

Topics for final exam in Stochastic processes

1. Discrete time Markov chains, examples, stationary distribution, Chapman–Kolmogorov equation, classification of states, irreducibility, periodicity, recurrence, transience
2. Irreducible and primitive matrices, Perron–Frobenius theorem and its application to Markov chains, convergence theorems, exit distribution and mean exit time by one step argument
3. Detailed balance, reversible Markov chains, simple random walk on graphs, time reversal, stationary distribution in birth and death chains
4. Recurrent and transient states, expected number of visits, simple random walk on \mathbb{Z} , branching processes
5. Poisson process, interarrival times, thinning and superposition of Poisson processes, continuous time Markov chains, infinitesimal generator
6. Kolmogorov’s forward and backward equations, stationary distribution, irreducibility and convergence
7. Stationary distribution of birth and death chains, detailed balance, $M/M/s$ queues, exit distribution and expected time of exit
8. Conditional expectation, properties, martingales, definition, examples
9. Betting strategies, stopping times, stopped martingale, optional stopping theorem and its application to gambler’s ruin
10. Convergence theorem for martingales, Pólya’s urn, Wald’s equality
11. Multivariate normal distribution, Brownian motion, definition, construction and properties