

MATH 581: Probability
Fall 2021, TuTh 2-3:15, EGRA 310, Instructor: Dr. David Olive

Text: Billingsley, Patrick (1986), *Probability and Measure*, 2nd ed., Wiley, New York, NY. ISBN: 0-471-80478-9

(\approx \$40 at www.addall.com and www.amazon.com. You may also use the 3rd or anniversary editions.)

Course Webpage: <http://parker.ad.siu.edu/Olive/M581.html>

The *prerequisites* for this class are Math 501: Lebesgue Measure and Lebesgue Integration, and a Calculus based course in Probability or Probability and Statistics: Math 480 or 483.

email: dolive@siu.edu *Office hours:* MWThF 9:00-9:30, 12:00-1:00

I am also available by appointment and on a walkin basis, e.g. after class. The course webpage will make some things available on the internet.

This course is a measure-theoretic introduction to probability theory. Topics include general probability spaces, product spaces and product measures, random variables as measurable functions, distribution functions, conditional expectation, types of convergence, characteristic functions and the Central Limit theorem, tail events and 0-1 laws, the Borel-Cantelli lemma, and the weak and strong law of large numbers. The course is useful for PhD students in Statistics and Probability, and for the major or minor for the PhD oral exam. This course is **much harder** than Math 580 and Math 584. **No notes for exams.** About 2 sheets of notes for quizzes.

Some other good books include

Ash, R.B., and Doleans-Dade, C.A. (1999), *Probability and Measure Theory*, 2nd ed., Academic Press, San Diego, CA.

Billingsley, P. (1995), *Probability and Measure*, 3rd ed., Wiley, New York, NY.

Capiński, M., and Kopp, P.E. (2004), *Measure, Integral and Probability*, 2nd ed., Springer-Verlag, London, UK.

Dudley, R.M. (2002), *Real Analysis and Probability*, Cambridge University Press, Cambridge, UK.

Durrett, R. (2019), *Probability, Theory and Examples*, 5th ed., Cambridge University Press, Cambridge, UK.

Feller, W. (1971), *An Introduction to Probability Theory and Its Applications*, Vol. II, 2nd ed., Wiley, New York, NY.

Gnedenko, B.V. (1989), *Theory of Probability*, 5th ed., Chelsea Publishers, Providence, RI.

Karr, Alan F. *Probability*, (1993), Springer, New York, NY.

Pollard, D. (2001), *A User's Guide to Measure Theoretic Probability*, Cambridge University Press, Cambridge, UK.

Rényi, A., (2007), *Probability Theory*, Dover, New York, NY.

Resnick, S. (1999), *A Probability Path*, Birkhauser, Boston, MA.

Rosenthal, J.S. (2006), *A First Look at Rigorous Probability Theory*, 2nd ed., World Scientific, Singapore.

Shiryaev, A.N. (1996), *Probability*, 2nd ed. Springer Verlag, New York, NY.

Stoyanov, J., Mirazchiiski, I., Ignatov, Z., and Tanushev, M. (1989), *Exercise Manual in Probability Theory*, Kluwar Academic Publishers, Boston, MA.

(Cumulative) Final: Wednesday, Dec. 8, 12:30-2:30.

The grading and schedule below are tentative. Last day to drop: office on Friday, Oct. 22, by internet Sunday, Oct. 24.

Students receive a WF if they stop attending class and fail. An INC is given if for reasons beyond their control, students engaged in *passing* work are unable to complete all class assignments. Two HWs may be turned in one class period late with no penalty and a 3rd with 25% penalty except for the last week of classes. I sometimes give a *B+* and *C+*.

Grading:

HW	300		Quizzes	100	
exam1	100	exam 2	100	exam 3	100
final	300			total	1000
min. grade	points	min. grade	points	min. grade	points
A	900-1000	B	800-899	C	700-799
D	550-699				

Week of	TU	Th
Aug 16	1.2	1.2, 1.4
Aug 23	1.4, 1.5, 2.13, 2.20, Q1	1.3, 1.5, 1.9, 2.10, HW1
Aug 30	1.3, 2.13, 2.14, 3.20, Q2	1.4, 2.13, 2.14 HW2
Sept 6	1.5, 3.15, Q3	1.5, 3.15, 3.16, HW3
Sept 13	3.16	Exam 1
Sept 20	3.16, 4.21, Q4	3.16, 4.21, HW4
Sept 27	2.13, Q5	2.13, 3.18, HW5
Oct 4	3.18, 3.20, Q6	3.20, 5.25, 5.27, HW6
Oct 11	5.25, 5.27, Q7	4.22, 5.25, HW7
Oct 18	5.25, 5.26, 5.27	Exam 2
Oct 25	5.25, 5.26, 5.27, Q8	5.25, 5.26, 5.27, HW8
Nov 1	5.27, 5.29, Q9	5.29, HW9
Nov 8	5.29, 6.32, Q10	no class
Nov 15	6.32, 6.33, 6.34, HW10, Q11	6.33, 6.34, HW11
Nov 22	no class	no class
Nov 29	Exam 3	review

Lorayne and Lucas (2000), *The Memory Book* is useful for **memorization**.

For the prerequisite, see the next 3 books.

Gelbaum, B.R., and Olmsted, J.M.H. (1964), *Counterexamples in Analysis*, Holden-Day, San Francisco, CA. (Now by Dover.)

Royden, H.L., and Fitzpatrick, P. (2007), *Real Analysis*, 4th ed., Prentice Hall, Englewood Cliffs, NJ.

Spiegel, M.R. (1969), *Schaum's Outline of Theory and Problems of Real Variables: Lebesgue Measure and Integration with Applications to Fourier Series*, McGraw-Hill, New York, NY.