

Review Guide for Midterm I on Friday, 11 October 2019

The in-class Midterm Exam is *closed book* and *closed notes*. Bring only a writing implement. I encourage you to get together with other students and work through this Review Guide. If you come prepared it will be easy.

The Exam will cover the content listed below from Carothers, *Real Analysis*; it will only cover topics that have appeared on homework or in lecture, or which are closely-related. You are responsible for, and should be able to prove unless otherwise stated, all propositions (including lemmas, theorems, and corollaries) in the following material, unless otherwise stated. Likewise you should know all the definitions, unless otherwise stated. Note that some important ideas/definitions/results are stated in the Exercises.

- **Chapter 1:** Know everything, including all definitions, except Nested Interval Theorem and Bernoulli's Theorem.
- **Chapter 2:** Know everything on pages 18–24, though you do not need to be able to prove either Cantor's Theorem or Bernstein's Theorem. Ignore the rest of this Chapter; we will return to the Cantor set when we need it as an example of a nontrivial measure zero set.
- **Chapter 3:** Everything here is important. Make sure to know the statements of the Cauchy-Schwarz, Young's, Hölder's, and Minkowski's Theorems, and study their proofs as well. Review and think about the definitions and basic facts of the ℓ_p spaces.
- **Chapter 4:** Most things here are important. However, don't worry about the definitions of "perfect", "isolated point", and "boundary point", and you can ignore the material on the relative metric.
- **Chapter 5:** Everything here is important.
- **Chapter 6:** I de-emphasized this material but you need to know these specifics: (i) the definition of "connected", (ii) Theorem 6.6 which says that the continuous image of a connected set is connected, (iii) the usage of "intermediate value property" as in Exercise 22, and (iv) that the Intermediate Value Theorem in calculus is a special case of Theorem 6.6.
- **Chapter 7:** Almost everything here is important (despite my criticism of Carother's organization). Review the Picard argument for the short-time existence and uniqueness of solutions to ordinary differential equation initial value problems on page 101. You can ignore the Nested Interval Theorem and the "uniformly homeomorphic/homeomorphism" definitions on page 105.
- **Chapter 8:** Again, essentially everything here is important. However, on pages 117 and 121 you can ignore the definitions of "uniformly homeomorphic/homeomorphism" and "uniformly/strongly equivalent".