Real Analysis Qualifier **Syllabus** Summer 2022

The course text was *Real Analysis* by Folland. We covered most of chapters 1-3, as well as parts of chapters 5-7. Here is a list of the sections of the text that may be on the qualifying exam. You may contact Jing Tao if you have any specific questions.

1. Measures

1.1 Introduction, including the construction of a non-measurable set

1.2 σ-algebras

1.3 Measures

1.4 Outer measures

1.5 Borel measures on $\mathbb{R}$

2. Integration

2.1 Measurable functions

2.2 Integration of non-negative functions

2.3 Integration of functions (mostly focused on real-valued)

2.4 Modes of convergence

2.5 Product measures

3. Signed measures and differentiation

3.1 Signed measures

3.2 Lebesgue-Radon-Nikodym Theorem

3.4 Differentiation on Euclidean space

3.5 Functions of bounded variation

5. Elements of functional analysis

5.1 Normed vector spaces

5.2 Linear functionals

5.3 Baire category theorem and consequences

5.4 Only definitions of weak topology, weak* topology, and theorem 5.18.

5.5 Hilbert spaces

6. L^p spaces

6.1 Basic theory of L^p spaces

6.2 The dual of L^p

6.3 Only Chebyshev's inequality