot provide accommodations on exams until I receive documentation from the Disability Services Coordinator. You can find more information about Student Disability Services here:* `https://students.uu.nl/en/university-college-utrecht/student-life/special-support`

Make-up Policy

Typically, missed exams cannot be made up. That said, I understand that some situations are beyond your control. Please contact me immediately if you find yourself in a situation that will prevent you from taking an exam during the assigned slot.

Religious Observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please contact me before the end of the second week of the semester to discuss appropriate accommodations.

Withdrawing From The Course

Students who receive a failing grade on the midterm examination are encouraged to speak with me immediately in order to determine the best course of action. Please do not withdraw from the course without speaking to me first. You may still be able to pass the course with a proper plan in place.

Course Schedule

The following is a rough schedule for the course. Please note that it may be adapted as needed.

Date	Brief Description	Homework
27/1	Symmetry	
29/1	Introduction to Groups; Basic properties of groups	
3/2	Order of a group; Groups of units	
5/2	Subgroups; The center of a group;	
10/2	Cyclic groups; Subgroups of cyclic groups	HW1 due
12/2	Dihedral groups	
17/2	Symmetric groups; Transpositions; Even/Odd Permutations	
19/2	Cosets; Lagrange's Theorem	
24/2	Normal subgroups; Quotient groups; Cauchy's Theorem	HW2 due
26/2	Simple Groups	
3/3	External Direct Products of Groups; Internal Direct Products of Groups	
5/3	Isomorphisms of Groups; Invariants and Isomorphism Classes	
10/3	Cayley's Theorem; The three isomorphism theorems	HW3 due
12/3	Conjugacy and the class equation; p-groups	
17/3	The Fundamental Theorem for Finite Abelian Groups; Classifying groups of small order	
19/3	**Midterm Exam**	
24/3 - 28/3	**Spring Break!** (No Class)	
31/3	Complex numbers and their properties	
2/4	Complex functions and their geometry; Extending functions from calculus to the complex plane	HW 4 due
7/4	Topology and Limits	
9/4	Derivatives; Cauchy-Riemann Equations; Holomorphic Functions	
14/4	Series; Power Series; Analytic Functions	HW 5 due
16/4	Contours; Contour Integrals	
21/4	**Easter Monday** (No Class)	
23/4	Fundamental Theorem of Calculus; Cauchy-Goursat Theorem	
28/4	Integral Formulas and Their Applications	HW 6 due
30/4	Singularities; Residue Theorem	
5/5	**Liberation Day** (No Class)	
7/5	Final Exam Review	
12/5	No Class (Exam Week)	HW 7 due
14/5	**Final Exam**	