

DISI – UNIVERSITY OF TRENTO  
Master in Computer Science AA 2014/2015  
Simulation and Performance Evaluation  
Assignment 2 (11 points available)  
**Simulation of a simple queuing network**

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May 20, 2015

This assignment consists in developing a simulator, verify and validate it, and present PE outputs relative to the queuing network depicted in Fig. 1. The queuing network must be “customized” by each student using the parametrization available on the course web site in the same folder as this assignment in the file `qnets-<surname>.pdf`. This file will specify the arrival process  $A$ , the stations characteristics including the service process and queue dimension if finite, and routing probabilities  $p_{ij}$ ,  $i, j = 1, 2, 3$  among queues.

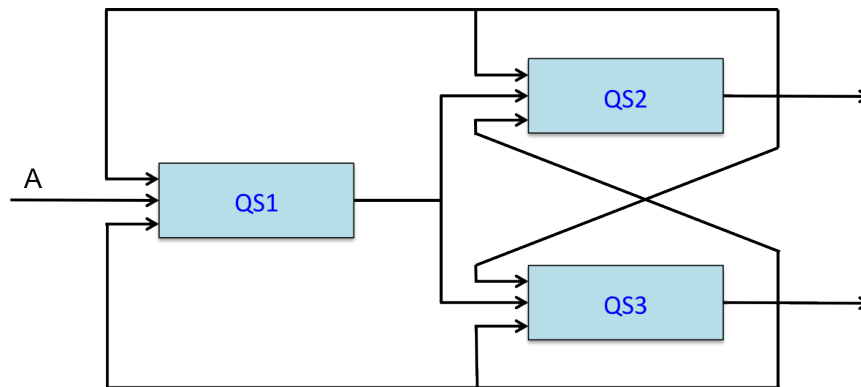


Figure 1: General structure of the queuing network to be simulated.

### Programming language and coding

A general purpose programming language must be used. We suggest python for its immediacy, but C, C++, and Java are also accepted. The program must run under Linux and be self-contained; code must be properly structured and commented to understand what it does (and possibly why it does it). Self-contention means that the code delivery on moodle must be in a tarball or zipped directory, it must contain a `readme.txt` file with all necessary information for compilation and running. The tarball must contain a `Makefile` with the following two commands:

> `make` that compiles the program and prepares for running; and

> `make run` which starts the simulation and reproduces all the results that you have obtained to write the report. The latter implies that there is an input file that the program reads to run all the required replicas of the simulation experiment. The tarball should also contain the scripts used to post-process the data obtained. Be sure to use standard software in your `Makefile` for compiling, e.g., `gcc/g++` or `clang/clang++` for C/C++ and `javac` for Java (python does not need a compiler).

## Preparing the report

The report should not exceed four pages in the given format. It should include a drawing of the actual queuing network simulated once the personal parameters have been applied to the general scheme. It should include a flow chart describing the structure of the simulator implemented and any other information useful to understand the simulator itself (e.g., algorithms or pseudo-code); do not replicate code comments.

The performance measures of interest are, for each queue and for the global system, the *empirical distribution* (histogram) of *i*) the queues length; *ii*) the customers waiting times (with and/or without service time as more appropriate); and *iii*) the loss rate. Aggregate, more compact results like average values and variances can also be useful in presenting and commenting the results. Results must be properly explained and interpreted, giving “insight” into the findings and their reason. Be careful in computing aggregate results for the system in presence of feedback, as feedback changes the properties of the system: e.g., the average time spent by customers in the system is not the sum of the average times spent in each queue anymore, as customers can visit the same queue multiple times.

**Good luck!**