

Lab. 8 - 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. Adapt Random Walk

Adapt the implementation of Random Walk simulation, presented in the slides of class 8, so that the probability to step forward is **p_for** (for example, $p = 80\%$, not 50% as in the slides). Use signature

```
function Sts = simulate_walk(max_stp, max_pos, p_for)
```

2. Study Random Walk

Use the implementation of the previous item to study the probability of reaching a certain forward position, **max_pos**, in a maximum number of steps, **max_stp**. Use signature

```
function Sts = probability_walk(max_stp, max_pos, p_for)
```

3. Use the Queueing System

Use the implementation of the queueing system presented in the slides of class 8, to study the percentage of busy time of the single server, with the distributions presented in the class. Use signature to obtain the intended percentage

```
function used = study_system(max_time)
```

4. 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 $\text{pdf}(x) < M$.

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

5. 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 4.
- 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.