Math 205A: Complex Analysis
Course Syllabus
UC Davis, Winter 2016

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1 Course meeting information

- Course lectures: MWF 1:10-2:00, Olson 227
- Office hours: F 11-12, MSB 2218.
- Weekly problem session: M 6:10-7, MSB 3106.

2 Prerequisites

Undergraduate complex analysis (UC Davis Math 185, or equivalent).

3 Course textbook

The course will be based to a large extent on the book *Complex Analysis*, by E. M. Stein and R. Shakarchi (Princeton University Press, 2003). Additional

*For questions about the class, email me at `romik@math.ucdavis.edu`.

recommended reading will be suggested for some of the topics covered.

4 Course description and learning objectives

The course is the first in the two-quarter graduate sequence in complex analysis. The course aims to revisit the material from undergraduate complex analysis and a select number of more advanced topics, emphasizing the beauty of the theory and its applicability and connections to other areas of mathematics.

Learning objectives

1. To relearn the material from undergraduate complex analysis at a higher level of rigor and depth.
2. To learn a select number of more advanced topics, including both theory and applications.
3. To improve your general abilities as a pure mathematician, including:
   - Proof writing and mathematical exposition skills
   - Proof reading and critiquing skills
   - Understanding of the mathematical analyst's way of thinking, e.g., ϵ-δ arguments, manipulation of inequalities.
   - Optional, but strongly recommended: mathematical typesetting (i.e., LaTeX) skills.

Detailed list of topics: [estimated class time in brackets]

- The fundamental theorem of algebra: three "proofs from the book" [**1 lecture**]
- Basic complex analysis: differentiation, analytic and harmonic functions, the Cauchy-Riemann equations, power series, the exponential and trigonometric functions, conformality, the Riemann sphere, stereographic projection [**3 lectures**]

- Integration and Cauchy's theorem: topology of planar curves, proof of Cauchy's theorem, the Cauchy integral formulas [**4 lectures**]

- Applications of Cauchy's theorem: the logarithm function, Liouville's theorem, the maximum principle, Rouché's theorem, the argument principle, principle of analytic continuation [**3 lectures**]

- Meromorphic functions; the residue theorem and applications [**2 lecture**]

- The Euler gamma function and its properties [**2 lecture**]

- The Riemann zeta function and its properties [**2 lectures**]

- Asymptotic analysis, the saddle-point method, Stirling's formula, the prime number theorem. [**3 lectures**]

- Entire functions of finite order, Hadamard's factorization theorem [**3 lectures**]

- Additional topics as time permits, such as: conformal maps and the Riemann mapping theorem; the Dirichlet problem and other applications to partial differential equations; doubly-periodic functions; the Mellin transform; ....

5 Assessment and grading policy

- **Summative assessment:** 100% of the course grade will be based on an in-class final exam.

- **Formative assessment:** a weekly homework problem set will be assigned. These homework problems will be discussed at a weekly discussion session where students will be given an opportunity to present and discuss their solutions. Participation in these sessions is voluntary and will not affect your grade.

  In addition, two of the homework problem sets will be collected and critiqued in detail by me for correctness and the quality of the presentation. Submission of these problem sets is also voluntary, and will not affect your grade, except that I reserve the right (which I plan to exercise sparingly and only in exceptional circumstances) to take the quality of these submissions into account for the purpose of giving a student a *higher* final grade than he or she would otherwise merit based on their final exam score.

Note. The final exam will be designed with the goal that a reasonably capable student who took maximal advantage of the formative assessment assignments should have no difficulty getting at least an A− on the exam. I make no claims about the level of difficulty that will be experienced by a student who *did not* take maximal advantage of the formative assessment.

6 Ethics policy

Any work submitted as part of the homework assignments must: (i) be physically written/typed by you; (ii) be written in your own words; and (iii) represent that you have taken a significant intellectual part in its creation and completely understand what you have written, unless explicitly specified otherwise. (I.e., you may work on a problem in collaboration with peers as long as you make a sincere effort to solve it yourself, and once a solution has been found by the group you must make sure that you understand it completely if you are submitting it as part of the assignment, or explicitly clarify which part you are not sure you understand.)

Failure to adhere to these guidelines would be considered by me as a violation of the UC Davis Code of Academic Conduct and warrant, at minimum, a failing grade in the assignment in question (which as stated above would not affect the final course grade negatively, but would forfeit the possibility of the assignments affecting your final grade positively) and a referral to Student Judicial Affairs.