

Optimization and Simulation

Laboratory 1

Random Number Generation and Poisson Process

Riccardo Scarinci

Transport and Mobility Laboratory TRANSP-OR
École Polytechnique Fédérale de Lausanne EPFL

Goals

Understanding how to draw from a distribution

- Inverse Transform Method

Understanding the Poisson process

- Why we need to draw from a distribution
- Application of the rejection method

Overview

Implementation of:

1. Exponential Random Number
2. Homogenous Poisson Process
3. Nonhomogenous Poisson Process

Steps:

- Read the specifications (written in the functions)
- Implement the requested functions
- Test the functions

1. Exponential Random Number

1. Exponential Random Numbers

Function to implement (.m)

`Exponential`

Test the function (.m)

`ExponentialTest`

Play with the code

Improve the script with good practices, e.g. comments, labels

2. Homogeneous Poisson Process

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Function to implement (.m)

`HomogeneousPoissonProcess`

Test the function (.m)

`HomogeneousPoissonProcessTest`

Play with the code

Improve the script with good practices, e.g. comments, labels

3. Nonhomogeneous Poisson Process

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Function to implement (.m)

`NonhomogeneousPoissonProcess`

Test the function (.m)

`NonhomogeneousPoissonProcessTest`

Play with the code

Improve the script with good practices, e.g. comments, labels

3. Nonhomogeneous Poisson Process

Extra questions

What is the efficiency of this nonhomogeneous Poisson process with only one λ where $\lambda(t) \leq \lambda$?

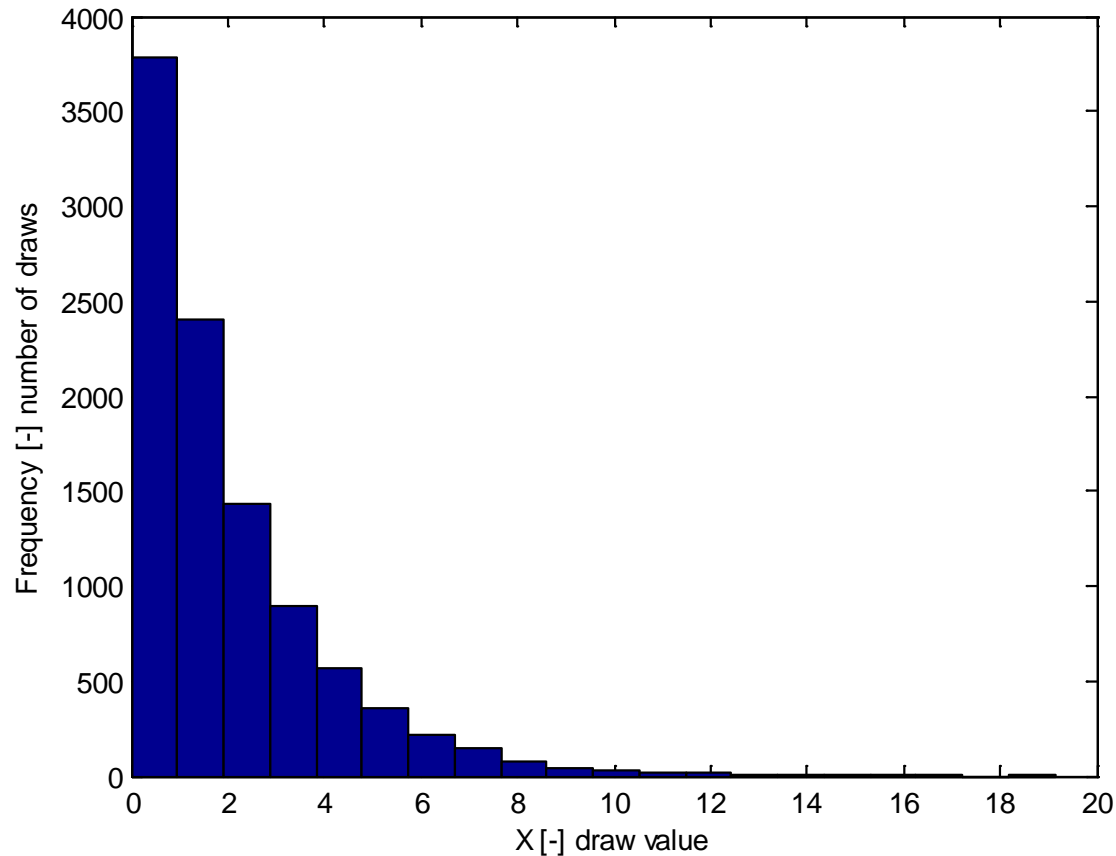
Can the efficiency be improved using several piecewise constant λ_i where $\lambda(t_{i-1}, t_i) \leq \lambda_i$?

Implement a nonhomogeneous Poisson process with multiple λ_i . What is the new efficiency? Attention at the transition between λ_i

My results

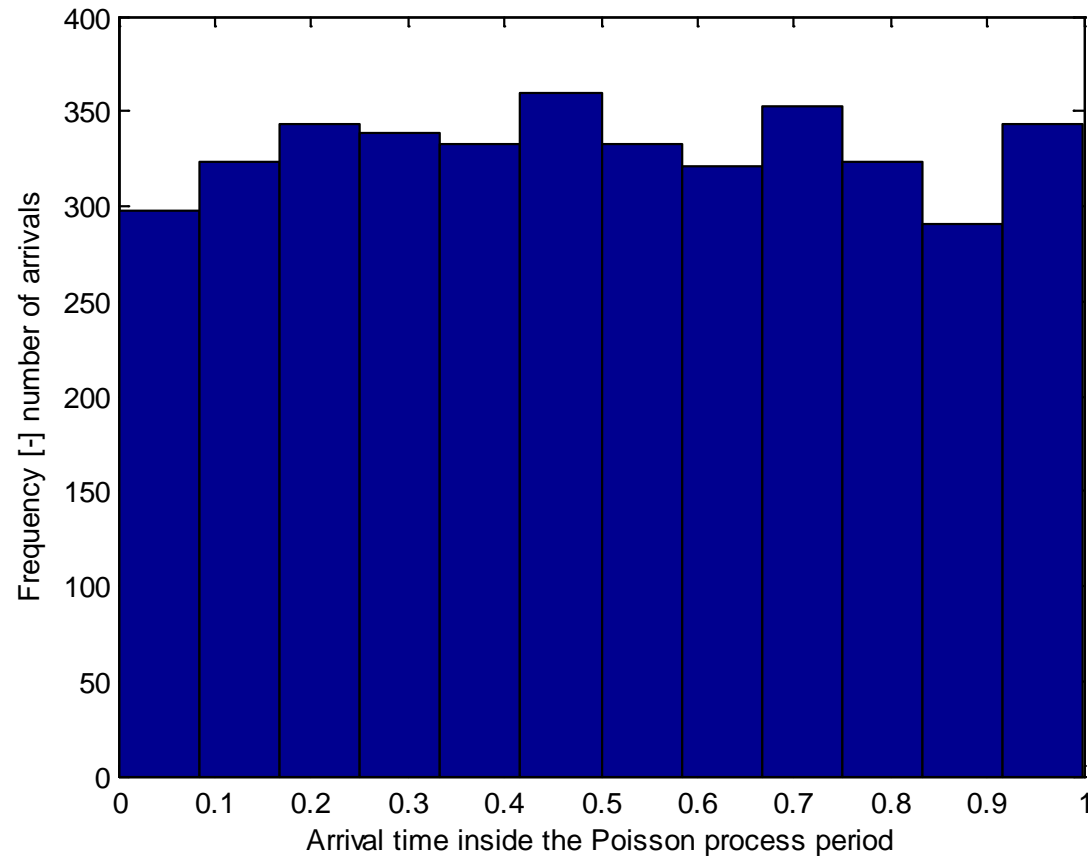
My results

1. Exponential Random Number



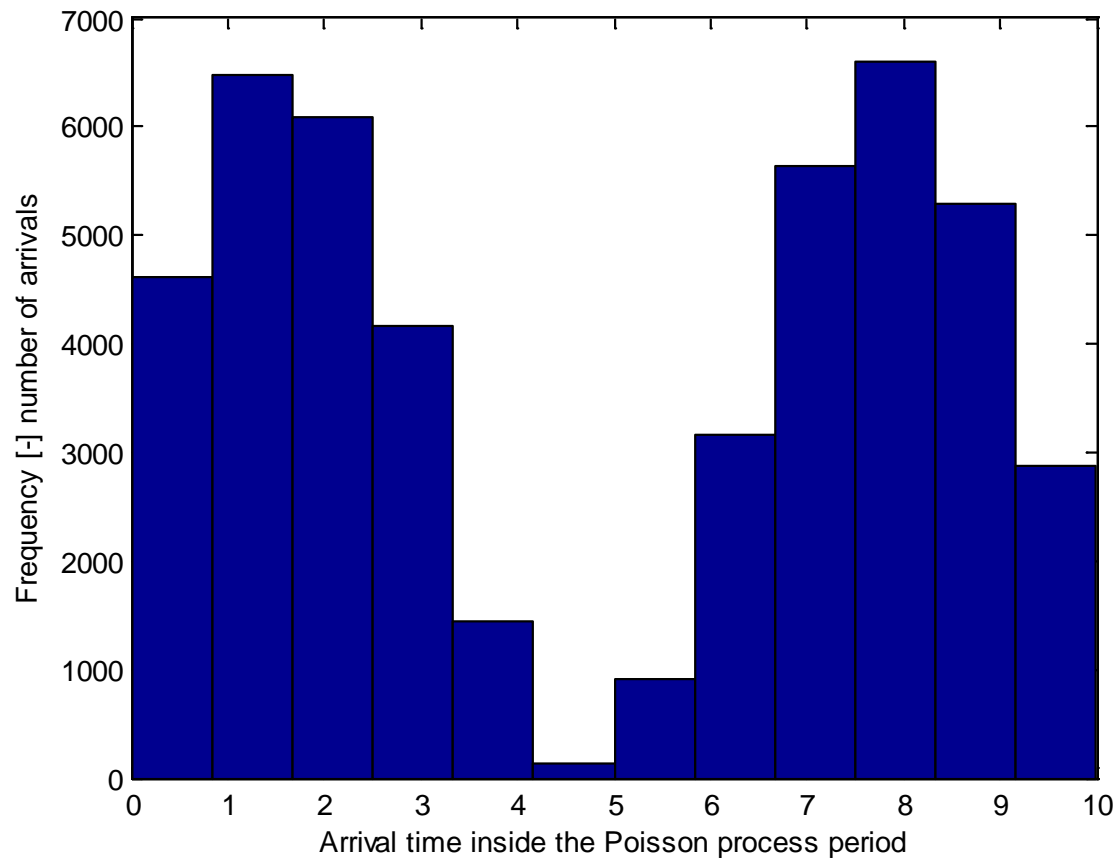
My results

2. Homogeneous Poisson Process



My results

3. Nonhomogeneous Poisson Process



My results

3. Nonhomogeneous Poisson Process - Extra questions

How efficient is generating this nonhomogeneous Poisson process with only one λ where $\lambda(t) \leq \lambda$? **0.59**

Can the efficiency been improved using several piecewise constant λ_i where $\lambda(t_{i-1}, t_i) \leq \lambda_i$? **Yes**

Implement a nonhomogeneous Poisson process with multiple λ_i , what is the new efficiency?

My solution: two λ_i , λ_1 between 0 and π , λ_2 between π and 2π , λ_1 between 2π and 3π , λ_2 between 3π and 4π , etc. **My new efficiency 0.72**