

Mathematical Modelling of Computer Networks: Part II

The course is a 2 credit advanced level module optional course in Autumn 2013 (29.10.2013 to 06.12.2013)

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Office hours: C 213, Thursday 12:00 - 13:00 or by appointment

Class Timings and Location.

Lecture class: Tue 14-16, B119

Exercise class: Fri 12-14, B119

Role of Mathematical Models in Networking - A sketch 1/2

- ▶ Wide variety Math models and tools used in networking: Optimization (especially Convex Optimization), Probability and Stochastic processes (Markov, Poisson processes etc), Random graph models
- ▶ They model phenomena in networking and support design and analysis of network algorithms
- ▶ As we build networks for Scalability and Optimal operation, mathematical tools have an important place in networking
- ▶ Optimality is sometimes a vital concern rather than a mere luxury.
 - ▶ For example, in designing gossip protocols used information in wireless/ mobile networks the time taken to spread information throughout the network depends on the mixing rate of the Markov chain of the graph model obtained from the network. An optimally designed gossip algorithm can spread the information in time $O(\log D)$ where D is the diameter of the network, whereas any non-optimal algorithm can take arbitrary long time!

Role of Mathematical Models in Networking - A sketch 2/2

- ▶ Experimental methods have been widely used in networking. Theory can provide useful heuristics to augment experimental work
- ▶ Here we develop the Mathematics hand-in-hand with the applications
- ▶ In our approach, we focus on an interesting networking result (stated as mathematical theorem), we explain the result with the help of numerous examples to understand it. We develop the necessary mathematical tools to understand and prove the result
- ▶ The network lectures (Tuesday lectures) focus on networking theory and applications. Exercises (Friday) develop the mathematical techniques in sufficient detail

Mathematical Modelling of Computer Networks: Part II

- ▶ Mathematical models and techniques have made enormous impact in Networking
- ▶ This course has two modules - Network coding and Wireless Scheduling
- ▶ Each topic has three lectures and three exercises
- ▶ In the lectures we focus on the theory needed to understand networking results
- ▶ In the exercises we develop the mathematical background in detail
- ▶ Each student in the course has to write a term paper on a chosen topic and there is a course exam at the end

Suggestions for Term Paper

- ▶ The term paper is a writeup about 4-5 pages based on reading a chosen paper.
- ▶ While writing it, explain ideas clearly in your own words or give a motivated detailed derivation of any proof that you learn from the chosen paper.
- ▶ It can be either a theoretical result in Network Coding or description of a practical system that implements Network Coding
- ▶ You may choose a theoretical topic from the references of the paper - P15: Bassoli et al. Network Coding Theory: A Survey
- ▶ Alternatively, use the references of P12: Network Coding meets TCP paper to find a suitable topic in practical Network Coding
- ▶ By next Monday (4th Nov 2013) send a mail about your topic
- ▶ By 18th Nov 2013, mail us the first draft and by 30th Nov 2013 mail us the final draft