# Real Analysis Qualifier Topics list

April 2017

## 1 Preliminary background

We assume an undergraduate class in advanced calculus covering material similar to at least the first seven chapters of:

Walter Rudin, *Principles of Mathematical Analysis*, 3rd edition, McGraw-Hill, 1976.

The real analysis portion of the qualifying exam will draw from the following topics and may also include questions from advanced calculus.

## 2 Suggested texts

- Folland, *Real Analysis*, 2nd edition, Wiley 1999
- Royden and Fitzpatrick, *Real Analysis*, 4th edition Prentice-Hall, 2010
- Stein and Shakarchi, *Real Analysis*, Princeton, 2005
- Makarov and Podkorytov, *Real Analysis: Measures, Integrals and Applications*, Springer, 2013
- Tao, *An Introduction to Measure Theory*, AMS, 2011
- Tao, *An Epsilon of Room I*, AMS, 2010

## 3 qualifier topics

- Jordan measure and the Riemann-Darboux integral on $R^d$
- Lebesgue measure and the Lebesgue integral on $R^d$
- Boolean algebras and sigma-algebras of sets; the monotone class lemma
- Measure and integration on abstract measure spaces
- Littlewoods three principles, including Lusin and Egoroff
- Fatous lemma, the Monotone Convergence Theorem, and the Dominated Comvergence Theorem.
- relationships among modes of convergence; uniform integrability

- pre-measures, outer measures, and the Hahn-Komogorov extension theorem
- product measure spaces and the Fubini-Tonelli theorem, and applications
- the Lebesgue Differentiation Theorem in $R^d$
- bounded variation, absolute continuity, and the Fundamental Theorems of Calculus for a.e. differentiable functions on $R$