Network modelling: theory and simulation
Lab. 1: Performance of single queues

The objective of this lab is to practice with the simulator in two ways.
First, starting from the simulator of the M/M/1 queue, simulators of other types of queue will be derived; hence, the student will get familiar with the main elements of the simulator.
Second, the plotting of results will allow the student to have a first experience of queue performance evaluation through simulation, including setting the simulation length, choosing the interesting working points and parameter setting.

Task 1: The M/M/1 queue

Consider an M/M/1 queue.
Plot the performance of the queue versus load in terms of:

- Average queuing delay
- Probability that the server is idle (i.e., fraction of time that the server is idle)

Verify Little's law. Compare simulation and analytical results.

Task 2: Effect of the service time distribution

Modify the simulator of the M/M/1 queue and study the performance of an M/H2/1 queue and an M/E2/1 queue.

- Compare the performance of the three considered queues, for the same values of load
- Verify the Pollaczeck-Khinchine formula

Task 3: The M/G/k queue

Modify the simulator of the single server queue to study the performance of an M/G/k queue.
Plot the performance of the queue versus load computing also the average number of busy servers.

Task 4: Finite queuing line

Modify the simulator of the M/G/k queue to study the performance of an M/G/k/B queue.
Plot the performance of the queue versus load computing also the loss probability.
In the special case B=0 show the insensitivity of the results with respect to the service time distribution.