# Syllabus for Probability I, Spring 2017

**Meetings time and place:**
Lecture: TTh 11:30am–12:50pm in Physics P123.

**Course webpage:**
`math.stonybrook.edu/~rdhough/mat639-spring17`

**Professor:**
Robert Hough
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Math Tower 4-118
Office Hours: F 10am-12pm

**Course Description:** This is a first graduate probability course, covering measure spaces, random variables, the weak and strong laws of large numbers, the Central Limit Theorem and Martingales. In the latter part of the course I intend to give an introduction to concentration of measure, including isoperimetric and log-Sobolev inequalities.

**Prerequisite:** Measure theory. Royden's *Real analysis* is a more than sufficient reference.

**Required text:** Rick Durrett. *Probability: Theory and Examples*, 4th ed. Cambridge University Press, 2010.
**Supplementary text:** M. Ledoux. *The Concentration of Measure Phenomenon*, AMS Publishing 2001.
**Note:** Amir Dembo's notes cover much of the material in Durrett with additional exercises and corrections. See the course webpage.

**Homework and exam policy:** Homework assigned is not mandatory. If turned in, the instructor agrees to return it with some comments.

**Students with disabilities:** If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services at (631) 632-6748 or `http://studentaffairs.stonybrook.edu/dss/`. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

**Administrative deadlines:**
Drop deadline: Friday Feb. 3, 4pm (no W)
Grade basis deadline: Friday Mar. 24, 4pm (drop with W)
For more details, see the SBU registrar: `http://www.stonybrook.edu/registrar/index.shtml`

**Tentative Course Schedule**: Sections labeled D refer to Durrett, sections labeled L refer to Ledoux.

| Date | Topics | Reading |
|---|---|---|
| Tu Jan 24. | Review of measure theory, random variables, expectation. | D 1.1–1.6, A.1 |
| Th Jan 26. | Product measures, independence. | D 1.7, 2.1, A.3–A.5 |
| Tu Jan 31. | Law of large numbers | D 2.2–2.4 |
| Th Feb 2. | Convergence of random series and large deviations | D 2.5–2.6 |
| Tu Feb 7. | Central limit theorems | D 3.1–3.4 |
| Th Feb 9. | Local limit theorem | D 3.5, 3.9 |
| Tu Feb 14. | Stein's method | |
| Th Feb 16. | Poisson approximation | D 3.6–3.8 |
| Tu Feb 21. | Random walks | D 4 |
| Th Feb 23. | Martingales | D 5.1–5.3 |
| Tu Feb 28. | Martingales | D 5.4–5.5 |
| Th Mar 2. | Martingales | D 5.6–5.7 |
| Tu Mar 7. | Markov chains | D 6.1–6.4 |
| Th Mar 9. | Markov chains | D 6.5–6.8 |
| Tu Mar 14. | Spring recess, no class | |
| Th Mar 16. | Spring recess, no class | |
| Tu Mar 21. | Random walk on the hypercube | |
| Th Mar 23. | Riffle shuffling | |
| Tu Mar 28. | Ergodic theorems | D 7.1–7.5 |
| Th Mar 30. | Ergodic theorems | |
| Tu Apr 4. | Ergodic theorems | |
| Th Apr 6. | Brownian motion | D 8.1–8.3 |
| Tu Apr 11. | Brownian motion | D 8.4–8.5 |
| Th Apr 13. | Brownian motion | D 8.6–8.8 |
| Tu Apr 18. | Consequences of concentration | L 1.1–1.6 |
| Th Apr 20. | Isoperimetric inequalities and concentration | L 2.1–2.3 |
| Tu Apr 25. | Concentration and geometry | L 3.1–3.5 |
| Th Apr 27. | Concentration in product spaces | L 4.1–4.5 |
| Tu May 2. | Entropy and concentration | L 5.1–5.5 |
| Th May 4. | Applications | L 8.1–8.5 |