A stochastic process is a description of a random function of time. There are various important classes of stochastic processes: Markov, martingale, stationary. This course Math 565A will begin with a brief survey and then concentrate principally on discrete time Markov processes. The following course Math 565B can then give a more complete treatment of continuous time Markov processes.

Discrete time Markov processes provide mathematical models that are useful in various areas of science and engineering. A typical situation in such a model is that the state at time $n + 1$ is represented as the value of a function that depends on the state at time $n$ and on a random variable. In other words, the scientific context is dynamics with randomness.

There is, however, another application of discrete time Markov processes in which the process is constructed to permit a Monte Carlo simulation of a probability distribution. Thus the process is not given by nature, but is constructed by the mathematician to have desirable properties suitable for scientific computation or for Bayesian statistics.

The course will begin with a review of some universal examples, such as Bernoulli trials and the Poisson process, and random walk and Brownian motion. Markov process topics include stopping times and the strong Markov property, transience and recurrence, invariant probability distributions, and coupling. The relation to martingales will be explored. The theory will be applied to various standard models and to Markov Chain Monte Carlo simulation.

The text for the course is notes by Rabi Bhattacharya and Ed Waymire on Discrete-Parameter Markov Processes. The prerequisite for the course is a strong probability background. It meets Tuesdays and Thursdays at 9:30 AM in Modern Languages 502. For further information see Bill Faris in Mathematics.