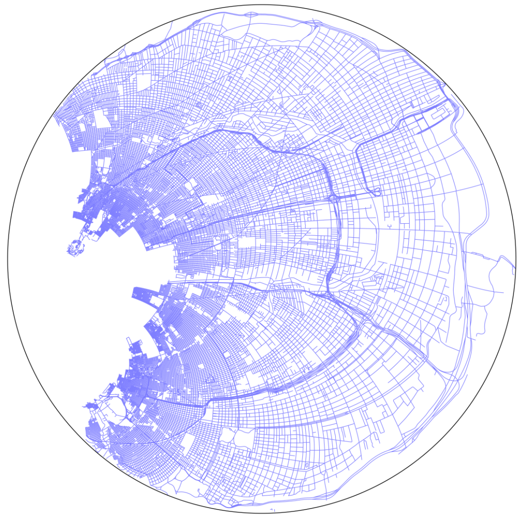
# Math 535 - Complex Analysis

Spring 2010



## 1. General Information

**Web Page** http://www.math.uic.edu/~ddumas/math535/

Textbook: Lars Ahlfors, *Complex Analysis*, 3ed.
ISBN-13: 978-0070006577

Meeting Time: MWF 12:00-12:50pm

Location: SEO 427

CRN: 19436

Instructor: David Dumas (ddumas@math.uic.edu)

Office: SEO 503

Office Hours: Mondays and Wednesdays 2-3pm
and by appointment

## 2. Course Overview

Math 535 is an introductory course in the theory of functions of a complex variable. This fundamentally important subject has applications in nearly every branch of mathematics (algebra, number theory, combinatorics, algebraic geometry, differential geometry, and numerical analysis, to name a few).

It will be assumed that students have worked with complex numbers before, though the first lecture will be devoted to a rapid presentation of the basic algebra and geometry of the complex numbers.

We will then move on to study the concept of differentiability for complex-valued functions of a complex variable (i.e. *complex functions*). Unlike the case of real-valued functions, it turns out that the existence of one derivative in the complex sense implies infinite differentiability and analyticity (representation by a convergent power series). This follows from the most important theorem in complex analysis—the *Cauchy integral formula*. Roughly speaking, this theorem implies that complex differentiation and complex integration are equivalent.

A substantial part of the course will be devoted to understanding the relationship between a complex function, its singularities, and its integrals along curves in the complex plane. This comprises the theory of complex integration and the *calculus of residues*. Remarkably, we will see that some integrals of real-valued functions are most easily evaluated using these complex-analytic considerations.

The set $\mathbb{C}$ of complex numbers can be identified with the Euclidean plane $\mathbb{R}^2$, and complex functions can be seen as geometric objects that transform this plane. Taking this point of view, we will study differentiable mappings between open sets in the complex plane (individually and in families). This discussion will culminate in the proof of the *Riemann mapping theorem*, which asserts that any proper open set in $\mathbb{C}$ that is topologically equivalent to the unit disk is actually complex-analytically equivalent to the disk. We will discuss applications of this theorem and work through some examples of such *conformal mappings*.

In our textbook, the main course material corresponds to chapters 1–4 and sections 5.1, 5.5, 6.1, 6.2. We will cover additional topics as time allows.

## 3. Grading

Your final grade for the course will be based on your homework assignments, an in-class midterm exam, and a cumulative final exam. These components will be weighted as follows:

| | | |
|---|---|---|
| Homework | | 30% |
| Midterm | Wed, Mar 3 | 30% |
| Final Exam | Tues, May 4 | 40% |

## 4. Homework Policies

There are two types of homework: Weekly problems and challenge problems.

Weekly homework will be assigned on the course web page, and will consist mostly of problems from the textbook. The weekly assignments are due by 4pm on the day of the first lecture of each week (usually a Monday), and can be turned in during lecture or directly to the grader's mailbox (Paul Reschke) on the third floor of SEO.

A list of challenge problems is posted on the course web page and updated regularly. During the semester, you are required to complete at least **four** of these problems and submit your written solutions. At least two solutions must be submitted before the midterm exam. Your solutions to these problems will be held to a high standard of completeness, clarity, and correctness; do not be alarmed if your solution is returned with comments and re-submission is requested.

You are allowed (and encouraged) to study the course material and work on the homework with other students. However, you must:

(1) Write and submit your own solutions
(2) Acknowledge your collaborators by name on your assignment
(e.g. write "in collaboration with Jane Doe" at the top of the page).

Your homework grade will be determined by dropping your lowest weekly assignment score and then averaging the remaining weekly scores and your four required challenge problems. In particular, *each challenge problem is worth as much as a weekly homework assignment.*

You are encouraged to complete and turn in more than the required number of challenge problems. Doing so will have a modest positive effect on your homework grade in a manner to be determined before the end of the semester.

## 5. Attendance

Attending the lectures is mandatory. If you must miss a lecture, you should make arrangements to get notes and any class materials from someone else in the class. You are responsible for the contents of all lectures, including any that you cannot attend.

## 6. Academic Honesty

All UIC students are expected to maintain the standards of academic honesty described in the *Guidelines for Academic Integrity* available from the Office of the Vice Chancellor for Student Affairs web page:

http://www.vcsa.uic.edu/MainSite/departments/dean_of_students/Our+Services/Student+Judicial+Affairs.htm#19

In particular, this policy prohibits plagiarism and giving or receiving aid on an examination.

Any violation of these standards will be referred to the Office of Student Judicial Affairs, and severe penalties (such as temporary or permanent expulsion from the University) may result.