6.431x Spring 2022 Syllabus

Unit 0: Overview (released Mon. Jan 31)

Unit 1: Probability models and axioms (released Mon. Jan 31; Sections 1.1-1.2)
L1: Probability models and axioms
Problem Set 1 due on Wednesday February 9

Unit 2: Conditioning and independence (released Mon. Jan 31; Sections 1.3-1.5)
L2: Conditioning and Bayes' rule
L3: Independence
Problem Set 2 due on Wednesday February 16

Unit 3: Counting (released Thur. Feb 10; Section 1.6)
L4: Counting
Problem Set 3 due on Wednesday February 23

Unit 4: Discrete random variables (released Thur. Feb 17; Sections 2.1-2.7)
L5: Probability mass functions and expectations
L6: Variance; Conditioning on an event; Multiple r.v.'s
L7: Conditioning on a random variable; Independence of r.v.'s
Problem Set 4 due on Friday March 4

Exam 1 (Timed) : Covers material from L1 to L7 (released Fri. Feb 25; due on Wednesday March 9)

Unit 5: Continuous random variables (released Thur. Mar 4; Sections 3.1-3.5)
L8: Probability density functions
L9: Conditioning on an event; Multiple r.v.'s
L10: Conditioning on a random variable; Independence; Bayes' rule
Problem Set 5 due on Friday. March 18

Unit 6: Further topics on random variables (released Thur. Mar 10; Sections 4.1-4.3, 4.5)
L11: Derived distributions
L12: Sums of r.v.'s; Covariance and correlation
L13: Conditional expectation and variance revisited; Sum of a random number of r.v.'s
Problem Set 6 due on Wednesday March 30

Unit 7: Bayesian inference (released Thur. Mar 24 Sections 3.6, 8.1-8.4)
L14: Introduction to Bayesian inference
L15: Linear models with normal noise
L16: Least mean squares (LMS) estimation
Problem Set 7 due on Friday April 8

(Optional Ungraded) L17: Linear least mean squares (LLMS) estimation
(Optional Ungraded) Problem set on LLMS

Exam 2 (Timed): Covers material from L8 to L17 (released Fri. Apr 1; due Wednesday. April 13)

Unit 8: Limit theorems and classical statistics (released Thur. Apr 7; Sections 5.1-5.4, pp. 466-475)
L18: Inequalities, convergence, and the Weak Law of Large Numbers
L19: The Central Limit Theorem (CLT)
L20: An introduction to classical statistics
Problem Set 8 due on Friday April 22

Unit 9: Bernoulli and Poisson processes (released Thur. Apr 21; Sections 6.1-6-2)
L21: The Bernoulli process
L22: The Poisson process
L23: More on the Poisson process
Problem Set 9 due on Wednesday May 4

(Optional) Unit 10: Markov chains (released Thur. Apr 28; Sections 7.1-7-4)
L24: Finite-state Markov chains
L25: Steady-state behavior of Markov chains
(Optional Ungraded) L26: Absorption probabilities and expected time to absorption
Problem Set 10 due on Wednesday May 11

Final Exam (Timed) (released Fri. May 6; due on Wednesday May 18)

***Note: All problem set and exam due dates are at 11:59AM UTC on the specified dates. Please note the AM UTC time, and find the corresponding time at your location.**