Lab. 9 - Stochastic Discrete Simulation

Do the exercises below in the Octave IDE. Make sure the files and the programs are in the same working directory.

1. Implement an Erlang distribution

Implement an Erlang (or Gamma) distribution with the following pdf (probability density function)

$$f(x; k, \lambda) = \frac{\lambda^k x^{k-1} e^{-\lambda x}}{(k-1)!}$$

Use the shape parameter k = 2, and the rate parameter $\lambda = 0.4$. Generate several events according to this distribution and check that their mean is $\mu = k / \lambda = 5$. **Suggestion**: Use the accept/reject method and truncate $t_{max} = 5\ \mu$, and use M = 0.15 to guarantee that pdf(x) < M.

Note: More about the Erlang distribution in **https://en.wikipedia.org/wiki/Erlang_distribution**

2. Adapt the Queueing System

Adapt the implementation of the queueing system presented in the slides of class 8, so that the servicing time follows the Erlang distribution of question 2.

3. Extend the Queueing System

Extend the implementation of the queueing system of the last question assuming that there is a buffer, with a capacity for one request.

If a request arrives at the system, when the server is free, it is immediately served. If the server is busy, but the buffer is empty, then the request stays in the buffer until the server is free. As soon as the server is free, a request waiting in the buffer is served, and the buffer becomes empty. A request is only rejected if the server is busy and the buffer is occupied.

4. Use the Queueing System

Use the implementation of the queueing system presented in the previous question to obtain the average waiting time of the messages that are eventually served by the system. Use a function with the signature below to obtain the intended average waiting time

```
function awt = study_waiting_system(max_time)
```