

The lecture "TMA4265: Stochastic Processes" is roughly divided into four (five) sections: discrete-time Markov chains, Poisson processes, continuous-time Markov chains, queuing theory, (Brownian motion). At the end of the first course segment the students should be able to

- explain what a discrete-time Markov chain is. You should be able to formulate a Markov chain and derive the corresponding transition graph linking the states of the state space.
- compute state probabilities and classify the states into equivalence classes and determine important class properties, such as transience, recurrence (positive and null) or periodicity.
- apply first-step analysis to answer questions such as in which state the Markov chain is ultimately trapped and how long, on average, it takes to reach this state.
- investigate long-term behavior of a Markov chain and distinguish between stationary and limiting probabilities.
- compute the expected time a Markov chain spends in transient states
- recognize and describe a branching process, determine if it converges to infinity or dies out, and compute certain quantities of interest.
- derive the transition probabilities of the reversed Markov chain, decide whether the process is time-reversible and exploit time-reversibility to compute limiting probabilities.
- simulate a Markov chain and check key-quantities derived theoretically using simulations. You should have a rough idea about Markov chain Monte Carlo procedures.