MATH 600 Real Analysis Section 01
Fall 2017

- Instructor: Dr. Jinglai Shen
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- Lectures: Mon and Wed, 4:00–5:15 pm, at SOND 112
- Office hours: Mon and Wed, 3:00–4:00 pm or by appointment
- Course web-page: http://www.math.umbc.edu/~shenj
- Prerequisites: undergraduate real analysis (e.g., Math 301-302)
- Recommended textbook (not required): *Principles of Mathematical Analysis* by W. Rudin, 3rd Edition, McGraw Hill, Inc., 1976.
- Other references:
  - *Elementary Classical Analysis* by J.E. Marsden and M.J. Hoffman, 2nd Edition, W.H. Freeman, Inc., 1993.
  - *Introduction to Real Analysis* by R.B. Bartle and D.S. Sherbert, 4th Edition, John Wiley & Sons, Inc., 2011.
- Important dates:
  - No class on Sept. 4 (Labor Day) and Nov. 22 (Thanksgiving Eve)
  - Last class: Dec. 11

Course Description and Objectives This course is concerned with metric spaces (including the Euclidean space), the space of continuous functions of real variables, and their fundamental analytic and topological properties, such as completeness, compactness, connectedness, and continuity of functions on these spaces. The course focuses on rigorous, logically sound reasoning (known as proofs) for solving problems. The proof skills and mathematical knowledge developed in this class will prepare you for advanced mathematical courses and will benefit you in various areas of pure and applied mathematics, such as topology, geometry, differential equations, scientific computing, and optimization.

Topics We will cover most of Chapters 2–4, 7 and 9 of the recommended textbook by Rudin. Specific topics are:

- Metric Spaces and Their Topology (Chapter 2)
  - Metric space, inner product space, normed vector space
  - Open/closed set, interior, closure, and boundary
  - Compact set and Heine-Borel theorem
  - Connected set and path-connected set
- Sequences in Metric Spaces (Chapter 3)
  - Sequence, convergence, and limit
  - Cauchy sequence
  - Completeness
- Continuous Mappings (Chapter 4)
  - Continuity, operations on continuous mappings
  - Continuous mappings on compact and connected sets
  - Uniform continuity
- Uniform Convergence (Chapter 7)
  - Uniform convergence, Weierstrass M-test for series
  - Uniform convergence and Integration/differentiation
  - The space of continuous functions, equicontinuity, Arzela-Ascoli Theorem
- Fixed-point Theorems
  - Contraction mapping principle
  - Brouwer's fixed-point theorem
- Differentiability of functions (Chapter 9)
  - Gâteaux and Fréchet derivatives
  - Mean value theorem
  - Inverse and implicit function theorems

Please note that these topics are subject to change, depending on class progress.

Homework Bi-weekly homework will be assigned. *No late homework will be accepted.* Please present your answers neatly and show all your work; answers without supporting work may not receive full credit.

Exams There will be two (2) mid-term exams and one (1) final exam. An exam date will be announced at least one week before an exam is held. A mid-term exam mainly focuses on topics covered by that month, and the final exam will be comprehensive but focus more on the latter part of the course.

Grading Policy The grading scheme is as follows:

- homework: 30%
- mid-term exams: 40% (20% for each)
- final exam: 30% (the final is comprehensive)

The letter grade will be computed based upon the numerical grade:

$A : \geq 85; \quad B : 84 - 75; \quad C : 74 - 65; \quad D : 64 - 50; \quad F :< 50$

Academic Integrity

- The UMBC Academic Integrity Statement:

  "*By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic dishonesty, and they are wrong. Academic misconduct could result in disciplinary action that may include, but is not limited to, suspension or dismissal. To read the full Student Academic Conduct Policy, consult the UMBC Student Handbook, the Faculty Handbook, or the UMBC Policies section of the UMBC Directory*".

- All work in a homework or an exam must be your own; collaborating on an exam is *not* permitted. Discussions with other students on homework problems are allowed, but you should present your own work in the final turn-in; simply copying other people's work is violation of academic integrity code.

- If you wish to contest a graded exam, you must make an appeal within *one week* of the return date to the class. All appeals should be made in writing to the instructor with a signed and dated note on the exam. End of the semester appeals for earlier exams will be ignored.

- Regarding make-up tests: if you must miss an exam due to a prior obligation, you must speak to the instructor *in advance* of the exam. If you must miss an exam due to an unforseen but valid reason (e.g. illness), you must submit a written excuse. Failing to do so may result in loss of substantial points in your make-up.