

Probability 1
CEU Budapest, fall semester 2014

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detailed approximate list of what to know and what to read for the exam

- Measure-theoretic language in Probability. Durrett [1], Chapter 1 – except for the construction of the integral in Section 1.4
- Independence: Durrett [1], sections 2.1, 2.1.1, 2.1.2 (pages 41-47)
- L^2 weak law of large numbers: Durrett [1], section 2.2.1
- Borel-Cantelli lemmas: Durrett [1], section 2.3, pages 64-68
- Strong law of large numbers: the proof is needed only in the case when X_i are i.i.d. and $\mathbb{E}(X_i^4) < \infty$ – as a consequence of Borel-Cantelli
- Weak convergence: Durrett [1], section 3.2
- Characteristic functions:
 - Durrett [1], section 3.3.1 – without the inversion formula;
 - Durrett [1], section 3.3.2;
 - HW 3.4;
 - proof of the weak law of large numbers in the general case with the method of characteristic functions
- Central limit theorem: i.i.d. case only: Durrett [1], section 3.4
- Martingales: Durrett [1], sections 5.1, 5.2
- Branching processes: Durrett [1], section 5.3.4
- The Optional Stopping Theorem and the ABRACADABRA problem: Ai [2]
- Wiener Process (= Brownian Motion in Durrett [1]):
 - definition and basic properties: Durrett [1], section 8.1 – only up to Theorem 8.1.1
 - Paul Lévy's construction: HW 8.5

References

- [1] Durrett, R. *Probability: Theory and Examples*. **4th** edition, Cambridge University Press (2010)
- [2] Ai, Di. *Martingales and the ABRACADABRA problem*.
<http://math.uchicago.edu/~may/VIGRE/VIGRE2011/REUPapers/Ai.pdf> (2011)