

Module 1 - Stochastic Processes

Goals

Students will gain a basic understanding of the concept of stochastic processes and probability models. Specifically, we will discuss random walks, markov chains and poisson processes in some detail. We will have an overview day near the end of the module that briefly introduces some more advanced topics for the interested student to pursue on their own.

Textbook

I feel guilty having you buy a book for a ~3 week module but I did find a resource through the Miami library system (free access!). We will essentially be covering the first 5 chapters in the text

- [Stochastic Processes: An Introduction](#), by P.W. Jones

Other resources I would consider for a course like this (you can likely get older versions of theses cheap on ebay and other sites)

- [Introduction to Probability Models](#) by Ross
- [Stochastic Processes](#) by Ross
- [An Introduction to Stochastic Modeling](#) by Taylor and Karlin

Class breakdown/workload

I plan to structure this module such that there is 100 points to be earned over the next 3.5 weeks. My anticipated breakdown (subject to change) is

- Three assignments worth 80 points
- An exam (on February 19) worth 20 points









Assignments

Each of the modules in STA 650 have a distinct curriculum that requires differing mechanisms to assess students (think GLM versus Computation last semester, fundamentally different and require different assessment tools). I think of this stochastic modules in the vein of Regression (563), Design (566) and Time Series (583). As such, your assignments will be a mix of derivation and computing type problems.


Fisher contact information


- Email: fishert4@miamioh.edu
- Office hours:
 - Monday, 1:30-2:30
 - Tues & Thurs, 10:00-11:00 (starting in week 2)

Calendar

Date	Topic	Notes/Code	Supplemental Documents
Mon 1/27	Course overview Intro to the Stochastics module Modeling review	day01motivationNotes.html day01motivationNotes.Rmd day01randomProcess.pdf 	Stochastic Processes An Introduction Third Edition ---- (chapter 2 Some Gambling Problems).pdf  Stochastic Processes An Introduction Third Edition ---- (chapter 3 RandomWalks).pdf  Stochastic Processes An Introduction Third Edition ---- (chapter 4 Markov Chains).pdf 
Wed 1/29	Stochastic Process Random Walks Gamblers Ruin	day02randomWalkGamblersRuin.pdf  randomWalkSims.R	
Fri 1/31	Introducing Markov Chains	day03introMarkovChain.pdf  miamiERCprecipitation.csv  markovChainOnERC.R	
Mon	Markov Chain Properties - Transition	day04markovChainClassProperties.pdf 	

2/3 probabilities, accessibility, classes,
irreducible, recurrent vs transient
states [ratTransitionsProbs.R](#)

Wed 2/5 Markov Chain properties - limiting
distributions, expected time to return,
other properties [day05markovChainLimitProperties.pdf](#) 
[ratTransitionsLimits.R](#)

Fri 2/7 Fitting Markov Chains (back to Dry-
Wet day example). [day06introPoissonProcess.pdf](#) 
Intro to counting processes [markovChainFittedOnERC.R](#)

Mon 2/10 Poisson Process Properties [day07poissonProcessProperties.pdf](#) 

[Stochastic Processes An Introduction
Third Edition ----
\(chapter 5 Poisson Processes\).pdf](#) 

Wed 2/12 More advanced Poisson Process ideas [day08poissonProcessNonhomogeneousCompound.pdf](#) 

Fri 2/14 Class cancelled -- Fisher at Lewis
Place

Hodgepodge day (all FYI)
- Queuing theory ideas
Mon 2/17 - Time reversible MC, Continuous
time MC
- Hidden Markov Chains
- Life-death & Branching processes

Wed 2/19 Exam Day