

Course content for MT3360/4360, Markov Chains and Applications

Prerequisites:

MT2320

Aims:

To introduce the student to a range of examples of probabilistic methods used to model systems that exhibit random behaviour.

Learning outcomes:

On completion of the course the student should be able to:

- understand the structure and concepts of discrete and continuous time Markov chains with countable state space;
- construct a probability model for a variety of problems;
- understand the basic theory behind Bayesian inference;
- be able to formulate statistical problems such as regression in terms of a Bayesian model;
- understand the concept of Gibbs sampling.
- MT4360: demonstrate a breadth of understanding appropriate for an M-level course.

Course content:

Poisson processes:

Inter-arrival and waiting times; conditional distribution of the waiting times; non-homogeneous processes; compound Poisson process; generalisation to renewal processes.

Markov processes: Markov chains; classification of states; some limit theorems; stationary distributions; absorption probabilities.

Bayesian inference and sampling: Bayes' theorem; choosing a conjugate prior; discrete data with a Beta prior; normal data with a normal prior; Bayesian linear and nonlinear regression; calculating expected values using Monte Carlo methods; Gibbs sampling in high-dimensional spaces.