Optimization and Simulation

Laboratory 1

Random Number Generation and Poisson Process

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Goals

Understanding how to draw from a distribution

- Inverse Transform Method

Understanding the Poisson process

- Why we need to draw from a distribution

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

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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

Extra questions

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

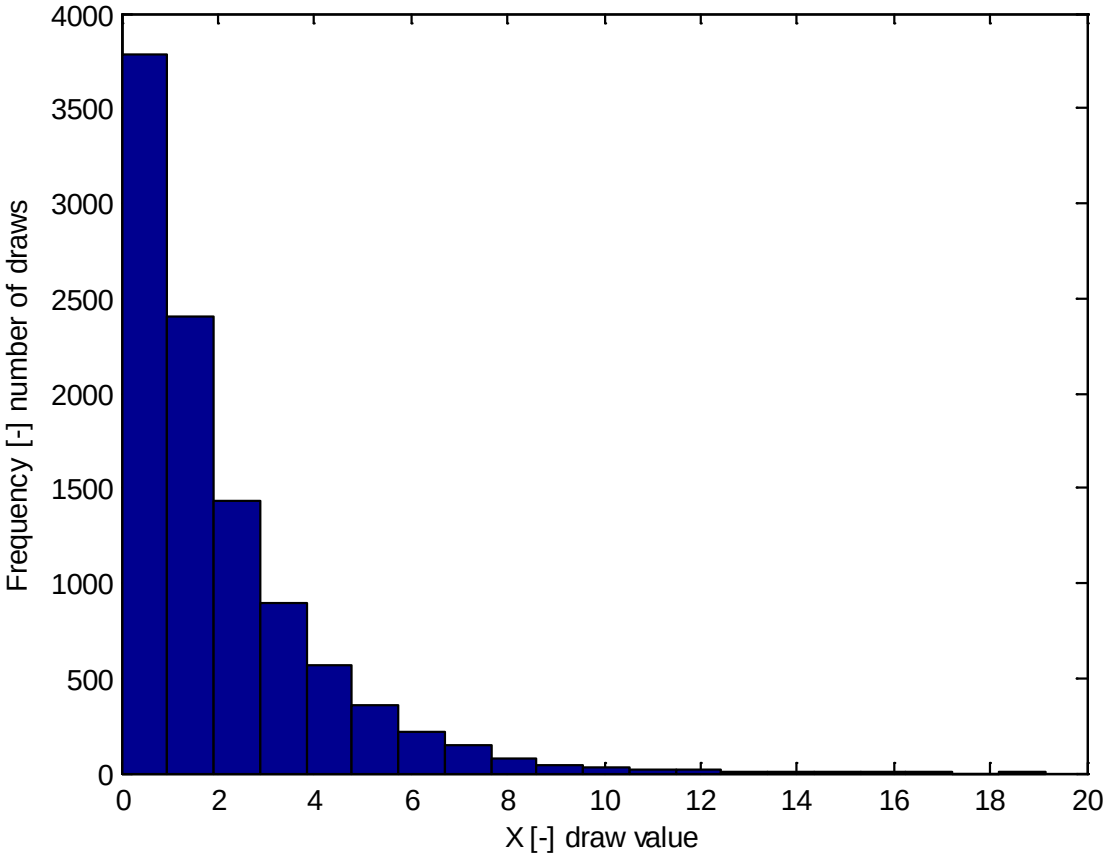
Can the efficiency be improved using several piecewise constant λ_i where $\lambda(t_{i-1}, t_i) \leq \lambda_i$?

Implement a nonhomogeneous Poisson process with multiple λ_i. What is the new efficiency?

My results

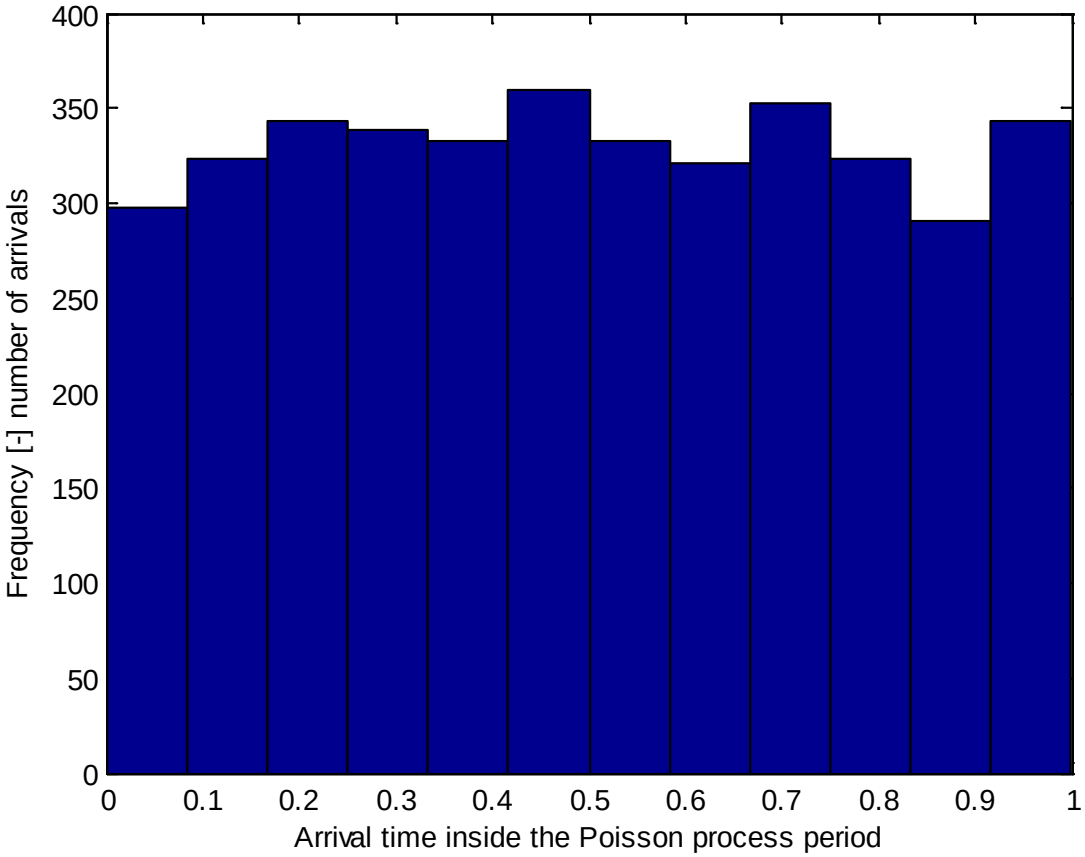
My results

1. Exponential Random Number

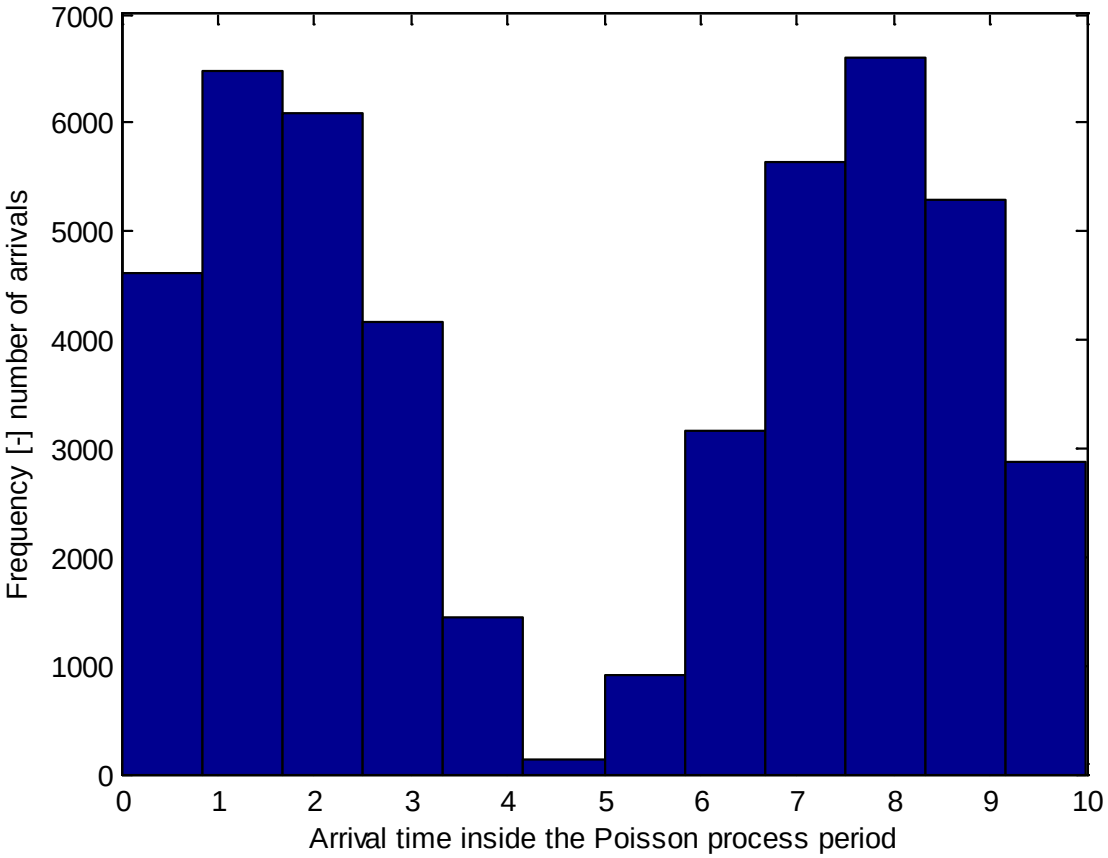


My results

2. Homogeneous Poisson Process



3. Nonhomogeneous Poisson Process



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**