Mila University Centre

M1: Mater mathematics modeling

Uncertain decision

Work 1 (Markov chain)

Exercice 1.

Let's consider a markov chain with transition matrix as follows:

$$A = \begin{bmatrix} 0,6 & 0,4 & 0 \\ 0,2 & 0,5 & 0,3 \\ 0 & 0,4 & 0,6 \end{bmatrix}$$

1- Make the graphical representation of the chain.

2- Check that the chain is irreducible and calculate the peridicity of states.

3- Calculate the stationary distribution of states.

Exercice 2.

Consider the following transition matrix:

$$P = \begin{array}{c} \\ \\ \end{array}\begin{array}{ccc} h & a & f \end{array}$$

$$P = \begin{bmatrix} 0,5 & 0,45 & 0,05 \\ 0,1 & 0,5 & 0,4 \\ 0 & 0,1 & 0,9 \end{bmatrix}$$

1- Calculate the probability of the following trajectories (h, a, f, h), (h, a, f, a), (a, a, a).

2- Calculate the distribution at t = 1 if we assume $\pi^0 = (1, 0, 0)$.

3- Show that a uniform distribution $X_0 = (1/3, 1/3, 1/3)$ is not a stationary distribution for this Markov chain.

4- Calculate the stationary Matrix, if it exists.

3. Exercice 3

Let's consider the markov chain,viewed in the course, that represents changes in weather, with the transition matrix as follows.

$$\boldsymbol{P} = \begin{bmatrix} 0,6 & 0,2 & 0,2 \\ 0,05 & 0,8 & 0,15 \\ 0,3 & 0,0,2 & 0,5 \end{bmatrix}$$

- Simulate the chain using the Monte-Carlo method method and Calculate the stationary distribution of states.

-find the stationary matrix.

-find the stationary distribution by calculating the left eigenvector of the matrix.