Universidade Federal de Minas Gerais - Programa de Pós-Graduação em
Engenharia Elétrica

EEE945 - INTRODUÇÃO AOS PROCESSOS ESTOCÁSTICOS

HOMEWORK 4

Instructor: Alexandre R. Mesquita and Eduardo M. A. M. Mendes

Problem 1. Define a hidden Markov model of your choice with a 6×6 transition matrix A and a 6×4 observation matrix B. Simulate this model in order to obtain an observation sequence Y_0^{100}. Apply the *forward-backward* algorithm, Viterbi's algorithm and the Baum-Welch algorithm to this data set. In your solution, compare the filtered states with the real ones known from simulation.

Problem 2. Consider the Markov chain on $\mathbb{R}$ given by:

$$X_{n+1} = aX_n + W_n$$

where $a < 1$ and $\{W_n\}_{n=0}^{\infty}$ are i.i.d. with $W_n \sim \gamma(w)$, $\gamma(w) > 0$ on $(-1, 1)$ and $\mathrm{E}[W_n^k] < \infty$. Using the Foster-Lyapunov theorem, show that X_n is positive recurrent and that its k-th moment is bounded.