

Rumours, epidemics and consensus in networks

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Abstract: The course will provide an introduction to the modelling and analysis of stochastic processes on networks, focusing on the spread of rumours, epidemics and opinions. Such models are of interest in a variety of fields. In computer science, many distributed algorithms for large-scale networks such as the Internet use rumour-spreading or consensus mechanisms as primitives; one well-known example is the BitTorrent algorithm for content dissemination. Epidemic models are obviously of interest in studying disease spread, but it is only recently that network models have become popular in this field. Finally, in the biological as well as social sciences, consensus models are of interest in understanding phenomena ranging from the flocking of birds to the adoption of competing technologies or products.

Lecture 1: Overview of the Poisson process and continuous time Markov chains

Lecture 2: Rumour spreading on the complete graph. Mean and variance of the spreading time. Probability inequalities.

Lecture 3: Rumour spreading on general graphs. The conductance of a graph. Bounds on the spreading time.

Lecture 4: The SIS epidemic on general graphs. Bounds on the epidemic lifetime.

Lecture 5: The voter model on general graphs. Martingales and the optional stopping theorem. The final state of the voter model.

Lecture 6: The voter model on complete graphs. Duality with coalescing random walks. Bounding the time to consensus.